# Remedial Action Plan

**Project**

**Western Sydney University – Milperra Campus**
**Horsley Rd & Bullecourt Ave, Milperra, NSW 2214**

**Prepared for**

**Mirvac Residential (NSW) Developments Pty Ltd**

**Date**

**15/09/2022**

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alliance
geotechnical & environmental solutions


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## Document Control

| Revision | Date | Author | Technical Reviewer | Project Manager |
|---|---|---|---|---|
| **0** | 04/12/2020 | Mehran Asadabadi | Aidan Rooney | Mehran Asadabadi |
| **01** | 14/12/2020 | Mehran Asadabadi | Aidan Rooney | Mehran Asadabadi |
| **02** | 02/09/2022 | Sam Scully | C. Cowper | Sam Scully |
| **03** | 15/09/2022 | Sam Scully | C.Cowper | Sam Scully |

## Important Information About This Report



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The findings presented in this report are based on specific data and information made available during the course of this project. To the best of Alliance's knowledge, these findings represent a reasonable interpretation of the general condition of the site at the time of report completion.

No warranties are made as to the information provided in this report. All conclusions and recommendations made in this report are of the professional opinions of personnel involved with the project and while normal checking of the accuracy of data has been conducted, any circumstances outside the scope of this report or which are not made known to personnel and which may impact on those opinions is not the responsibility of Alliance.

Logs, figures, and drawings are generated for this report based on individual Alliance consultant interpretations of nominated data, as well as observations made at the time fieldwork was undertaken.

Data and/or information presented in this report must not be redrawn for its inclusion in other reports, plans or documents, nor should that data and/or information be separated from this report in any way.

Should additional information that may impact on the findings of this report be encountered or site conditions change, Alliance reserves the right to review and amend this report.

## Executive Summary

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Mirvac Residential (NSW) Developments Pty Ltd (the client) to prepare a remedial action plan (RAP) for Western Sydney University – Milperra Campus, Bullecourt Avenue, Milperra NSW (refer **Figure 1,** with the 'site' boundaries outlined in **Figure 2**)**.** This RAP has been prepared to assist the planning process by outlining the requirements of a future data gap closure assessment prior to remediation works and to generally guide remediation works, to assist the client in making the site suitable for the proposed residential land use.

At the commencement of the project, Alliance had the following project appreciation:

- the site is an active campus of Western Sydney University;
- the site is proposed for rezoning and subdivision to facilitate residential development. It is understood that this will comprise demolition of the existing university campus and construction of a low-density residential development;
- a Detailed Site Investigation (DSI) (ref: 9996-ER-1-1, dated January 2020) was undertaken by AG (AG 2020) and a recommendation included for a supplementary contamination assessment to understand the nature and extent of contamination identified onsite and address data gaps presented by building footprints, previous contamination assessments and inaccessible areas of environmental concern; and
- the DSI also concluded that a RAP be prepared in order to detail the works needed to adequately delineate, remediate and validate the areas of concern that present an unacceptable contamination risk.

It is the ultimate intention of the client to redevelop the site into a low-density residential development. This is deemed as a change of land-use from "SP2 Infrastructure" to a residential land use scenario. The site currently falls within Infrastructure (SP2) in accordance with Bankstown Local Environment Plan (2015). Currently under State Environmental Planning Policy (SEPP) Hazards and Resilience (2021), a consent authority must not consent to the carrying out of any development unless it has considered whether the land is contaminated. This report has been prepared to facilitate the client addressing relevant aspects of State Environmental Planning Policy (SEPP) Hazards and Resilience (2021) and Canterbury Bankstown Council planning policies. Development plans for the proposed development are appended to this report as **Appendix A**.

In the context of NEPC (2013a), this is considered to be a land use scenario[1] comprising:

- Residential with accessible soil, including garden with home grown produce contributing less than 10% fruit and vegetable intake (excluding home grown poultry and/or eggs), and includes children's day care centres, preschools and primary schools.

Primary contamination remaining on completion of the previous contamination assessments includes:

- ***NAA 2011*** - Localised lead contamination recorded in surface soils (0m to 0.2m), exceeding residential human health and cadmium and zinc exceeding ecological criteria, at BH03 and S2. The contamination was vertically delineated soil type (i.e. sandy silt topsoil up to 0.25m depth) and by the deeper soil sample BH03 0.6-0.8, with contaminants in the sample below human health and ecological criteria. Based on the soil logs and available results indicate that lead, cadmium and copper are restricted to the upper 250mm of soil lack mobility.

[1] Adopted from Section 2.2 of NEPC (2013a) and Section 3 of NEPC (2013f)

- ***Coffey 2011*** – Friable asbestos was detected in six samples collected at depths ranging 0.2m to 1.1m, in the following boreholes:
    - EBH1, EBH2 and EBH3 (located in the vicinity of the former farm buildings and shed);
    - EBH5 (located in the vicinity of the historical dam area); and
    - EBH24 and EBH25 (located in the southern part of the previous filling of building rubble).
- ***JBS&G 2018*** – Asbestos fines/ friable asbestos (AF/FA) was detected in surface sample SS10 (located in the vicinity of the former farm buildings and shed).
- ***AG 2020*** – Asbestos Containing Materials (ACM) were encountered on the surface at the following borehole/ test pit locations:
    - BH59;
    - TP101/BH101; and
    - TP09.
- Asbestos Containing Materials (ACM) were encountered in the fill materials (at depth) at the following borehole/ test pit locations:
    - BH53; and
    - TP56.
- Friable asbestos (FA) was encountered in the fill materials at the following borehole locations:
    - BH53; and
    - TP56.

Contaminants of concern identified in soil by the DSI are priority metals (lead, cadmium and zinc) and asbestos (AF/FA). These contaminants are expected given the conceptual site model (CSM) that was developed for the site and presented in the DSI. Exposure routes for the identified contaminants relate to dermal contact, inhalation and/or ingestion, and uptake (biota only).

The CSM is presented in **Appendix B.** Refer to **Figure 3** which indicate the areas which will be subject to remediation and the remedial strategy for each area to mitigate the risks to human health and the wider environment.

Potential remediation options associated with impacted soil is extensive.

Consequently, only remediation strategies considered relevant to this site have been assessed, which include the following:

- Institutional controls / do nothing.
- Capping and Isolation.
- Excavation and off-site disposal.

AG notes that the remediation strategy will be reassessed upon completion of the additional assessments, as the lateral and vertical extents of impacted fill materials have not yet been delineated. Based on AG's understanding of the project objectives and taking into consideration the proposed development plans, the modified site-wide selected remedial strategy may comprise a combination of 'excavation and offsite disposal', and possibly some 'capping and isolation' of impacted soils (if appropriate, noting that the opportunity for containment on site may be limited and likely require further assessment once final development plans have been prepared).

Based on the information presented in the historical contamination assessment reports and AG's observations on site, AG concludes that the remedial strategies and goals can be achieved and the site made suitable in informing future land use planning and rendering the site suitable for proposed land use, subject to:

- Preparation of a SAQP prior to commencement of data gap assessment.
- Implementation of the strategies, methodologies and measures set out in this RAP.
- Should newly identified unacceptable land contamination risks be identified during supplementary assessment works, an addendum to this RAP may be required. The addendum should be prepared by a suitably experienced environmental consultant.
- Prior to any removal of soils from site for offsite disposal during remedial works, waste classification for those soils should be prepared by a suitably experienced environmental consultant. Residual impacted fill materials must also be appropriately characterised as per the strategy outlined in this RAP.
- AG recommends that any waste classifications, remediation monitoring and validation works be undertaken by a suitably experienced environmental consultant.
- It is recognised that contamination risks may remain on the site. If so, a LT-EMP will document areas where residual contamination is present on the site, and information on management measures that have been adopted. Provisions contained in the LT-EMP will need to have a mechanism to be legally enforceable and will be publicly notified. A revised RAP will be prepared to document where and how management measures will be implemented, and how a LTEMP can be made legally enforceable.

This report must be read in conjunction with the ***Important Information About This Report*** statements at the front of this report.

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# 1 Introduction

## 1.1 Background

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Mirvac Residential (NSW) Developments Pty Ltd (the client) to prepare a remedial action plan (RAP) for Western Sydney University – Milperra Campus, Bullecourt Avenue, Milperra NSW (refer **Figure 1,** with the 'site' boundaries outlined in **Figure 2**)**.** This RAP has been prepared to assist the planning process by outlining the requirements of a future data gap closure assessment prior to remediation works and to generally guide remediation works, to assist the client in making the site suitable for the proposed residential land use.

At the commencement of the project, Alliance had the following project appreciation:

- the site is an active campus of Western Sydney University;
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- the DSI also concluded that a RAP be prepared in order to detail the works needed to adequately delineate, remediate and validate the areas of concern that present an unacceptable contamination risk.

## 1.2 Proposed Development

It is the ultimate intention of the client to redevelop the site into a low-density residential development. This is deemed as a change of land-use from "SP2 Infrastructure" to a residential land use scenario. The site currently falls within Infrastructure (SP2) in accordance with Bankstown Local Environment Plan (2015). Currently under State Environmental Planning Policy (SEPP) Hazards and Resilience (2021), a consent authority must not consent to the carrying out of any development unless it has considered whether the land is contaminated. This report has been prepared to facilitate the client addressing relevant aspects of State Environmental Planning Policy (SEPP) Hazards and Resilience (2021) and Canterbury Bankstown Council planning policies. Development plans for the proposed development are appended to this report as **Appendix A**.

In the context of NEPC (2013a), this is considered to be a land use scenario[2] comprising:

- Residential with accessible soil, including garden with home grown produce contributing less than 10% fruit and vegetable intake (excluding home grown poultry and/or eggs), and includes children's day care centres, preschools and primary schools.

[2] Adopted from Section 2.2 of NEPC (2013a) and Section 3 of NEPC (2013f)

## 1.3 Objectives

The objectives of this project were to prepare:

- a conceptual RAP for the site to outline the requirements of a data gap closure assessment and to address potentially unacceptable land contamination exposure risks identified for the site during previous site investigations completed, in the context of informing future land use planning;
- a strategy to mitigate these potential exposure risks, by exploring available remediation options that will effectively and efficiently provide this outcome; and
- a risk-based clean-up strategy to achieve an outcome that is technically, logistically, and financially feasible, and that facilitates making the site suitable for rezoning and subsequent residential land use.

## 1.4 Scope of Work

The following scope of works was undertaken address the project objectives:

- A desktop review of the previous contamination assessments;
- Preparation of a RAP with reference to the relevant sections of NSW EPA (2020a), including the following:
    - Outline key roles and responsibilities of key staff responsible for implementation of the works.
    - Define the remedial works required, assess the options available and plan a strategy to achieve site suitability for the proposed use.
    - A sampling and analysis quality plan (SAQP) to guide the collection of future soil and groundwater samples.
    - Appropriate requirements for the validation and verification of the remediation strategy, including soil and groundwater criteria to measure the success of the remediation.
    - Appropriate procedures to manage unexpected finds throughout remediation works.
    - Details of the appropriate environmental measures to be implemented to mitigate adverse effects that may occur because of the remediation.
    - Work Health and Safety (WH&S) procedures to facilitate the remediation works being conducted in a manner that will not pose an unacceptable risk to the health and safety of site workers or site users.

# 2 Site Identification

## 2.1 Site Details

Site identification details are presented in **Table 2.1**.

**Table 2.1 Site Identification Details**

| | |
|---|---|
| Cadastral Identification | Lot 105 DP 1268911 and Lot 1 DP 101147 |
| Geographic Coordinates (Google Earth) | 33°56’25” S and 150°59’27” E |
| Site Area | Approximately 20 hectares (ha) |
| Local Government Authority | City of Canterbury Bankstown |
| Current Zoning | SP2 Infrastructure |

## 2.2 Site Layout

The layout of the site including site boundary and access points is present in **Figure 2**.

## 2.3 Site History

The site has been used for agricultural and residential uses prior to redevelopment for a university. There is the potential for impacts to soil as a result of the demolition of former building structures potentially containing hazardous building materials, including asbestos and lead paint. This was confirmed by the identification of asbestos at sampling point SS10 and review of the Coffey 2011 Phase 2 Environmental Site Assessment Report, which also identified and recommended management of asbestos in soil.

There is the potential for presence of imported fill material of unknown origin to have been used during historical construction activities at the site.

Based on the presence of the landfill site to the south and the nearby commercial industrial properties to the north, northwest and east, it was considered that there is potential for contaminated groundwater and landfill gas migration to have impacted the site.

# 3 Site Environmental Setting

## 3.1 Geology

A review of the Sydney 1:250,000 Geological Series Sheet (3rd Edition) 1966, indicated that the site is likely to be underlain by a combination of:

- 'Triassic, Wiannamatta Group, Liverpool Sub-group (Rwl), defined as shale with some sandstone beds', located within the central and northern portions of the site; and
- Quaternary (Qa), characterised as alluvium, gravel, sand, silt and clay', located within the southern portion of the site.

## 3.2 Site Topography and Elevation

The site topography was observed to be undulating and sloped downwards towards the south southwest. Review of a contour plan provided by the client indicated the site resides at an elevation ranging between approximately 3m to 22.5m AHD. The contour plan is presented in **Appendix B.**

## 3.3 Hydrogeology and Beneficial Use of Groundwater

Based on distances to the nearest surface water course and the site topography, groundwater flow in the vicinity of the site is considered likely to be towards the south southwest.

As part of the AG (2020) investigation, surveying points were established from the top of each monitoring well casing, to provide an understanding of groundwater movement onsite. Following the survey evaluation, AG assessed each monitoring well using an interface probe to measure the depth to standing water level (SWL) from the top of casing (TOC). The depth to groundwater measured during the well gauging task.

Based on the results of the survey, AG 2020 considered reasonable to assume groundwater onsite is flowing from the northeast corner to the west and south.

No beneficial use of groundwater was identified in AG (2020).

## 3.4 Visual Observations of Contamination (AG 2020)

Visual evidence of potential asbestos containing materials (ACM) in the soil samples collected, was detected at sampling points:

- TP09;
- TP53;
- TP56;
- BH59; and
- TP101.

The locations of the sampling points above are displayed in **Figure 4**. Visual evidence of staining in the soil samples collected, was not detected. Olfactory evidence of odours in the soil samples collected, was not detected.

# 4 Previous Contamination Assessments and Results

The previous investigations identified areas of land which pose a risk to future site users:

- Coffey 2011, 'Phase 2 Environmental Site Assessment – Student Residence Development University of Western Sydney, Bankstown Campus', Report dated 25 August 2011 ref: GEOTLCOV24163AG-AB (Coffey 2011).
- Noel Arnolds and Associates, 2011 'Soil Contamination Investigation, University of Western Sydney – Bankstown Campus Bullecourt Avenue, Milperra NSW', Report dated October 2011. ref: SJ0085:95458 (NAA 2011).
- Environmental Investigation Services, 2016 'Preliminary Contamination Screening and Waste Classification, Proposed Oval Facilities, UWS Bankstown Campus, 2 Bullecourt Avenue, Milperra' dated 7 April 2016.
- JBS&G Australia Pty Ltd 2018, '*Phase 1 Environmental Assessment Report, Bullecourt Avenue, Milperra NSW'*, Report ref: 54086-110124 (Rev 1), dated 7 February 2018.
- Alliance Geotechnical Pty Ltd, 2020 '*Detailed Site Investigation, Bullecourt Avenue, Milperra NSW* ', Report ref: 9996-ER-1-1, dated 30 January 2020.

Relevant information regarding the site was obtained from the above reports and summarised within **sub sections 4.1** to **4.5**.

## 4.1 Coffey (2011)

For the purposes of this Phase 2 Environmental Site Assessment (P2 ESA), Coffey assumed the site boundary comprised approximately 1.5ha. At the time of reporting, it was subsequently understood that the proposed student residence development was to extend further to the east and cover an area of approximately 3ha. Coffey understood that UWS required a P2 ESA to support a development application (DA) to Bankstown City Council.

The objectives of the assessment were to:

- Assess the acid sulfate soil status of the site based on a review of risk map and field observations;
- Assess the contamination status of the site by undertaking sampling and testing of soil; and
- Provide recommendations for further investigation/remediation requirements (if any) for the site to be suitable for the proposed student accommodation development.

The scope of work undertaken included:

- Fieldwork including soil sampling;
- Laboratory testing; and
- Data assessment and reporting.

Based on the site history information and visual observations, a number of Areas of Environmental Concern (AECs) and Chemicals of Potential Concern (COPCs) were identified. The identified AECs and associated CoPCs are presented in **Table 4.1.**

**Table 4.1 - AECs and associated CoPC**

| Potential Areas of Concern | Chemicals of Potential Concern | Chemicals of Potential Concern |
|---|---|---|
| Southern end of the site – building rubble burial | TPH, PAH, Metals, Asbestos | Building rubble was buried up to 3m to 4m below the site surface. |
| Former farm dam – potential contaminated fill | TPH, BTEX, PAH, OCP, Metals, Asbestos | Potentially contaminated fill could have been used to backfill the dam. |
| Whole site – use of pesticides for pest/weed control | OCP, Metals | Chemical application (such as pesticides) was commonly used in historical farming activities. Contamination, if present, is likely to be localised near the surface and minor. |
| Whole site – hazardous building materials | Asbestos, Lead | Historical farm sheds/houses could contain asbestos and lead paint. Weathering, leaching and spreading (during demolition) of material would likely to be localised in the near surface. |

A total of 25 boreholes were cored across the site on 11 and 12 July 2011, and samples submitted to a NATA accredited laboratory for analysis of CoPC.

Analytical results indicated the contaminant concentrations were less than the adopted site criteria, with the exception of:

- Asbestos, which was detected at six locations across the site.

Coffey recommended additional assessment to be undertaken to further characterise the asbestos impact and to assist in the selection of remedial/management options.

## 4.2 NAA (2011)

NAA was commissioned by JDH Architects to undertake a Soil Contamination Investigation (SCI) in an area in the northeast of the Bankstown Campus at the University of Western Sydney - Bankstown Campus located at Bullecourt Avenue, Milperra NSW (the site). The portion of the site investigated in NAA (2011) was approximately 2,500m$^2$ in area and resided to the north of the existing P2 car park at the Bankstown Campus. The proposed redevelopment comprised construction of a single storey childcare facility with adjacent car parking facilities.

The objectives of the SCI were to provide information on the extent and nature of contamination (if any) within the fill/soil material at the site and to assess the suitability of the site for the proposed land-use as a childcare facility.

NAA undertook the following scope of works to achieve the project objectives:

- Prepare a safe work method statement for works to be conducted at the site;
- Complete a site inspection and a comprehensive site walkover;
- Conduct grid-based sampling pattern by the hand augering of eight locations within the boundaries of the site. Hand augering was undertaken to a maximum depth of approximately 1.2m below ground surface with sampling conducted at varying depths through the fill/soil profile;

- Collect seventeen soil samples;
- Conduct NATA-certified laboratory-based analysis of soil; and
- Prepare a SCI report.

Based on the findings of the investigation, NAA 2011 concluded the following:

- Hotspots of lead contamination at locations BH3 0.0-0.2m and S2 0.0-0.1m were identified during an intrusive investigation previously undertaken by Coffey (AG were not provided this report);
- Concentrations of cadmium (BH3 0.0-0.2m) and zinc (BH3 0.0-0.2m, S2 0.0-0.1m and S7 0.0-0.1m) have been found to exceed the adopted Provisional Phytotoxicity Investigation Levels (PPIL);
- The site was unsuitable for the proposed land use as a childcare facility due to the presence of hotspots of lead contamination which may present a risk to human health if not appropriately managed;
- Exceedances of PPILs have also been reported at these locations and can be addressed as part of the management of the lead hotspots; and
- A marginal exceedance of zinc concentrations when compared with the PPIL was recorded at S7 0.0-0.1m. Given the marginal nature of this exceedance, it does not impact upon the suitability of the site for the proposal land use as a childcare facility.

Based on these conclusions, NAA 2011 made the following recommendations:

- Given the shallow nature of the impacted material, it was assumed that this material will be excavated and removed from site during the course of site preparation works (e.g. stripping back of topsoil material) for the purposes of redevelopment;
- Fill/soils to be removed offsite for disposal should be classified in accordance with NSW EPA Waste Classification Guidelines (2014) and should be disposed of at an appropriately licenced landfill facility;
- Following site preparation works, a suitably qualified Environmental Consultant should return to site to collect validation samples of the area of concern (in vicinity of BH3, S2 and S7) in order to confirm acceptable residual concentrations of heavy metals are present with respect to the adopted HIL and PPIL and that the site is suitable for the intended land use; and
- If it is determined that site preparation works will not result in the excavation and removal of the shallow material at BH3 0.0-0.2m and S2 0.0-0.1m, remediation works will be required. In this event, it is recommended that a Remedial Action Plan (RAP) be developed to address remediation of the hotspots of contamination identified.

### 4.3 EIS (2016)

Burtenshaw Scoufis Architecture + Interiors commissioned Environmental Investigation Services (EIS) to assign a waste classification to in-situ soil adjacent to the west of the athletics track located at 2 Bullecourt Avenue, Milperra NSW.

The aim of the investigation was to assess soil contamination issues at the site and to provide a waste classification for the material to be excavated for the proposed oval development.

The scope of work included the following:

- Review of available geological information;
- Soil sampling from three boreholes;
- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC); and

- Preparation of a letter report presenting the results of the investigation.

All results were below the site assessment criteria (SAC) adopted for the site. Overlying fill soils were classified as General Solid Waste (Non-putrescible) and underlying natural soils were classified as Virgin Excavated Natural Material (VENM). Based on this data, EIS concluded that the risk of widespread significant soil contamination in the development area was relatively low. The fill and natural soil material assessed was considered by EIS to be suitable for re-use on the subject site, provided it meets geotechnical and earthwork requirements.

### 4.4 JBS&G (2018)

JBS&G Australia Pty Ltd (JBS&G) were engaged by Western Sydney University (WSU) (the client) to prepare a Phase 1 Environmental Assessment Report for the WSU Milperra Campus located off Bullecourt Avenue, Milperra NSW (the site). Based on current Master Plan concepts for the Milperra Campus, JBS&G understood WSU intends to create an integrated living and working precinct with a range of land uses including medium to high density residential, mixed use, retail, community, open space and conservation areas at the site.

The objective of the investigation was to assess the potential for contamination relating to historical and current land use activities at the site to constrain the intended development objectives, and to make recommendations for further investigations and or remediation to achieve intended land uses of the development.

To meet the project objectives, JBS&G carried out the following scope of works:

- Review of available council documentation, aerial photographs, legal title information, EPA records and heritage records to identify areas of environmental concern (AECs) and associated contaminants of potential concern (CoPC)
- Review of site setting including topography, hydrology, hydrogeology and geology;
- Review of records of environmental incidents or former environmental licenses held by the NSW EPA;
- A detailed site inspection of accessible areas to identify potential AECs and CoPC not identified in the historical record review;
- Development and documentation of a conceptual site model (CSM);
- Limited soil sampling and analysis of soil samples for a range of CoPC;
- Assessment of soil sampling and analysis results against EPA endorsed guideline criteria for residential land use; and
- Preparation of the Phase 1 Environmental Site Assessment report in general accordance with guidelines made or approved by the NSW EPA.

Surrounding land use at the time of JBS&Gs site walk over was comprised of the following:

- North: Bullecourt Avenue with commercial / industrial land-use beyond including a service station to the north-west;
- East: Mount Saint Joseph’s High School and Horsley Road with commercial / industrial land-use beyond;
- South: The South Western Motorway (M5) with Kelso Landfill beyond; and
- West: Ashford Avenue with residential land-use beyond.

A SafeWork NSW search of the Stored Chemical Information Database (SCID) and the microfiche records held by SafeWork was requested. Information provided by SafeWork NSW included details on a number of abandoned (2) underground storage tanks (USTs) formerly located in the central eastern section of the site. Review of the SafeWork NSW documentation indicated the 2 x 2,500L USTs were removed on Friday 19 December 1997 by Email Petroleum Systems.

Based on site history review and observations during the site walkover, JBS&G identified the following AEC and associated CoPC presented in **Table 4.4.**

**Table 4.4- AECs and associated CoPCs**

| Areas of Environmental Concern (AECs) | Contaminants of Potential Concern (CoPCs) |
|---|---|
| Demolition of historical site structure that may have contained hazardous building materials | Heavy metals, lead and asbestos |
| Surface soils impacted with herbicides/pesticides due to the maintenance of site from noxious weeds/pests | OCPs |
| Fill materials across the site, potential imported to site | Heavy metals, TRH, BTEX, PAH, OCPs, PCBs and asbestos |
| Burial Area (fill material) | Heavy Metals, PAH, OCPs and asbestos |
| Groundwater along the northern and eastern boundaries adjacent commercial / industrial properties | Heavy metals, TRH, BTEX, PAH, VOCs |
| Landfill gas along the southern boundary adjacent the Kelso Landfill | Methane and other landfill gases (LFG) |

Based on the unidentified sources of fill material potentially imported to the site to backfill/raise topographic features and the potential for fill material at the site to contain waste materials associated with demolition of historical buildings potentially containing asbestos and/or lead paint, fill materials must be considered a potential contaminated medium. Due to the age of some existing site structures, it is possible that they may contain hazardous building materials including asbestos and lead based paints. Soils immediately surrounding buildings are considered as potentially contaminated medium.

In addition, buildings containing asbestos and / or lead paint which may have been demolished without appropriate controls may have also impacted surface soils. Surface soils must also therefore be considered a potential contaminated medium.

Based on the suspected depth of groundwater >8 m bgs, the likelihood of contamination of groundwater as a result of activities at the site is considered to be low. Based on the presence of the landfill site to the south and the nearby commercial/industrial properties to the north and east, there is potential for groundwater to be impacted as a result of offsite activities.

Given the relatively close proximity of the landfill to the south of the site, landfill gas has the potential to be a contaminated medium in the southern portion of the site.

JBS&G carried out a limited detailed site inspection and investigation. During the detailed site inspection JBS&G noted the observation of topography for potential adjustments in ground levels due to filling, presence of waste material such as asbestos containing material (ACM) on the ground surface and on external surfaces of structures and potential chemical/fuel storage, use or spillage.

On 23 August 2017, ten surface samples were collected from the site using a hand auger and forwarded to a NATA accredited laboratory for analysis of heavy metals, PAH, asbestos (NEPM 500ml) and OCPs. During soil sampling, a geotechnical fabric layer was identified below the ground surface at sampling point SS10. Analytical results indicated the contaminant concentrations were less than the adopted site criteria, with the exception of:

- SS10 – asbestos fibres/fibrous asbestos (AF/FA) detected at 0.02% w/w above the adopted HSL site criteria 0.001% w/w.

Based on the findings of this investigation, JBS&G made the following conclusions:

- The site has historically been used for a combination of agricultural and residential uses prior to development of the university;
- There is the potential for impacts to soil as a result of the demolition of former building structures potentially containing hazardous building materials, including asbestos and lead paint. This was confirmed by the identification of asbestos at sampling point SS10 and review of the Coffey 2011 Phase 2 Environmental Site Assessment Report, which also identified and recommended management of asbestos in soil;
- There is the potential for presence of imported fill material of unknown origin to have been used during historical construction activities at the site; and
- Based on the presence of the landfill site to the south and the nearby commercial industrial properties to the north, northwest and east, there is considered to be a potential for contaminated groundwater and landfill gas migration to have impacted the site.

Based on these conclusions, JBS&G recommended a detailed site investigation (DSI) is undertaken for the site in order to assess the extent and degree of contamination at the site and to provide an assessment of risk posed by site contaminants to human and environmental health. In addition to the DSI, JBS&G recommended a hazardous building material survey be completed prior to commencement of redevelopment works such that materials identified as comprising lead paint and or asbestos may be appropriately managed with regard to exposure risks to site workers and future building occupants.

### 4.5 AG (2020)

Alliance Geotechnical Pty Ltd (AG) was engaged by Mirvac Homes NSW Pty Ltd, to undertake a Stage 2 Detailed Site Investigation for a site located at Western Sydney University – Milperra Campus Bullecourt Avenue, Milperra, NSW 2214.

AG had the following project appreciation:

- the site was an active campus of Western Sydney University;
- the investigation was to be limited to areas outside of building structures and discretion was required in active areas of the site (roads, ovals and carparking areas);
- the site was proposed for rezoning and subdivision to facilitate residential development. It was understood that this will comprise demolition of the existing university campus and construction of a low-density residential development; and
- a Detailed Site Investigation was required, in accordance with State Environmental Planning Policy No. 55 – Remediation of Land, to accompany the development application.

It was the intention of the client to redevelop the site into a low-density residential development. This was deemed as a change of land-use from commercial / industrial to a residential land use scenario. The site was zoned as Infrastructure (SP2) in accordance with Canterbury Bankstown Local Environment Plan (2015). The report was prepared to facilitate the client addressing relevant requirements of State Environmental Planning Policy (SEPP) Hazards and Resilience (2021) and Canterbury Bankstown Council planning policies.

The objectives of the investigation were to:

- assess the potential for contamination to be present on the site in available/ accessible areas as a result of past and current land use activities;
- provide advice on whether the site would be suitable (in the context of land contamination) for the proposed land use setting; and
- provide recommendations for further investigation, management and/or remediation (if warranted).

AG undertook the following scope of works to address the project objectives:

- A desktop review of the previous investigation reports and other relevant information relating to the site;
- A site walkover to understand current site conditions and conduct underground utility locating;
- An intrusive site investigation using a track-mounted hydraulic drill rig, hand auger and/or track-mounted excavator to assess subsurface ground conditions and install groundwater monitoring wells;
- Collect representative soil and groundwater samples;
- Facilitate laboratory analysis of selected soil and groundwater samples for contaminates of potential concern (CoPC);
- Assess the results in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 (NEPM 2013); and
- Prepare a DSI in accordance with the Guidelines for Consultants Reporting on Contaminated Sites, 2011.

Based on AG's assessment of the desktop review information, fieldwork data and laboratory analytical results, in the context of the proposed redevelopment scenario, AG made the following conclusions:

**Soil Assessment**

- the detected concentrations of identified contaminants of potential concern in the soil samples analysed are considered unlikely to present an unacceptable direct contact human health exposure risk;
- the detected concentrations of asbestos fines/ friable asbestos and non-friable asbestos containing material in the soil samples analysed are considered likely to present an unacceptable human health exposure risk;
- the detected concentrations of identified contaminants of potential concern in the soil samples analysed are considered unlikely to present an unacceptable inhalation / vapour intrusion exposure risk;
- the detected concentrations of identified contaminants of potential concern in the soil samples analysed are considered unlikely to present an unacceptable TPH management limit exposure risk; and
- the detected concentrations of identified contaminants of potential concern in the soil samples analysed are considered unlikely to present an unacceptable aesthetics risk.

**Groundwater Assessment**

- the detected concentrations of contaminants of potential concern in groundwater are considered unlikely to present a risk to surrounding aquatic environments;

- All groundwater samples returned concentrations less than the adopted Groundwater Health Screening Levels for vapour intrusion (clay 2 - 4m) for a residential land use setting as per Table 1A (4) of NEPM 2013
- the detected concentrations of contaminants of potential concern in the groundwater samples analysed is considered unsuitable for discharge to municipal stormwater without further assessment/treatment due to the detected concentrations of the contaminants of concern analysed.

Based on the above conclusions, AG made the following recommendations:

- Consideration should be given to the preparation of a supplementary contamination assessment, to further understand the nature and extent of contamination identified onsite and address data gaps presented by building footprints, previous contamination assessments and inaccessible areas of environmental concern;
- Preparation of a remedial action plan (RAP) will be required to detail the works needed to adequately delineate, remediate and validate the areas of concern that present an unacceptable contamination risk;
- If groundwater is expected to be encountered during the proposed development, a groundwater management plan would be required;
- The preparation of any supplementary contamination assessments, remedial action plans and/or groundwater management plans should be completed by an appropriately experienced environmental consultant;
- As per NSW WHS Regulations, any removal of friable asbestos requires the engagement of a Class A licensed asbestos removalist and a pre-notification to SafeWork NSW, with accompanying air monitoring during the works and clearances post completion to be conducted by a licensed asbestos assessor (LAA);
- Following remediation of the identified contamination, validation sampling and a site validation report will be required to confirm the effectiveness of the remedial works; and
- Any soil proposed for disposal should be classified and disposed of as per the NSW EPA Waste Classification Guidelines, 2014 with all disposal documentation retained by the client for inclusion within the site validation report.

## 4.6 Contamination Summary

Primary contamination remaining on completion of the previous contamination assessments includes:

- ***NAA 2011*** - Localised lead contamination recorded in surface soils (0m to 0.2m), exceeding residential human health and cadmium and zinc exceeding ecological criteria, at BH03 and S2. The contamination was vertically delineated soil type (i.e. sandy silt topsoil up to 0.25m depth) and by the deeper soil sample BH03 0.6-0.8, with contaminants in the sample below human health and ecological criteria. The soil logs and available results indicate that lead, cadmium and copper are restricted to the upper 250mm of soil.
- ***Coffey 2011*** – Friable asbestos was detected in six samples collected at depths ranging 0.2m to 1.1m, in the following boreholes:
    - EBH1, EBH2 and EBH3 (located in the vicinity of the former farm buildings and shed);
    - EBH5 (located in the vicinity of the historical dam area); and
    - EBH24 and EBH25 (located in the southern part of the previous filling of building rubble).
- ***JBS&G 2018*** – Asbestos fines/ friable asbestos (AF/FA) was detected in surface sample SS10 (located in the vicinity of the former farm buildings and shed).

- ***AG 2020*** – Asbestos Containing Materials (ACM) were encountered on the surface at the following borehole/ test pit locations:
    - BH59;
    - TP101/BH101; and
    - TP09.
- Asbestos Containing Materials (ACM) were encountered in the fill materials (at depth) at the following borehole/ test pit locations:
    - BH53; and
    - TP56.
- Friable asbestos (FA) was encountered in the fill materials at the following borehole locations:
    - BH53; and
    - TP56.

Contaminants of concern identified in soil by the DSI are priority metals (lead, cadmium and zinc) and asbestos (AF/FA). These contaminants are expected given the conceptual site model (CSM) that was developed for the site and presented in the DSI. Exposure routes for the identified contaminants relate to dermal contact, inhalation and/or ingestion, and uptake (biota only).

The CSM is presented in **Appendix C.**

# 5 Remediation Criteria

Taking into consideration the objectives of this project, and the conceptual site model and land use setting, the following soil investigation criteria relevant to the proposed land use setting have been adopted for this project:

**Table 5-1 Remediation Criteria**

| Exposure Pathway | Land Use Setting[3] | Reference |
|---|---|---|
| Dermal contact and ingestion | HIL A | Table 1A(1) in ASC NEPM (2013a)<br>Table B4 in Friebel, E & Nadebaum P (2011)<br>Table 2 in HEPA (2020) |
| Inhalation of dust | HSL A / Residential A | Table 1A(2) in ASC NEPM (2013a)[4]<br>Table 1A(3) in ASC NEPM (2013a)<br>Table 1A(4) in ASC NEPM (2013a)<br>Table 1A(5) in ASC NEPM (2013a) |
| Inhalation via release of airborne fibres | Residential A | Table 7 in ASC NEPM (2013a)[5] |
| Inhalation of vapour | HSL A & HSL B | Table 1A(5) in ASC NEPM (2013a) |
| Human health (aesthetics) | All | Characteristics and processes in Section 3.6.2 and 3.6.3 in ASC NEPM (2013a) |
| Uptake by plants and terrestrial organisms in root zones. | Urban residential / public open space | Table 1B(6) in ASC NEPM (2013a)[1,2]<br>Table 3 in HEPA (2020)<br>Table 11 in CRC CARE (2017) |
| Ground gases including methane | - | Section 3.6.2 in NSW EPA (2020a) |

[3] Consideration will be given to soil type, soil texture, soil depth, groundwater depth and appropriate species protection levels.

[4] Residential and other associated buildings within the site to be assessed using the Residential A HSLs for vapour intrusion purposes.

[5] A depth of up to 10cm below ground level is adopted to define ‘surface soil’.

# 6 Results and Site Characterisation

A discussion on comparison of all laboratory analytical results exceedances to date and field observations, in the context of the assessment criteria adopted for this project, is presented in **Sections 6.1 to 6.4.**

Results summary tables for soil and groundwater are included in AG 2020 whilst the exceedances against the site remediation criteria are presented in **Figure 4.**

## 6.1 AEC01 – Asbestos in soil

In all investigations to date, asbestos was detected (absence presence) in four locations (Coffey 2011) and exceeding HSL A criteria in two locations (JBS&G 2018 and AG 2020). The locations are as follows:

**Table 6.1 Asbestos exceeding site remediation criteria (HSL-A) of 0.001% (w/w) for AF/FA and 0.01% (w/w) for Bonded ACM**

| Sample Locations/ Depth (m) | Asbestos Concentration (% w/w) | Asbestos in soil (absence/presence) |
|---|---|---|
| EBH1/ 0.5m | - | Asbestos detected |
| EBH2/ 0.5m | - | Asbestos detected |
| EBH3/ 0.5m | - | Asbestos detected |
| EBH5/ 0.5m | - | Asbestos detected |
| SS10/ 0-0.1m | 0.02 | - |
| BH39/ 0-0.2m | 0.043 | - |

Based on the above results, AG considers that remediation will be required for AEC01. AG recommends a detailed asbestos gravimetric assessment to be conducted (double the minimum required density, based on known asbestos), in order to potentially reduce/ delineate the area to be remediated.

## 6.2 AEC01a – Lead, Cadmium & Zinc exceeding site remediation criteria

In all investigations to date, lead was detected exceeding HIL A criteria in two locations (Coffey 2011). The locations are as follows:

**Table 6.2.1. Lead exceeding site remediation criteria (HIL-A) of 300mg/kg**

| Sample Locations/ Depth (m) | Lead Concentration (mg/kg) |
|---|---|
| BH3/ 0.0-0.2 | 4400 |
| S-2/ 0.0-0.1 | 1800 |

The 95% UCL was not considered for the above recorded exceedances, due to the concentration of both soil samples being greater than 250% of adopted site criteria (300mg/kg).

As a result, AG considers that remediation will be required for AEC01a.

In relation to Ecological Investigation Levels (EILs), in all investigations to date, lead and zinc was detected exceeding EIL criteria in two locations (Coffey 2011). The locations are as follows:

**Table 6.2.2. Lead & Zinc exceeding site remediation criteria (EIL)**

| Sample Locations/ Depth (m) | Lead Concentration (mg/kg) | Zinc Concentration (mg/kg) | Site Criteria (mg/kg) |
|---|---|---|---|
| BH3/ 0.0-0.2 | 4400 | 6,800 | 1100 (lead) & 320 (Zinc) |
| S-2/ 0.0-0.1 | 1800 | - | 1100 (lead) |

The 95% UCL was not considered for the above recorded exceedances, due to the lead and zinc concentration in soil sample BH3/0.0m-0.2m being greater than 250% of adopted site criteria.

As a result, AG considers that remediation will be required for AEC01a.

## 6.3 AEC02 – Asbestos in soil

In all investigations to date, asbestos was detected in five locations, in relation to AEC02. The locations are as follows:

**Table 6.3. Asbestos detections in soil and on surface**

| Sample Locations/ Depth (m) | Asbestos Concentration (% w/w) | Asbestos in soil (absence/presence) |
|---|---|---|
| EBH24/ 1.1 | - | Asbestos detected |
| EBH25/ 0.2 | - | Asbestos detected |
| TP101-FCS/ 0.0m | - | Asbestos detected (ACM) |
| TP09-FCS/ 0.0m | - | Asbestos detected (ACM) |
| BH21/ 0.1-0.3m | 0.00021 | - |

AG notes that friable asbestos (FA) was detected in soil sample BH21/ 0.1m-0.3m at concentration of 0.00021% w/w, which was below the site remediation criteria (0.001% w/w) for AF/FA.

Based on the above, AG considers that remediation of asbestos contaminated soils will be required for AEC02. AG recommends a detailed asbestos gravimetric assessment to be conducted (double the minimum required density, based on known asbestos), in order to appropriately characterise the contamination and potentially reduce/ delineate the area to be remediated.

## 6.4 AEC03 – Asbestos in soil

In all investigations to date, asbestos was detected in five locations, in relation to AEC03. The locations are as follows:

**Table 6.4 Asbestos exceeding site criteria for bonded ACM (HIL-A) of 0.01% and FA/AF (HIL-A) of 0.001%**

| Sample Locations/ Depth (m) | Asbestos Concentration (% w/w) | Asbestos in soil (absence/presence) |
|---|---|---|
| TP53-FCS/ 1.2m | - | ACM in soil |
| TP56-FCS/ 0.0 – 2.2 | - | ACM visible within the entire fill profile (>2.2m) |
| BH59/ 0.0m (FCS_59) | - | ACM on surface |
| TP09-FCS/ 0.0m | - | Asbestos detected (ACM) |

Based on the above, AG considers that remediation of asbestos contaminated soils will be required for AEC03. AG recommends a detailed asbestos gravimetric assessment to be conducted (double the minimum required density, based on known asbestos), in order to appropriately characterise the contamination and potentially reduce/ delineate the area to be remediated.

# 7 Data Gap Closure Assessment (prior to remediation)

Prior to commencing data gap assessment, a detailed Sampling Analysis Quality Plan (SAQP) should be prepared and reviewed by a suitably qualified certified contaminated land consultant.

## 7.1 Detailed Asbestos Gravimetric Assessment

Site conditions and restrictions encountered including inaccessible areas (i.e. structures, hardstand areas) in the previous investigations limited AG to borehole drilling at the site and therefore appropriate asbestos gravimetric assessment, in accordance with ASC NEPM (2013), could not be conducted.

In lieu of the above and in an attempt to delineate (vertically and horizontally) the extent of contamination, the underlying fill materials at the site are assessed to require gravimetric assessment.

The objectives of the asbestos gravimetric assessment are to:

- Characterise the likely nature and extent of asbestos in surface and fills soils onsite;
- Assess whether the detected concentrations of asbestos in soil presents an unacceptable human health exposure risk, in the context of the proposed land use scenario; and
- Assess the inferred extents of asbestos in soils that require management or remediation.

The below **Sections 7.1.1 to 7.1.5** discuss the requirements of the detailed asbestos gravimetric assessment.

### 7.1.1 AEC01 (Area ≈ 12,800m$^2$)

Based on the above and in accordance with ASC NEPM (2013) and Western Australia, Department of Health 'Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites' May 2009 (WA DOH 2009), AG proposes the following additional assessment/ sampling plan for the site:

- The collection of 10L samples, which is required every 1m from surface (commencing with the top 100mm of soil) to the base of the fill materials in nominated areas. At every sampling point the materials will be spread/ screened onsite to observe ACM. The fragments observed will be collected and weighed onsite and subsequently sent to the laboratory for asbestos content. A 500mL sub-sample will be collected separately to the 10L bucket for asbestos quantification testing (AF/FA);
- A grid-based walkover to assess whether the top 10cm of site is visually free of asbestos;
- Based on Appendix A of WA DOH, 2009, a minimum of twenty-three (23) sampling points is required for assessment of asbestos contamination based on an area of approximately 12,800m$^2$. However, based on Table 1 of WA DOH 2009 (Triggers and Types of Asbestos Investigations), if there is known asbestos at the site, the sampling density is then doubled to account for confirmation and delineation of the asbestos concern;
- Intrusive investigation to the base of the fill layer in forty-six (46) sampling points using an appropriately sized excavator with bucket attachment; and
- The findings of the assessment will address the data gaps and inform an addendum to the RAP prior to commencement of remediation works.

### 7.1.2 AEC02 (Area ≈ 17,100m$^2$)

Based on the above and in accordance with ASC NEPM (2013) and (WA DOH 2009), AG proposes the following additional assessment/ sampling plan for the site:

- The collection of 10L samples, which is required every 1m from surface (commencing with the top 100mm of soil) to the base of the fill materials in nominated areas. At every sampling point the materials will be spread/ screened onsite to observe ACM. The fragments observed will be collected and weighed onsite and subsequently sent to the laboratory for weight confirmation and asbestos content. A 500mL sub-sample will be collected separately to the 10L bucket for asbestos quantification testing (AF/FA);
- A grid-based walkover to assess whether the top 10cm of site is visually free of asbestos;
- Based on Appendix A of WA DOH, 2009, a minimum of twenty-seven (27) sampling points is required for assessment of asbestos contamination based on an area of approximately 17,100m$^2$. However, based on Table 1 of WA DOH 2009 (Triggers and Types of Asbestos Investigations), if there is known asbestos at the site, the sampling density is then doubled to account for confirmation and delineation of the asbestos concern;
- Intrusive investigation to the base of the fill layer in fifty-four (54) sampling points using an appropriately sized excavator with bucket attachment; and
- The findings of the assessment will address the data gaps and inform an addendum to the RAP prior to commencement of remediation works.

### 7.1.3 AEC03 (Area ≈ 13,500m$^2$ known asbestos impacted + Area ≈ 18,240m$^2$ potential asbestos impacted)

Based on the above and in accordance with ASC NEPM (2013) and (WA DOH 2009), AG proposes the following additional assessment/ sampling plan for the site:

- The collection of 10L samples, which is required every 1m from surface (commencing with the top 100mm of soil) to the base of the fill materials in nominated areas. At every sampling point the materials will be spread/ screened onsite to observe ACM. The fragments observed will be collected and weighed onsite and subsequently sent to the laboratory for weight confirmation and asbestos content. A 500mL sub-sample will be collected separately to the 10L bucket for asbestos quantification testing (AF/FA);
- A grid-based walkover to assess whether the top 10cm of site is visually free of asbestos;
- Based on Appendix A of WA DOH, 2009, a minimum of forty-two (42) sampling points is required for assessment of asbestos contamination based on an area of approximately 31,740m$^2$. However, based on Table 1 of WA DOH 2009 (Triggers and Types of Asbestos Investigations), if there is known asbestos at the site, the sampling density is then doubled to account for confirmation and delineation of the asbestos concern;
- Intrusive investigation to the base of the fill layer in eighty-four (84) sampling points using an appropriately sized excavator with bucket attachment; and
- The findings of the assessment will address the data gaps and inform an addendum to the RAP prior to commencement of remediation works.

### 7.1.4 AEC01a (Area ≈ 1,000m$^2$ known lead, cadmium and zinc) with the potential for asbestos impacted soils

Asbestos sampling was not undertaken by NNA (2011) within AEC01a. Therefore, the risk of asbestos to be present in fill soils at the site, exceeding the adopted land use criteria cannot be precluded and confirmatory test pits would be required. Based on the above and in accordance with ASC NEPM (2013) and (WA DOH 2009), AG proposes the following additional assessment/ sampling plan for the site:

- The collection of 10L samples, which is required every 1m from surface (commencing with the top 100mm of soil) to the base of the fill materials in nominated areas. At every sampling point the materials will be spread/ screened onsite to observe ACM. The fragments observed will be collected and weighed

onsite and subsequently sent to the laboratory for asbestos content. A 500mL sub-sample will be collected separately to the 10L bucket for asbestos quantification testing (AF/FA);

- A grid-based walkover to assess whether the top 10cm of site is visually free of asbestos;
- Based on Appendix A of WA DOH, 2009, a minimum of six (6) sampling points is required for assessment of asbestos contamination based on an area of approximately 1,000m$^2$. However, based on Table 1 of WA DOH 2009 (Triggers and Types of Asbestos Investigations), if there is known asbestos at the site, the sampling density is then doubled to account for confirmation and delineation of the asbestos concern;
- Intrusive investigation to the base of the fill layer in six (6) sampling points using an appropriately sized (5-tonne) excavator with 600mm diameter bucket attachment; and
- The findings of the assessment will address the data gaps and inform an addendum to the RAP prior to commencement of remediation works.

#### 7.1.5 Areas of the Site Outside of AEC01, AEC02 & AEC03 (Area ≈ 80,000m$^2$) with the potential for asbestos impacted soils

Alliance note that asbestos was not identified by laboratory analysis, in the soil samples analysed within areas outside of AEC01, AEC02 & AEC03 onsite. However, the use of soil bores instead of test pits limits the consultant's ability to visually inspect the materials and does not align with guidance provided in ASC NEPM (2013) and (WA DOH 2009) for asbestos in-soil suitability assessments. Therefore, the risk of asbestos to be present in fill soils at the site, exceeding the adopted land use criteria cannot be precluded and confirmatory test pits would be required.

Based on the above and in accordance with ASC NEPM (2013) and (WA DOH 2009), AG proposes the following additional assessment/ sampling plan for the site:

- The collection of 10L samples, which is required every 1m from surface (commencing with the top 100mm of soil) to the base of the fill materials in nominated areas. At every sampling point the materials will be spread/ screened onsite to observe ACM. The fragments observed will be collected and weighed onsite and subsequently sent to the laboratory for weight confirmation and asbestos content. A 500mL sub-sample will be collected separately from the 10L bucket for asbestos quantification testing (AF/FA);
- A grid-based walkover to assess whether the top 10cm of site is visually free of asbestos;
- Based on Appendix A of WA DOH, 2009 and noting the sampling point density previously completed within these areas of the site, a minimum of forty-two (47) sampling points is considered suitable for assessment of asbestos contamination based on an area of approximately 80,000m$^2$. However, based on Table 1 of WA DOH 2009 (Triggers and Types of Asbestos Investigations), if there is known asbestos at the site, the sampling density is then doubled to account for confirmation and delineation of the asbestos concern;
- Intrusive investigation to the base of the fill layer in forty-seven (47) sampling points using an appropriately sized excavator with bucket attachment; and
- The findings of the assessment will address the data gaps and inform an addendum to the RAP prior to commencement of remediation works.

### 7.2 Post Demolition Assessment

#### 7.2.1 AEC05 (Area ≈ 37,000m$^2$)

Once all structure onsite has been demolished, a post demolition assessment will be required to assess the associated footprints. Based on the area occupied by structures and in accordance NSW EPA *Sampling Design Guidelines 1995*, a minimum of forty-seven (47) sampling points are required to be conducted.

Discrete soil samples should be recovered from 47 test pit locations. Each soil sample will be collected using a new clean pair of nitrile gloves and placed in the appropriate sample containers provided by the laboratory.

The test pits will be excavated to 0.3m into natural soils. Samples for potential analysis will be collected from the near surface, at ~0.5 m interval within the soil profile or with change of strata.

The soil jars will be labelled with sample identification (sample location and depth), date and name of sampler.

In relation to potential asbestos contamination, all proposed sampling locations will require collection of 10L samples, which is required every 1m from surface (commencing with the top 100mm of soil) to the base of the fill materials in nominated areas. The top 100mm of site must be visually free of asbestos. At every sampling point the materials will be spread/ screened onsite to observe ACM. The fragments observed will be collected and weighed onsite and subsequently sent to the laboratory for weight confirmation and asbestos content. A 500mL sub-sample will be collected separately to the 10L bucket for asbestos quantification testing (AF/FA). In relation to proposed asbestos assessment, AG makes the following comments:

- Based on the field observations and /or test results, the lateral and vertical extent may need to be increased; and
- If asbestos contamination is observed and/or identified, further sampling points will be required to adequately delineate the horizontal and vertical extent.

Upon completion the test pits will be backfilled and track rolled.

Soil test pit logs will be maintained in the field by an experienced AG environmental scientist for all exploratory pits. Field observations such as lithology, odours, staining, depth of water etc. will be noted on the logs.

As a minimum requirement, the following COPCs will be considered for the investigation:

- TRH;
- BTEX;
- PAHs;
- Metals (As, Cd, Cr, Cr (VI), Cu, Ni, Pb, Zn);
- OCPs; and
- Asbestos 0.001% (WA/ NEPM – 10L Gravimetric samples);

### 7.2.2 AEC04 – Previously Decommissioned Underground Storage Tanks (JBS&G 2018)

Based on review of JBS&G 2018 and in relation to previously decommissioned UST's, AG makes the following comments:

- There were two (2) underground fuel tanks located at the site. The tanks were understood not be in use and decommissioned;
- The removal and associated works for the decommissioning of the 2 USTs were conducted on Friday 19 December 1997 by 'Email Petroleum Systems'. The validation report was not provided to AG; and

- AG understands that the USTs comprised storage capacity 2,500L and one of the tanks contained Unleaded Petrol and the other Diesel product.

Based on the above and in the absence of a UST validation report, AG recommends that confirmation testing be carried out in the vicinity of the former USTs. Discrete soil samples should be recovered from 6 test pit/ borehole locations with two locations to be drilled for installation of groundwater monitoring wells (1 upgradient and the other down gradient). Samples will be collected using a new clean pair of nitrile gloves and placed in the appropriate sample containers provided by the laboratory.

The soil bores will be excavated/ drilled to a maximum depth of at least 4.0m bgl and the groundwater wells drilled to a target depth of 6m, 2m below inferred standing water level or practical refusal, whichever occurs first. Monitoring wells will be constructed using 50mm Class 18 PVC machine slotted screen and casing, gravel pack from the base to approximately 0.2m above the top of the screen, followed by approximately 0.5m of hydrated bentonite, grout to the surface and a lockable cast iron road box or lockable monument

Soil samples for potential analysis will be collected from the near surface, at ~0.5 m interval within the soil profile or with change of strata. Soil samples will be subjected to field screening for ionisable volatile organic compounds (VOC), using a photo-ionisation detector (PID). The results of field screening will be recorded on sampling point log.

Low flow sampling – low flow sampling should be adopted and groundwater to be extracted from the well at a rate so that drawdown of water is minimised (ideally less than 10cm below standing water level). Water quality meters will be used for stability to indicate the change from stagnant well water to representative formation water. The depth of sampling will be the mid-way point of the water column. Field filtering will be undertaken using 0.45 micron filters for metals analysis.

The sample jars/bottles will be labelled with sample identification (sample location and depth), date and name of sampler.

Upon completion of the soil boring, where applicable, the test pits/ boreholes will be backfilled.

Soil test pit/ borehole logs will be maintained in the field by an experienced AG environmental scientist for all exploratory pits. Field observations such as lithology, odours, staining, depth of water etc. will be noted on the logs.

As a minimum requirement, the following COPCs will be considered for the investigation:

- TRH;
- PAHs;
- Metals (As, Cd, Cr, Cr (VI), Cu, Ni, Pb, Zn); and
- VOCs/ SVOCs; and
- Phenols.

## 7.3 Hazardous Ground Gas

### 7.3.1 AEC06 – Adjacent Landfill at Southern Boundary of Site

Based on review of JBS&G 2018, there is potential for landfill gases to be migrating onto the southern boundary of the site, from the adjacent the Kelso Landfill.

Hazardous ground gas (HGG) generated by methanogenic degradation typically contains approximately 55 %v/v methane, 45 %v/v carbon dioxide and typically over 100 trace gaseous compounds termed Volatile Organic Compounds (VOCs).

NSW EPA (2020a) provides advice on ground gases that if present in the pore space of soils and rocks, and can adversely impact human health and safety or the integrity of structures. The ground gases that are generally of concern in this context are:

- Bulk ground gases, including methane, carbon dioxide, carbon monoxide, hydrogen, hydrogen sulphide, and petroleum vapours; and

Trace ground gases including radon, volatile organic compounds and mercury vapour.

The driving force of HGG is affected by a number of variables and for HGG to migrate away from the fill mass a pathway must be available and for migration to be sustained the source of gas must be replenished. CIRIA C665 2007 ‘Assessing risks posed by hazardous ground gases to buildings’ describe the following main factors that influence HGG migration:

- Pressure differential;
- Diffusion;
- Flow in dissolved form in liquids; and
- A combination of any of the three mechanisms.

The proposed redevelopment of the site is considered likely to include structural piers, construction of on-grade buildings. It is considered that ground gases (if present in sufficient concentration and with an adequate migration mechanism) may intrude into buildings and ancillary structures (especially confined spaces, small rooms and service cupboards) via pathways formed by wall cavities, joints formed during construction process, service ducts and trenches, etc

AG considers that a hazardous ground gas exposure pathway may be potentially complete and further assessment of presence of, and the risk posed by, hazardous ground gas, in the context of this project, may be warranted.

Sampling locations for ground gas investigations are based upon the guidelines for the assessment and management of sites affected by hazardous ground gases (NSW EPA, 2020b). The following strategy will be considered for the establishment of a ground gas monitoring well and the ground gas assessment at each gas well location:

- Gas wells are to be drilled in locations appropriate to assess inferred worst-case conditions, and peripheral locations to confirm the extent of the source.
- Boreholes are to be able to assess potential migration pathways.
- The depth of investigation will take into account the likely construction methods, such as service trenching and/or piling.
- The sensitivity of the planned site use, the nature of the gas source and the heterogeneity of ground conditions, as well as the assessed robustness of the conceptual site model.

Based on the above, it is considered reasonable to adopt a sampling plan comprising of 2 gas wells drilled as per below **table 7.3.1.1**:

**Table 7.3.1.1. Location and justification of proposed monitoring locations**

| Well ID | Location | Depth (m bgl) | Method | Justification |
|---|---|---|---|---|
| GW01 & GW02 | Southern boundary of site, adjacent to Kelso Landfill | ~3.5 to 6.0 depending upon gauged depth to groundwater within MW02 and MW03 prior to installation (~0.5-1.0m above SWL). | Mechanical drilling using a drill rig fitted with auger, 50mm uPVC class 18 screen and casing, gravel pack, hydrated bentonite seal, concrete and standpipe sticking above ground with gas cap tapped to take a quick-connect nipple. | Measurement of potential gas from adjacent landfill (significantly filled) |

Each gas well will be constructed using 50mm Class 18 PVC machine slotted screen and casing, gravel pack from the base to approximately 0.1m above the top of the screen, followed by approximately 0.3m of hydrated bentonite, grout to the surface and standpipe sticking above ground with gas cap tapped to take a quick-connect nipple.

Ground gas monitoring bores will be drilled to nominally 1m above standing water level (with consideration given to seasonal / tidal variations in standing water level) Target depths will also consider changes in lithology and geological formations, in the context of the CSM, targeting relevant permeable horizons, and avoiding creating pathways between potential gas sources (e.g. thick layers of fill material), with highly permeable horizons that may be subject to pressure fluctuations due to barometric or tidal effects.

The monitoring wells will be developed using a landfill gas meter (or similar). Each well will be developed for a minimum of 3 minutes.

Prior to gas sampling, each monitoring well will be subjected to leak testing (typically a minimum of 48 hours after well construction, to provide time for the bentonite seal to have cured).

The ground gas monitoring should be conducted during falling atmospheric pressure. Sampling will be scheduled to occur within 48 hours after falling atmospheric pressure and / or during low atmospheric pressure (e.g. less 101.3 kPa).

It should be noted that existing groundwater wells within the associated AEC, may also be assessed for the presence of HGG, if the gas wells (GW01 and GW02) identify HGG. In this instance, ex-caps can be installed on the groundwater wells for assessment of HGG across the site.

The ground gas monitoring should be undertaken during falling atmospheric pressure using a calibrated landfill gas analyser. Selection of measuring equipment will consider the need to collect the following data:

- Static gas pressure in the borehole;
- Dynamic gas pressure at the sampling flow rate;
- Atmospheric pressure;
- Differential pressure;
- Combined gas flow rate; and

- Concentration (as % v/v) of each hazardous ground gas.

The ground gas meter will be run (without brass fittings) for approximately one minute in ambient air and ambient air readings recorded (generally <0.1% methane, <0.1% carbon dioxide, ~21.0% oxygen, ~79% balance (nitrogen plus trace gases)).

The ground gas meter transducers will then be zeroed and the meter then attached to the monitoring well (with brass fittings), and the relative and atmospheric pressure readings recorded.

The ground gas parameters shown in **Table 7.3.1.2** should be recorded to derive a gas screening value (GSV) and characteristic gas situation (CS) in accordance with NSW EPA (2020b).

The monitoring should be undertaken by tapping a quick-connect nipple fitted with airtight tubes onto the gas cap at each well. Readings should be taken every 30 seconds for approximately 5 minutes at each gas well location or until the concentrations stabilise. If readings are still fluctuating, the pump will continue to be run and concentration readings recorded at one minute intervals until equilibrium is reached. If after two minutes, the readings do not stabilise, the final gas concentrations will be recorded, along with the direction of rate of change (rapidly or slowly increasing or decreasing), and a note made that the readings are 'non stabilised' final readings.

If high ground gas concentrations are recorded on the meter (>30% v/v methane and/or 30% v/v carbon dioxide), then monitoring of the bore will be extended a further two minutes to further assess the persistence of the gas detected within the bore.

**Table 7.3.1.2. Gas monitoring parameters**

| Ground Gas | Unit of Measurement |
|---|---|
| Methane | % v/v |
| Carbon dioxide | % v/v |
| Oxygen | % v/v |
| Carbon monoxide | ppm |
| Hydrogen sulphide | ppm |
| VOCs | ppm |
| Differential pressure | Millibar |
| Borehole gas flowrate | l/hr |

At completion of monitoring on a ground gas well, the gas meter will be purged in open air (until ambient readings are achieved, (generally <0.1% methane, <0.1% carbon dioxide, ~21.0% oxygen, ~79% balance (nitrogen plus trace gases)), to mitigate risk of cross contamination with the next monitoring well. The gas meter will be switched off between monitoring wells.

Should ground gas monitoring data be required beyond that which would be collected as part of his preliminary assessment, the number of monitoring events will take into consideration advice provided in Section 3.4.6 of NSW EPA (2020a), which may include 6-12 monitoring rounds over a period of 2 months to 24 months, to facilitate capturing worse case meteorological scenarios.

## 7.4 Groundwater

### 7.4.1 AEC07 – Adjacent Industrial land use to the north and northeast of the site

Based on review of AG (2020), there is potential for groundwater contamination to be migrating onto the site from adjacent industrial land use to the north and northeast of the site.

A total of eight (8) groundwater monitoring wells were installed on 16, 17 and 18 December 2019 by Epoca Environmental Drilling, under the supervision of AG, at sampling points BH01/MW01 to BH08/MW08. Each well location was drilled using a track mounted drilling rig fitted with push tube and solid stem rotary augers.

Drilling depths were extended to a nominal depth ranging between 5m to 10m bgl. A monitoring well was then constructed using 50mm uPVC Class 18 screen and casing, PVC end cap, gravel pack, hydrated bentonite seal, lockable torque cap and a cast iron gatic lid.

On 18 December 2019, each monitoring well was developed using a battery-operated submersible pump or bailer, with groundwater removed from each well until dry.

Surveying points were established by Affinity Survey from the top of each monitoring well casing, to provide a comprehensive understanding of groundwater movement onsite. Following the survey evaluation, AG assessed each monitoring well using an interface probe to measure the depth to standing water level (SWL) from the top of casing (TOC). The depth to groundwater measured during the well gauging task, is presented in the table below.

| Sampling Point | Top of Casing (TOC) Level (m AHD) | Gauged Depth to Groundwater (m) from (TOC) | Standing Water Level (m AHD) |
|---|---|---|---|
| MW01 | 7.374 | 0.875 | 6.499 |
| MW02 | 5.475 | 3.800 | 1.675 |
| MW03 | 7.494 | 5.960 | 1.534 |
| MW04 | 16.672 | 4.503 | 12.169 |
| MW05 | 21.697 | 5.385 | 16.312 |
| MW06 | 18.711 | Well Dry | Not Applicable |
| MW07 | 20.557 | Well Dry | Not Applicable |
| MW08 | 16.641 | 4.335 | 12.306 |

Based on the survey results and gauged depth to groundwater, it is considered reasonable to assume groundwater onsite is flowing from the northeast corner to the west and south.

The locations of the monitoring well sampling points (MW01 to MW08) established on site, are presented in **Figure 5**.

Given that the two groundwater monitoring wells located in the northeast corner of the site (MW06 and MW07) were observed to be dry and no groundwater samples were collected and/or laboratory tested, the risk of groundwater contamination from adjacent industrial land use to the north and northeast of the site cannot be precluded.

Based on the above and in accordance with ASC NEPM (2013), AG proposes the following additional assessment of groundwater for the site:

- all site groundwater monitoring wells (MW01 to MW08) will be purged, tested and sampled with reference to relevant Australian Standards, NSW EPA and NEPM 2013 Guidelines.

- Prior to groundwater sampling, the groundwater level in each monitoring well will be measured using an oil / water interface meter. This will adequately assess the depth to groundwater and whether light non-aqueous phase liquids (LNAPL) are present in the water column. Groundwater will then be sampled using a disposable bailer to make a visual assessment of the potential presence of LNAPL.
- A water quality meter will be used to measure pH, electrical conductivity (EC), redox potential, dissolved oxygen (DO) and temperature (groundwater indicators). Purging will be undertaken until the field parameters are stable (generally within 10% or 0.1 for pH) for three consecutive readings taken 5 minutes apart.
- Groundwater will be sampled for COPC outlined in **Appendix C** and the groundwater stabilisation data will be recorded on groundwater sampling logs.

If groundwater monitoring wells (MW06 and MW07) are again observed to be dry and unable to be sampled, consideration will be given to the installation of additional groundwater monitoring wells onsite.

## 7.5 Review of RAP Strategy

The nature and extent of contamination onsite identified during this data gap closure assessment, will be assessed in the context of the final development design, and the RAP will be revised / updated to:

- address the nature and extent of relevant land contamination risks; and
- refine the remedial extents for the site.

The overarching remediation strategy proposed to be implemented for the site, is discussed in **Section 8**.

# 8 Remedial Strategy Options Discussion

The final remediation extent will be dependent on the outcomes of the data gap closure assessment in **Section 7**. The existing estimated extents of remediation are limited to the areas of contamination identified in the DSI and the previous investigations. Refer to **Figure 4** for sampling point locations of the exceedances recorded and refer to **Figure 3** for existing estimated extent of contamination associated with each AEC. A range of soil remediation options have been considered for the site. The options considered include only those which are proven to be effective on past remediation or related projects. The following sections review each of the soil remediation option considered and outline the selection process used.

## 8.1 Remediation Strategy Development Rationale

When assessing management of contamination, the preferred hierarchy[6] of options for site clean-up and/or management should be considered, which includes:

- on-site treatment of the contamination so that it is destroyed, or the associated risk is reduced to an acceptable level; and
- off-site treatment of excavated soil so that the contamination is destroyed, or the associated risk is reduced to an acceptable level, after which the soil is returned to the site; or

if the above are not practicable;

- consolidation and isolation of the soil by on-site containment with a properly designed barrier; and
- removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material; or
- where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

Based on the existing understanding of contaminants of concern at the site, remedial options have been considered soils impacted by asbestos and metals. However, given the data gap closure assessments (refer **Section 7**) are still to be undertaken to better understand the nature and distribution of contamination, various remediation options will remain open for consideration.

Due to the nature and potential distribution of the contamination in the underlying soil matrix, an effective remediation approach for the site will be tailored towards the key impacted source material which is the impacted reworked imported fill material. A discussion of remediation options for impacted soil is provided in the below sections.

[6] NEPC 2013, 'National Environment Protection (Assessment of Site Contamination) Measure 1999, Site Contamination Policy Framework, Section 6' dated May 2013

Further, the data gap closure assessment (**Section 7),** includes assessment of hazardous ground gas and groundwater risks. If the assessment of hazardous ground gas and/or groundwater indicates that remediation and/or management of ground gas or groundwater is required, preparation of a revised RAP setting out remedial/management options for those contamination risks will be undertaken, taking into consideration the measures set out in **Section 9**.

## 8.2 Remediation Options for Impacted Soils

Potential remediation options associated with impacted soil are extensive.

Consequently, only remediation strategies considered relevant to this site have been assessed, which include the following:

- Institutional controls / do nothing.
- Capping and Isolation.
- Excavation and off-site disposal.

A discussion on the merits and disadvantages of each option is discussed in **Table 8.1**.

**Table 8.1. Remediation Options Assessment**

| Treatment Option | Description | Advantages | | | Disadvantages | | |
|---|---|---|---|---|---|---|---|
| | | Technical | Financial | Logistical | Technical | Financial | Logistical |
| Do Nothing Scenario | No remedial action taken. Impacted soil left in-situ. | Lowest greenhouse emissions. Not considered a significant human health risk as long as the site is not disturbed. | No short-term remedial costs incurred. No operation and maintenance required. | No disturbance to site required. Existing landscape can be retained. No odour or dust management is required. | As the site is to be developed for 'residential' purposes, direct access to soil will not be restricted. This option is not protective of human health including site development workers and future tenants of the site in the long term, given increased likelihood for adverse effects with prolonged exposure. On-going liabilities including human health and the environment would remain. | Potential for future liability (e.g. EPA notices and potential health impacts to site users if exposed to unsafe levels for a long period of time.) | A long-term environmental management plan will need to be developed for site users and potential future excavation or maintenance requirements. Impacted material would remain on-site indefinitely. |
| Capping and Isolation of impacted soils | Soil removal, capping and isolation to restrict direct access to soil. Some impacted soil left in-situ. | Protective of human health including construction/ maintenance workers. Direct access to soil will be restricted and can be isolated with the appropriate mitigation measures. | Potentially lower costs through greater confidence of delivery through strategic planning (no time delays). | Moderate excavation is required to remove all the identified AECs across the entire site. | Some impacted material would remain on-site indefinitely. A notation would be placed on the planning certificate/ certificate of title. | Moderate disposal costs incurred in addition to the cost of importing clean soil material. | A long-term environmental management plan will need to be developed for site users and potential future excavation or maintenance requirements. Impacted material would remain on-site indefinitely. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Limited environmental management required during the works (e.g. dust, noise) ~ 2 months to remediate the site. | Consideration must be given to the existing drainage easements on site (if any) and the area will be required to be designed and constructed to a standard that satisfies Sydney Water/ Council development standards. Ecological impacts from loss of existing trees on the site. | | Council must confirm and approve that the containment of contamination is a suitable strategy on land that is to be reverted to Council. |
| Excavation & Offsite Disposal | Removal of all identified contaminated soil to an EPA licensed waste facility. Validation sampling to demonstrate the conditions of the residual soil impact. Reinstatement of excavated areas with material validated as suitable for the intended land use. | Protective of human health including future tenants and construction workers. Facilitate future development of the entire site. No long-term EMP will be required. | No onsite operation and maintenance required. | No ongoing management required as the impacted soil will have been removed offsite. | Based on the soil investigation results, for off-site disposal purposes, the impacted soil to be excavated and removed offsite would require waste classification in accordance with the NSW EPA *Waste Classification Guidelines 2014.* Ecological impacts from loss of existing trees on the site. | Very high remedial cost incurred to remediate and backfill the entire site. | Major excavation works is required.<br><br>Odour, vapour and dust management required during the excavation works.<br><br>May increase truck traffic in area to transport contaminated soil for a short period of time. |

## 8.3 Preferred Method and Extent

Given the nature of known contamination, impacted material must be either isolated or removed to limit risk. Therefore, two management options for this material are proposed, and decisions regarding selection of the appropriate methodology will ultimately lie with the site owner with input from the appointed environmental consultant.

Disposal to an approved facility, or onsite encapsulation with long term management by means of a management plan, are considered suitable and appropriate options for the management of the impacted fill. The areas of the site where encapsulation may be feasible are likely to be limited and adoption of this strategy will require revision of the RAP once:

- final development design is known;
- appropriate encapsulation areas identified; and
- approval from the planning authority has been received.

It is noted that there are limitations with onsite encapsulation with a long term management plan. Mechanisms to enforce the management plan, and obtaining confirmation from the local planning consent authority (City of Canterbury Bankstown Council) that contamination containment is acceptable, will need to be considered (in addition to public notification via notation on relevant planning certificates and/or certificates of title.

The remediation method/ strategy will be finalised once the full extent of contamination onsite has been quantified. This will be based on the additional (data gap closure) assessments to be conducted.

Staged demolition and bulk earthworks is proposed for site redevelopment works.

Alliance understand that data gap assessments (where required) and area/stage specific RAPs will be prepared and implemented to coincide with the proposed staged demolition and bulk earthworks plan for the site.

The proposed staged demolition and bulk earthworks plan for the site is presented in **Appendix D**.

## 8.4 Anticipated Volumes (prior to data gap closure assessment)

Known contamination at AEC01, AEC01a, AEC02 and AEC03 are unsuitable for the proposed use of the site, therefore will require remediation. Based on the results of investigations to date, the volume of material requiring management was calculated as follows:

**AEC01** – Remediation area = 12,800 $m^2$ x 0.8m (avg. depth of fill) depth = **10,240 $m^3$** insitu asbestos impacted soil.

**AEC01a** – Remediation area = 1,000 $m^2$ x 0.25m depth = **250 $m^3$** metals (lead, cadmium and zinc) impacted soil.

**AEC02** – Remediation area = 17,100 $m^2$ x 1.0m (avg. depth of fill) depth = **17,100 $m^3$** asbestos impacted soil.

**AEC03** – Remediation area = 13,500 $m^2$ x 1.5m (avg. depth of fill) depth = **20,250 $m^3$** asbestos impacted soil.

AG notes that AEC04 and AEC05 are yet to be investigated, but will be once all structures onsite have been demolished and removed. AG also notes that the above approximate volume of contaminated soils may be amended by way of delineation (vertically and horizontally) and further assessment.

## 8.5 Timing of Works

Timing of the works is dependent on the data gap assessment and construction schedule of the development, but should be completed prior to any preparatory earthworks commencing at the site.

## 8.6 Deviations from RAP

While it may be possible to vary the sequence and/or details of the validation works to meet site constraints, a suitably experienced environmental consultant should be appointed to the project to ensure:

- Critical stages of the site remediation/validation process are appropriately monitored, implemented and documented, with the relevant data collected for environmental reporting purposes.
- Any deviations from the works specified in this RAP are properly documented and approved, as required under the NSW EPA (2020) *Contaminated Site Guidelines: Consultants Reporting on Contaminated Sites*.

Performing assessment works without the presence of a qualified environmental engineer/scientist when necessary may lead to project delays and extra costs due to additional environmental investigation requirements imposed by the qualified Environmental Consultant or the appointed Site Auditor to confirm the environmental status of the site. Revisions of the RAP or preparation of staged remedial works plans (RWPs) for the site will be subject to review and approval by the Site Auditor.

Furthermore, excess spoil removed from the site without proper characterisation and/or waste classification assessment, may lead to regulatory action and potential penalties, as described under the *Protection of the Environment Operations* (*Waste) Regulation 2014*, the *Protection of the Environment Operations Act 1997* and the *Contaminated Land Management Act 1997*.

# 9 Remedial Contingency Plan

## 9.1 Contingency Measures

It is possible that during works, unexpected conditions may be encountered, such as the discovery of different types of filling, aesthetic impacts, or soil conditions different to those currently understood. If encountered, it may be necessary to stop work and re-consider the proposed approach before continuing. **Table 9.1** presents a contingency plan for contamination related scenarios.

**Table 9.1. Remediation Contingences**

| Scenario | Remedial Contingencies/Corrective Action |
|---|---|
| Contamination not identified during previous investigation is encountered. | Isolate material and classify for offsite disposal.<br>Ensure no risk of residual contamination exists. |
| Chemical spill / exposure | Stop work, refer to Health and Safety Plan and immediately contact the Site Supervisor. |
| Excessive Rain | Cover those working areas not located under cover, where possible, with plastic during off-shifts. Inspect and maintain sediment controls. |
| Excessive Dust | Use water sprays, biodegradable dust sprays, cease dust-generating activity until better dust control is achieved, or apply interim capping systems. If necessary, install dust deposition gauges prior to and during works to monitor the effectiveness of dust controls implemented on-site. |
| Release of fuel/oil from machinery | Remove source, use spill kit to absorb oil and make any repairs as required. If necessary, implement temporary measures until booms can be deployed; (e.g. earth embankments) to prevent movement of spill into water courses. |
| Complaint Management | Notify site management and owners (if required) following complaint and record details as per management procedures. Implement control measures to address reason of complaint (if possible) and advise complainant of results. |
| Unexpected potential contamination or underground structures encountered during remediation (e.g. underground storage tank, underground pit) | Consider excavation of test pits / trenches to assess potential for contamination to be present.<br>Remove underground structures (if required) and associated soil contamination (if required).<br>Consider groundwater assessment, subject to nature and extent of identified contamination.<br>Amendment to the preferred remedial strategy (if required), pending the outcomes of the assessment of the unidentified contamination. |
| Greater volume of soil than anticipated, requiring management or remediation | • Waste classification of the additional material, with excavation and offsite disposal; or<br>• Increased onsite containment, with appropriate long term management strategy |

| | |
|---|---|
| Hazardous ground gas risks | Depending on the nature and extent of hazardous ground gas contamination, consideration may be given to the following remedial strategies:<br>• passive measures, including vertical barrier installation, vertical sub-surface venting, building foundation and ventilation design amendments, floor slab joint and penetration sealing; gas proof membranes, and venting systems beneath buildings; and<br>• active measures, including sub slab depressurisation, sub-slab venting systems, gas extraction wells or trenches, and over-pressurisation systems (for buildings and/or slabs).<br>The preferred strategy will be incorporated into a revision of the RAP or preparation of an RWP, for review and approval by the Site Auditor. |
| Groundwater contamination risks | Depending on the nature and extent of groundwater contamination, consideration may be given to the following remedial strategies:<br>• Point source removal;<br>• In-situ air sparging to facilitate contaminant biodegradation, or be coupled with soil vapour extraction (SVE);<br>• In-situ chemical oxidation (ISCO);<br>• Skimming;<br>• Monitored natural attenuation (MNA);<br>• Barrier systems (either reactive barriers or impermeable walls);<br>• Pump and treat systems; or<br>• Long term management by way of embargoes on groundwater abstraction<br>The preferred strategy will be incorporated into a revision of the RAP or preparation of an RWP, for review and approval by the Site Auditor. |

# 10 Remedial Works

The sequence of remedial works is expected to occur as follows:

1. Review of Data Gap Closure Assessment and revision of RAP (with Site Auditor review and approval).
2. Notification / Planning.
3. Site Establishment.
4. Offsite Disposal and/or onsite encapsulation.
5. Site Validation and Reporting.

The following remediation works, is based on data available at the time of preparing this RAP.

## 10.1 Remedial Goal

The remedial goal for this site is to remediate potential soil contamination (where identified) to a level that does not present an unacceptable human health or ecological exposure risk, based on the proposed land use scenario.

## 10.2 Notification / Planning

Alliance understands that remedial works classified as Category 2 under State Environmental Planning Policy (SEPP) Hazards and Resilience (2021), do not require development consent. However, in the event that the proposed remedial works trigger the Category 1 criteria in the SEPP, including but not limited to issues related to:

- designated development under the Environmental Planning and Assessment Regulation;
- critical habitat under the Threatened Species Conservation Act;
- the works having a significant effect on threatened species, populations or ecological communities or their habitats;
- the works being located in areas of environmental significance; or
- requiring consent under another SEPP or a regional environmental plan (REP),

then development consent for the remedial works may be required.

Demolition works (if required) will be undertaken by a contractor holding an appropriate SafeWork NSW demolition licence. That licence will hold a chemical endorsement, in the event that demolition works include an underground and/or aboveground storage tank.

Approvals will be obtained (if required) from NSW Roads and Maritime Services (RMS) for works being undertaken adjacent to (or on) RMS identified assets.

A water access licence will be obtained (if required) from Water NSW, in the event remediation works requires water to be taken at specified times, rates and circumstances from specified areas or locations.

A water supply work and use approval will be obtained (if required) from Water NSW, in the event remediation works requires construction and use of a specific water supply at a specified location. Water supply works may include pumps, bores, spear points and wells.

Asbestos removal works (if required) will be notified to SafeWork NSW by the remediation contractor. The asbestos removal works will be undertaken by a contractor that will hold a:

- Class A licence for removal of friable asbestos / asbestos fines; and
- Class B licence for removal of bonded asbestos.

Within seven days of completion of underground storage tank abandonment / decommissioning / removal works (if applicable), a notification will be sent to SafeWork NSW by the remediation contractor.

Within 30 days of completion of all remediation and validation works, a notice of completion of the remedial works will be submitted to the relevant planning authority.

Site specific management plans will be developed to guide the development and ensure compliance with applicable legislation. Methods and procedures for minimising potential impacts to the environment, dust control, traffic movements, work health and safety and material stockpiling will be included. From a contamination perspective, the main issues requiring management are dust and sediment. Typical management measures for such issues include (but are not limited to):

- In dry conditions, soils can be covered with plastic sheeting to reduce dust generation.
- Locating stockpiles away from any open drainage systems, overland flow paths or exposure to rain, and reduce the movement of soil by placing haybales around the base of each stockpile.
- Soil for offsite disposal should be excavated by strata type (fill, clay, rock, etc.) to reduce mechanical transport of contaminants.
- Personal protective equipment and identifying the location of underground services.

The stability of structures (including, but not necessarily limited to footings, walls, buildings and roads), which may be impacted by the proposed remedial works) will be assessed by a suitably experienced structural consultant before commencing remedial works. Recommendations made by the structural consultant will be incorporated by the remediation contractor, into the execution of all relevant site works.

## 10.3 Site Establishment

Site establishment will involve communications between the Environmental Consultant, Remediation Contractor and Project Manager(s) and discuss the need for any further remedial measures, excavation plans, and environmental management requirements. Mitigation measures required under site management plans such as sedimentation control and hygiene facilities should also be installed.

The below sections will be updated in relation to remedial extent and strategy, based on the findings of the post demolition and additional assessments to be conducted at the site.

## 10.4 AEC01, AEC02 and AEC03 – Offsite Disposal and/or Onsite Encapsulation of Asbestos Impacted Soils

### 10.4.1 Offsite Disposal (Option 1)

Impacted soils within AEC01, AEC01a, AEC02 and AEC03 will be excavated to the base of fill materials, exposing underlying natural materials. The fill materials will be stockpiled within an AEC (to be updated, based on discussions with remediation contractor) and sampled for waste classification in accordance with the relevant waste classification and SafeWork NSW Codes of Practice.

AG notes that the remedial works for the associated AECs will result in remediation/ removal of asbestos impacted soils.

The validation strategy for the associated AECs are set out in **Section 11**.

### 10.4.2 Onsite Encapsulation (Option 2)

The feasibility of adopting on-site encapsulation as a strategy will be dependent on the final development design and approval by the planning authority. However, onsite encapsulation has been included here as an option if the data gap closure assessment and RAP revision considers it to be an appropriate and practical option.

Impacted soils within AEC01, AEC01a, AEC02 and AEC03 will be excavated and temporarily stockpiled, prior to capping the materials at a suitable location (to be selected by site owner and remediation contractor). The selected area within the site proposed for encapsulation will be excavated to an appropriate depth in order to accommodate the placement of the asbestos impacted materials and clean fill capping materials.

The capping strategy for the excavated materials has been prepared with reference to relevant sections of WA DOH (2009). The containment by capping strategy is primarily focussed on isolating the fill material using appropriate barriers to prevent the disturbance and generation of potentially harmful materials. This will be carried out by:

- placement of high visibility geo-textile membrane (marker layer) over contaminated fill material, ensuring the geotextile membrane comprises:
    - Water permeable;
    - Highly visible;
    - Rot-proof and chemically inert;
    - High tensile strength;
    - Covers contaminated area and 0.5m, beyond contaminated boundary (if practical); and
    - Parallel sheets to be fixed together or overlap by a minimum of 20cm.
- Ensure a capping layer of clean fill (ENM or VENM) is placed over geo-textile membrane to the nominal depth of up to 1.0m, with a minimum thickness of at least 0.5m cap for residential/commercial and an additional minimum of 0.2m of topsoil in landscaped areas, and minimum of 1m cap for open space area; and
- Vegetate/landscape the surface of the capping layer, to protect the clean fill capping layer from natural erosion and/or anthropogenic disturbances.

In addition to the above, areas proposed for installation of inground services, a capping layer of clean fill (ENM or VENM) is placed over geo-textile membrane to the nominal minimum depths (about 0.5m below proposed invert levels) below surface finished level.

The depth of clean fill capping may be reduced based on a presence of a hardstand (i.e. proposed courts, slabs, pavements).

### 10.4.3 Onsite Encapsulation for Tree Protection Zones (TPZ's)

If any significant trees are to be retained onsite and are located within asbestos impacted areas, the following remediation strategy is proposed for Tree Protection Zone Areas in order to preserve the ecological significance of native trees onsite:

- hand pick visible construction and demolition waste and potential asbestos containing material in selected areas under the tree canopies, where feasible;
- remove surface soils (150mm) using non-destructive excavation techniques such as dry vacuum (equipped with HEPA filtration system), hand held implements or water pressure in an attempt to reduce potential root damage to the trees;
- the lateral extent of capping of the TPZ's are dependent on the meter radius (mR) provided for specific tree species identified at the site. The lateral extent of the TPZ's will identified and surveyed by the remediation contractor prior to commencement of excavation/ remediation works onsite;
- placement of high-visibility geo-textile membrane (marker layer) over contaminated fill material, ensuring the geotextile membrane comprises:
    - Water permeable material;
    - Highly visible;
    - Rot-proof and chemically inert;
    - High tensile strength;
    - Covers contaminated area and 0.5m, beyond contaminated boundary (if practical); and
    - Parallel sheets to be fixed together or overlap by a minimum of 0.2m.
- place a minimum depth of 450mm of clean fill materials that is coarse in texture (i.e. 300mm of 20mm Gravel) surrounding the tree trunk and a course sandy loam material for the remainder of the capping.

The remediation strategy for TPZ areas will be assessed and the RAP revised following the results of the data gap closure assessment and preparation of the final development design. The encapsulation option may not be feasible based on the proposed land use.

Care shall be undertaken to preserve woody roots intact and undamaged during excavation. Any roots encountered of less than 0.05m in diameter may be cleanly severed with clean sharp pruning implements at the face of the excavation. The root zone in the vicinity of the excavation shall be kept moist following excavation for the duration of construction to minimise moisture stress on the tree. Where large woody roots (greater than 0.04m diameter) are encountered during excavations, further advice from a qualified arborist shall be sought prior to severance.

*AG notes that the appointed Arborist along with the remediation contractor will assess and survey the lateral extents of all TPZ areas onsite. The survey will be used to inform the Long-Term Environmental Management Plan (LT-EMP).*

### 10.4.4 Backfilling

Should remedial excavations require backfilling, then backfill soils will be limited to:

- Virgin excavated natural material (VENM);
- Excavated natural material (ENM);
- Inground Services Trench Backfilling - Other material that is the subject of a resource recovery exemption and the placement of that material is within the lawful constraints of the resource recovery

exemption (and does not present an unacceptable exposure risk to human health or the environment, within the context of the proposed land use setting);

- Landscaping materials that has been analysed and verified for importation and placement onsite; or
- Material that has been analysed and verified for beneficial re-use onsite**.**

Consideration will be given to geotechnical engineering requirements associated with backfilling; however, those requirements will be specified by others elsewhere.

#### 10.4.5 Unexpected Finds Protocol

The contamination assessments to date have not indicated the presence of significant soil contamination that is unacceptable for the proposed land use beyond the area of remediation described in this RAP. However, it is possible that unexpected finds may be present within the fill material. To this end, an unexpected finds protocol has been compiled, and is summarised herein. Unexpected finds could include, but are not limited to:

- Other underground storage tanks that are previously not identified;
- Buried containers and drums;
- Phase separated hydrocarbons;
- Powders and other suspicious buried material;
- Potentially hazardous materials; and
- Evidence of contamination including significant staining, odours and discolouration.

In the event that any material suspected of containing potentially hazardous substances is found during remediation works, the unexpected finds protocol, included in **Appendix E** is to be followed.

### 10.5 Roles and Responsibilities

The remediation management team (RMT) is responsible for the decision making and ultimately, the success of the project. **Table 10.5** identifies current key roles and responsibilities required and those entities currently responsible. However, as development consent has not been granted, not all details can be provided. Details of the management team should be updated and remain current for the duration of the work.

**Table 10.5. Remediation Management Team**

| Team Member | Organisation | Responsibilities |
|---|---|---|
| Property Owner or Site Developer | Mirvac Residential (NSW) Developments | • Overall responsibility of site and key liaison for council. Appoints site contractors, including all other members of the RMT. |
| Project Manager – Site Operations | TBA | • Overall site management and day to day decision maker. Key communicator between site and owner / developer<br>• Ensure relevant control plans are developed and implemented. |
| Remediation Contractor | TBA | • Site preparation including establishment of management plan requirements, importation of suitable landscaping material (if required) waste classification and disposal, as well as ensuring the remediation is conducted in accordance with this plan.<br>• Ensure consultant is up to date with work schedules and is engaged to complete key components of the work (i.e. waste classification).<br>• Implementation of measures required to mitigate any adverse effects resulting from the remediation;<br>• Ensure all spoil removed from site is classified by the environmental consultant and is disposed of at a suitable facility.<br>• Tracking of waste between site and deposition facility, including collection of all waste documentation to be provided to the environmental consultant.<br>• Reporting any environmental issues, complaints or unexpected finds to the project manager and environmental consultant. |
| Environmental Consultant | Alliance Geotechnical | • Development of the remediation objectives and strategy.<br>• Support all other members of RMT in understanding the requirements of the RAP and the potential risk posed should measures not be implemented.<br>• Monitoring of key remediation components, collection of all environmental samples, and provide guidance to ensure the remediation is understood, and effective.<br>• Complete site validation tasks and detail the works in a validation report concluding on site suitability. |
| Local Government Authority | Canterbury Bankstown Council | • Responsible for the granting of all consents and ensuring the recommendations of environmental reports are implemented. |

# 11 Validation Data Quality Objectives

## 11.1 Data Quality Objectives

Data Quality Objectives (DQO) were developed in a sequential manner as documented below

**Table 11.1 Data Quality Objectives**

| Step | Description |
|---|---|
| State the Problem | The site is to be subdivided for residential use, with other site areas designated for ecological conservation and infrastructure. Historical information and site inspection identified the potential for localised contamination to be present in site soils. A conceptual site model has also been developed for the site and is present in **Appendix C**. |
| Identify the Decision | Based on the objectives, decisions that need to be made are<br>• Is the sampling adequate to determine the risk of contamination at the site, including any potential offsite migration?<br>• If the data does not provide enough information, what data gaps require closure to enable the suitability of the site to be determined, or selection and design of an appropriate remedial strategy |
| Identify Inputs to the Decision | Inputs to the decision process include:<br>• Previous works and details of the proposed development;<br>• Understanding of current site use and historic activities that have occurred;<br>• Geological and hydrogeological data relevant to the area, including physicochemical parameters for calculating ecological criteria;<br>• Site observations for the presence of visual/olfactory contamination indicators;<br>• Contaminant concentrations in soil at the site indicating the distribution of contaminants; and<br>• Further input to the decision will be sample collection and handling, field and laboratory QAQC and confirmation that data quality indicators (DQIs) were achieved. |
| Define the Boundary of the Assessment | Spatial – Works are limited to the site boundaries and to a depth below reported contamination.<br>Temporal – The results will be valid on the day samples are collected and will remain valid if no changes to site use occur, and contamination (if present) does not migrate on to site from off-site sources.<br>Constraints of sampling requiring consideration include access restrictions (due to site operations and/or conditions) and presence of both above and underground services / structures. |
| Develop a Decision Rule | • Is the site suitable for the proposed land use?<br>*If the concentrations of contaminants in the soil that remains are below the relevant health-based and ecological criteria for the intended land use; then the site will be deemed suitable for the proposed development.* |

| | |
|---|---|
| | • Is additional information required to determine the suitability of the site for its proposed use?<br><br>*Should additional information be required as determined by the conceptual site model (CSM), then appropriate recommendations will be provided.*<br><br>Decision criteria for analytical data are defined by the Data Quality Indicators (DQI) in **Table 11.2**. |
| Specify Acceptable Limits on Decision Errors | Specific limits for this project are to be in accordance with NEPM, appropriate data quality indicators (DQIs) for assessing the useability of the data, and standard procedures for field sampling and handling.<br>To assess the useability of the data, pre-determined DQIs for completeness, comparability, representativeness, precision and accuracy, as presented below in **Table 11.2.**<br>If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly influence the usability of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of samples. |
| Optimise the Design for Obtaining Data | To achieve the DQOs, the following is required:<br>• Soil sampling (waste classification and imported backfill material) is to be completed for validation of remedial excavations, and waste classification for offsite disposal and the suitability of any materials for site importation; and<br>• Documentation of the condition of the site as being suitable for the proposed development |

## 11.2 Data Quality Indicators

To ensure that the data collected is of an acceptable quality, the data set will be evaluated against the data quality indicators (DQI) outlined in **Table 11.2** which related to both field and laboratory-based procedures.

**Table 11.2 Data Quality Indicators**

| Data Quality Objective | Data Quality Indicator | Acceptable Range |
|---|---|---|
| Accuracy | Field – Trip blank (laboratory prepared)<br>Laboratory – Laboratory control spike and matrix spike | < laboratory limit of reporting (LOR)<br>Prescribed by the laboratories |
| Precision | Field – Blind replicate and spilt duplicate<br>Laboratory – Laboratory duplicate and matrix spike duplicate | < 30 % relative percentage difference (RPD [%])<br>Prescribed by the laboratories |
| Representativeness | Field – Trip blank (laboratory prepared)<br>Laboratory – Method blank | < laboratory limit of reporting (LOR)<br>Prescribed by the laboratories |
| Completeness | Completion (%) | - |

## 11.3 Sampling Procedures

Based on the existing data and in-lieu of additional assessments to be conducted, sample collection is for validation purposes will to be required, and for waste classification (should material require offsite disposal). A conceptual site model derived for the site is presented in **Appendix C**. Procedures for the collection of samples is presented below.

**Table 11.3. Sampling Procedures**

| Action | Description |
|---|---|
| Sample Collection | Soil sampling will be directly from within the centre of the excavator bucket or immediately from the exposed excavation surface. Sampling data shall be recorded to comply with routine chain of custody requirements. When collecting the sample, either in-situ or from an excavator bucket, the outside layer of soil is to be removed. |
| Sampling, handling, transport and tracking | Stainless steel sampling equipment (including hand tools or excavator parts) is to be washed in a 3% solution of phosphate free detergent (Decon 90), followed by a rinse with potable water prior to each sample being collected. Direct transfer of the sample is preferred, with each sample container sealed to eliminate cross contamination during transportation to the laboratory. Each sample is labelled with individual and unique identification including Project No., Sample No., Sampling depth, date and time of sampling then placed into a chilled, enclosed and secure container for transport to the laboratory; and Provide chain of custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to the environmental laboratory. |
| Sample Containers & Holding Times | All sample containers should be supplied from respective laboratory. All containers are to be filled with sample to the brim, then capped and stored in ice-filled chests, until completion of the fieldwork and during sample transit to the laboratory. |
| Field QA/QC | Quality assurance (QA) and quality control (QC) procedures will be adopted throughout the field sampling programme to ensure sampling precision and accuracy, which will be assessed through the analysis of 10% field duplicate/replicate samples.<br>• Appropriate sampling procedures will be undertaken to prevent cross contamination. This will ensure:<br>o Standard operating procedures are followed;<br>o Site safety plans are developed prior to works commencement;<br>o Split duplicate field samples are collected and analysed;<br>o Samples are stored under secure, temperature-controlled conditions;<br>o Chain of custody documentation is employed for the handling, transport and delivery of samples to the contracted environmental laboratory; and<br>o Contaminated media from the site area is disposed in accordance with relevant regulatory guidelines. |

| | |
|---|---|
| | In total, field QA/QC will include one in 10 samples to be tested as blind field duplicates, one in 20 samples to be tested as inter-laboratory duplicates (ILD), and one equipment wash blank sample per sample batch. No QA/QC samples will be collected for asbestos sampling. |
| Laboratory Quality Assurance and Quality Control | The contract laboratory will conduct in-house QA/QC procedures involving the routine analysis of:<br>• Reagent blanks;<br>• Spike recoveries;<br>• Laboratory duplicates;<br>• Calibration standards and blanks;<br>• QC statistical data; and<br>• Control standards and recovery plots. |
| Achievement of Data Quality Objectives | Based on the analysis of quality control samples (i.e. duplicates/replicates and in-house laboratory QA/QC procedures), the following data quality objectives are required to be achieved:<br>• Conformance with specified holding times; and<br>• Field and laboratory duplicates and replicates samples will have a precision average of +/- 30% relative percent difference (RPD).<br>An assessment of the overall data quality should be presented in the final validation report, in accordance with the EPA (2017) *Guidelines for the NSW Site Auditor Scheme*. |

## 11.4 Validation Sampling

Review of the draft NSW EPA Contaminated land guidelines, Sampling design – part 1 application (2020a) – Section 5.2.1 states that judgemental sampling is recommended for validation of the remediation of solid media and the removal of infrastructure. Further, Section 6.2.1 of NEPM ASC (2013) states that the number and location or sampling points is based on the knowledge of the site and professional judgement. Sampling should be localised to known or potentially contaminated areas identified from knowledge of the site either from the site history or an earlier phase of site investigation. Judgemental sampling can be used to investigate sub-surface contamination assessment issues in site assessment.

Validation should focus on collecting clear evidence to assess whether the key objectives have been met. Validation sampling programs should identify and delineate the lateral and vertical extent of contamination (if any) and arrive at a scientifically defensible and statistically valid data set which characterises the chemical concentrations and human health risk present at the site.

An appropriately experienced environmental consultant will be present onsite at all stages of the remediation works, to assess the extent of remediation required to render the site suitable for the proposed development. Site observations and field screening equipment can be used to assist in decision-making in relation to:

- The location and extent of any excavations to trace contamination or whether to remove additional soil;
- Create a more focused sample collection (number and location) and laboratory analysis; and
- The need to consider (or implement) any specific health and safety measures.

A judgemental validation sampling pattern will be carried for asbestos sampling in areas of natural soils, with one soil sample collected from the base of the excavation (1 per 50m$^2$ grid) and one soil sample collected from each wall (per 10 linear meters – at the approximate depth of the of the initial contamination) of the remedial excavation footprints. Additional sampling will be required for characterisation of fill as per the AEC requirements in **Table 11.4**.

Certification will be required for any importation of recycled materials to site, with reference to the relevant resource recovery exemption. Analysis and verification of the materials will also be conducted as per requirements in **Table 11.4**.

For areas considered for remediation via capping/ isolation, placement of the high visibility geotextile membrane must be validated in accordance with WA DOH (2009). A survey of site levels for the vertical and lateral extent of the capped areas will be conducted prior to placement of any capping materials at an appropriately spaced across the capping area. The spacing of survey spot levels must be agreed with the environmental consultant. Once capping of the subject remediation area is completed, a final survey (in the same spot levels as previous survey) must be conducted in order to confirm the appropriate capping thickness has been achieved.

The validation sampling arrangements for this project are presented in **Table 11.4**.

**Table 11.4 Applicable Validation Sampling per validation scenario**

| Area of Environmental Concern | Validation Scenario | Validation Sampling |
|---|---|---|
| AEC01a | Excavation and removal of contaminated fill material and validation of excavation base. | A systematic visual assessment of the base of the excavation (exposing natural materials) will be undertaken by an environmental consultant. It is anticipated that all fill materials will be removed.<br>If there are fill materials exposed on the walls of the excavation, collect one 250ml jar and one asbestos grab soil sample per 10 linear meters of excavation wall (minimum one per wall - at the approximate depth of the of the initial contamination, i.e. 0.0m to 0.25m from existing surface level).<br>Collect one 250ml jar and one asbestos grab soil sample per 100m$^2$ from the base of the excavation footprint.<br>Samples are to be analysed for Heavy Metals and asbestos (absence/presence) by a NATA accredited lab. |
| AEC01, AEC02 and AEC03 | Excavation and removal of contaminated fill material and validation of excavation base and walls. | A systematic visual assessment of the base and walls of the excavation will be undertaken by an environmental consultant. Fill material within the AEC will be excavated down to natural soils.<br>As there will be no fill materials remaining upon removal of asbestos impacted soils, and natural materials exposed, then a 500mL validation sample is required to be collected at a rate of 1 per 50m$^2$.<br>One (1) 10 L sample collected and assessed for fragments of ACM >7 mm, per 10 linear meters of excavation wall (minimum one per wall for every vertical metre of exposed fill materials).<br>One (1) 500 mL NEPM asbestos quantification (0.001%) (sealable plastic bag) sample per 10 linear meters of excavation wall (minimum one per wall for every vertical metre of exposed fill materials) be analysed for friable asbestos (FA)/asbestos fibres (AF) by a NATA accredited lab.<br>A visual clearance and an asbestos clearance report issued by a licensed asbestos assessor upon removal of asbestos impacted soils. |

| | | |
|---|---|---|
| AEC01, AEC02 and AEC03 | Excavation and removal of contaminated fill material;<br>Lateral and vertical survey pre and post cap installation to confirm the extent of each cell and the installation thickness for the overlying cap;<br>Inspection of geotextile marker layer to confirm its adequacy as a high visibility layer, the extent of placement over fill materials and the integrity of the geotextile when placed; and<br>Assessment of imported fill (VENM/ENM) prior to placement. | **Option A – in-situ isolation of impacted materials:**<br>A systematic visual assessment of the base and walls of the excavation will be undertaken by an environmental consultant. Fill material within the AEC will be excavated down to a depth of 1m below ground surface and capped with 1m of imported (VENM/ENM) materials. Survey plans, photographic records of geo-textile marker layer and review and approval of documentation on imported fill (VENM/ENM) by appointed environmental consultant prior to delivery to site.<br>One (1) 10 L sample collected and assessed for fragments of ACM >7 mm, per 10 linear meters of excavation wall (minimum one per wall for every vertical metre of exposed fill materials).<br>One (1) 500 mL NEPM asbestos quantification (0.001%) (sealable plastic bag) sample per 10 linear meters of excavation wall (minimum one per wall for every vertical metre of exposed fill materials) be analysed for friable asbestos (FA)/asbestos fibres (AF) by a NATA accredited lab.<br>For the purpose of characterising residual fill materials that are to capped, soil samples are required to be collected (frequency dependant on AEC area in accordance with NSW EPA *'Sampling Design Guidelines' 1995*) to the base of the residual fill layer.<br>Samples are to be analysed for asbestos AF/FA quantification, metals and associated ASLP characteristics (where required) by a NATA accredited laboratory.<br>**Option B – excavation and placement in a burial cell within the site (area to be selected by the site owner):**<br>**Step 1** - A systematic visual assessment of the base and walls of the excavation will be undertaken by an environmental consultant. Fill material within the AEC will be excavated down to natural soils.<br>As there will be no fill materials remaining upon removal of asbestos impacted soils, and natural materials exposed, then a 500mL validation sample is required to be collected at a rate of 1 per 100m$^2$.<br>Collect one 10L sample (in accordance with WA DoH 2009) per 10 linear meters of excavation wall (minimum one per wall for every vertical metre of exposed fill materials).<br>Samples are to be analysed for asbestos AF/FA quantification, by a NATA accredited lab.<br>A visual clearance and an asbestos clearance report issued by a licensed asbestos assessor upon removal of asbestos impacted soils.<br>**Step 2** – Excavation of the burial cell, allowing for the volume of impacted materials to be capped.<br>The stockpiled fill materials will be backfilled within the burial cell and capped with a combination of proposed pavements/ hardstand. Details of the proposed |

**Table 11.4 Applicable Validation Sampling per validation scenario**

| Area of Environmental Concern | Validation Scenario | Validation Sampling |
|---|---|---|
| | | hardstand and/or pavement will need to be included in the future versions of the RAP (if required).<br>Survey plans, photographic records of geo-textile marker layer and review and approval of documentation on imported fill (VENM/ENM) by environmental consultant. |
| Waste Classification | - | Quantity dependent – refer to NSW EPA *Waste Classification Guidelines (2014)* and sample density based on Tables 1 and 2 of the *Excavated Natural Material Order 2014.* Auditor to be consulted once quantity is known. |
| Beneficial re-use of fill materials (if reused onsite and not subject to capping) | - | Collection of 1 sample per 25m$^3$.<br>Samples are to analysed for Heavy Metals (where required) and 10L samples collected and assessed for fragments of ACM >7 mm (in accordance with WA DoH 2009) for asbestos quantification by a NATA accredited lab. One (1) 500 mL NEPM asbestos quantification (0.001%) (sealable plastic bag) sample per 25 m$^3$ of material. Soil samples will be analysed for friable asbestos (FA)/asbestos fibres (AF).<br>Validation of material to include an assessment for aesthetics as per 3.6.2 and 3.6.3 of ASC NEPM 2013(a). |
| Contingency Areas | - | A systematic visual assessment of the base and walls of the excavation will be undertaken by an environmental consultant. All fill material within the AEC will be excavated down to inferred natural material. PID screening will be conducted on samples collected on areas of potential impact.<br>Collect one 250 ml jar soil sample per 25 m$^2$ from the base of the excavation footprint.<br>Collect one 250 ml jar soil samples per 5 linear metres of excavation wall (minimum one per wall).<br>Samples are to be analysed for TRH, BTEXN, PAHs, VOC's, Metals, PCBs, OCP, and asbestos by a NATA accredited lab. |

**Table 11.4 Applicable Validation Sampling per validation scenario**

| Area of Environmental Concern | Validation Scenario | Validation Sampling |
|---|---|---|
| Imported Fill – VENM | - | One (1) per 1,000 $m^3$ or at least 3 samples per stockpile / site. |
| Imported Fill - ENM | - | Quantity dependent – refer to the Excavated Natural Material (ENM) order for further details. |
| Imported resource recovery order/ exemption material | Laboratory certification required to confirm imported engineering materials has been classified with reference to a relevant resource recovery order/exemption.<br>Visual verification (by the client) of materials upon delivery to site for confirmation they are free of visible/olfactory indicators of contamination. | At least 3 samples per source site.<br>For aggregates - samples are to be analysed for asbestos (absence/presence) by a NATA accredited lab; or<br>If the material contains significant fines, asbestos testing to be conducted in accordance with NEPM (2013) w/w% for asbestos quantification by a NATA accredited lab. One (1) 500 mL NEPM asbestos quantification (0.001%) (sealable plastic bag) sample (minimum 3 samples). |

NOTE: If the validation testing identifies contamination outside of the known AEC extent (lateral and vertical), AG will conduct delineation testing (targeting the depth of newly identified contamination) in order to identify the contamination extent (lateral and vertical).

The quantity and movement of all waste materials excavated and removed offsite will be closely tracked by the remedial contractor under the supervision of the appointed environmental consultant. This will include internal tracking of material for reuse on the site. All waste disposal dockets issued by the suitably licensed waste receiving facility will be retained by the remedial contractor for reconciliation against the material tracking records, and for inclusion in the final site validation report. This will demonstrate that the waste was appropriately disposed to licensed facilities.

The site validation report will be issued by a suitably experienced environmental consultant.

If visual or olfactory observations indicated a potential for soil contamination to be present, then collection of additional validation samples will be considered.

The location of each sampling point will be marked on a site plan.

### 11.4.1 Soil Sampling Methodology

Grab soil samples will be collected at each required sampling point directly from the base and walls (where appropriate) of the excavation, however for asbestos sampling of fill material (should fill materials remain) a 10L (bucket sample for bonded ACM) and a 500mL (quantification AF/FA) samples are required.

The asbestos sampling and analysis for assessment and validation of fill materials will be conducted in accordance with WA DOH (2009), and involves:

- Collection of a 10L sample from each test location;
- The 10L sample will be weighed and recorded;
- Samples shall be screened through a 7mm sieve or spread out on a contrasting colour fabric/ tarp;
- Observable ACM and FA weighed and calculated for asbestos soil concentration;
- One wetted 500mL sample will be collected from each test location; and

- Samples will be sent to the laboratory for asbestos quantification (AF/FA) testing.

Depending on the depth of the excavation footprint, an excavator may be required to obtain samples. In these instances, samples will be collected from soils in the centre of the excavator bucket, to avoid cross contamination from the excavator bucket.

For soil sampling in areas where potential VOC impacts may be present, a photo-ionisation detector (PID), fitted with a 10.9 eV lamp, will be used to screen selected discrete soil samples (collected at every 0.5m intervals) for the presence of potential volatile organic compounds. Soil vapour field screening results will be utilised for the selection of samples for laboratory analysis. Dedicated nitrile gloves were used for the collection of each soil sample.

Sampling will be guided by a combination of visual evidence (ACM) and olfactory evidence.

Observations of the materials encountered during sampling will be recorded on the relevant field observation log with photographic record.

### 11.4.2 Identification, Storage and Handling of Samples

Sample identifiers will be used for each sample collected, based on the sampling point number and the depth/interval the sample was collected from, e.g. a sample collected from AEC04 from the excavation footprint base, would be identified as AEC04-Base.

Project samples will be stored in laboratory prepared glass jars or zip-lock bags if collected for asbestos).

Reference will also be made to Table 5 in WA DOH (2009) for the sampling and screening of fill soils for the presence of asbestos, where practical. Subsequently, application of asbestos screening criteria published in ASC NEPM (2013a) may be limited.

Soil samples in glass jars will be placed in insulated container/s with ice.

Samples will be transported to the relevant analytical laboratory, with chain of custody (COC) documentation that includes the following information:

- AG project identification number;
- Each sample identifier;
- Date each sample was collected;
- Sample type (e.g. soil or water);
- Container type/s for each sample collected;
- Preservation method used for each sample (e.g. ice);
- Analytical requirements for each sample and turnaround times; and
- Date and time of dispatch and receipt of samples (including signatures).

### 11.4.3 Decontamination

In the event that non-disposable sampling equipment is used, that equipment will be decontaminated before and in between sampling events, to mitigate potential for cross contamination between samples collected. The decontamination methodology to be adopted for this project will include:

- Washing relevant sampling equipment using potable water with a phosphate free detergent (i.e. Decon 90 or similar) mixed into the water;
- Rinsing the washed non-disposable sampling equipment with distilled or de-ionised water; and
- Air drying as required.

### 11.4.4 Laboratory Selection

The analytical laboratories used for this project will be NATA accredited for the analysis undertaken.

### 11.4.5 Laboratory Analytical Schedule

Project samples will be scheduled for NATA accredited laboratory analysis, using a combination of:

- Observations made in the field of the media sampled;
- Headspace screening results (where available);
- The contaminants of potential concern (COPC) identified for the area of environmental concern that the sample was collected from.

Based on site history, AG has adopted the laboratory analytical schedule presented in **Table 11.4.5** for this project.

**Table 11.4.5 Laboratory Analytical Schedule**

| AEC | Analytical Schedule | No. of samples |
|---|---|---|
| AEC01, AEC02 and AEC03 | Asbestos (500mL – AF/FA) | As per Table 11.4 |
| AEC01a | Heavy Metals and Asbestos (500mL – AF/FA) | As per Table 11.4 |
| AEC04 | TRH/BTEX/PAH, VOCs/SVOCs, phenols and metals | As per section 7.2.2 |
| AEC05 | TRH/BTEX/PAH, metals and Asbestos (500mL-AF/FA) | As per section 7.2.1 |
| AEC06 | Real time measurement for ground gases | As per section 7.3.1 |
| AEC07 | Heavy metals, TRH, BTEX, PAH, VOCs, OCP, PCB, PFAS and inorganic compounds | As per section 7.4.1 |
| Contingency Areas | Asbestos (500mL-AF/FA) and metals, (if required, VOCs) | As per Table 11.4 |

### 11.4.6 Laboratory Holding Times, Analytical Methods and Limits of Reporting

The laboratory holding times, analytical methods and limits of reporting (LOR) being used for this project, are presented in **Table 11.4.6**.

**Table 11.4.6 Analytical Methods, Limits of Reporting and Holding Times**

| Analyte | Method | Limit of Reporting (mg/kg) | Limit of Reporting (µg/L) | Holding Time |
|---|---|---|---|---|
| BTEX and TRH $C_6$-$C_{10}$ | USEPA 5030, 8260B and 8020 | 0.2-0.5 | 1-2 and 50 | 14 days |
| TRH $C_{10}$-$C_{40}$ | USEPA 8015B & C | 20-100 | 50-500 | 14 days |
| VOC | USEPA 8260 | 0.1-0.5 | - | 14 days |
| PAH | USEPA 8270 | 0.1-0.2 | 0.5-10 | 14 days |
| PCB | USEPA 8270 | 0.2 | - | 14 days |
| OCP | USEPA 8081 | 0.2 | - | 14 days |
| Metals (Hg and $Cr^{vi}$) | USEPA 8015B & C | 0.05-2 | 0.1-5 | 6 months (28 days) |
| PFAS Short Suite | In house based on USEPA 537 V1.1 | 5µg/kg | 0.01-0.05 | 14 days (soils) 28 days (waters) |
| PFAS Extended Suite | In house based on USEPA 537 V1.1 | 5µg/kg | 0.01-0.05 | 14 days (soils), 28 days (waters) |
| Asbestos ID | AS4926 | Absence / presence | - | No limit |
| Asbestos (WA DOH) | Inhouse | 0.001% w/w | - | No limit |
| pH | APHA 4500 pH | - | 0.1 pH unit | 24 hours (up to 7 days allowed) |
| Hardness | APHA 2340 | - | 5mg/L | 6 months |
| pHF and pHFox | AN104 | 0.1 pH unit | - | 24 hours |
| CRS / SPOCAS | AS 4969 | 0.005% | - | 24 hours / 7 days if frozen/dried |

# 12 Validation Reporting

Site validation reports will be prepared by the appointed environmental consultants as per the needs of the project and the client. At the completion of each stage of demolition, bulk earthworks and subsequent remedial works, a separate site validation report for each stage/area will be prepared with reference to the relevant sections of NSW EPA (2020). The site validation reports will include:

- An executive summary;
- The scope of reporting work undertaken;
- Site identification details;
- A summary of geology and hydrogeology;
- A summary of site condition and the surrounding environment;
- Information on supplementary contamination assessment works undertaken (if any);
- A pre-remediation conceptual site model;
- Summary of the remedial action plan;
- Remediation and validation activities undertaken;
- Information on waste management;
- Information on the remedial works undertaken;
- Information on imported material;
- An assessment of field and laboratory quality assurance / quality control data;
- Validation results and discussion;
- A post remediation conceptual site model; and
- Conclusions and recommendations.

It is recognised that the remedial strategy proposed potentially includes for contamination risks to remain on the site and as such, a long term – environmental management plan (LT-EMP) that documents all areas where residual contamination is still present on the site and all capping and isolation measures installed will likely be required. Any provisions contained in the LT-EMP as discussed in **Section 14**, will need to be legally enforceable and will need to be publicly notified.

# 13 Site Management Plan

The following site management plan will apply during undertaking of the remediation tasks. AG notes that the following management plans must be prepared and should be incorporated as a sub-plan of the site Construction Environmental Management Plan (CEMP):

- Asbestos Management Plan; and
- Asbestos & Dust Monitoring Plan.

## 13.1 Interim Site Management Measures

Based on the findings of previous contamination assessments undertaken at the site and the existing site activities, it is considered reasonable to suggest that the identified contamination risks to the identified receptors at the site are currently considered to be low and physical site management measures to reduce exposure risks to identified contamination onsite, is considered not warranted.

The site owner should be notified of the contamination risks that have been identified for the site and the asbestos management plan should be updated to include appropriate management controls.

## 13.2 Asbestos Management & Controls

### 13.2.1 Equipment

The following is an equipment register of required materials in preparation for works:

- Appropriate personal protective equipment; disposable suits, P2 and P3 respirators, disposable gloves and disposable boot covers;
- Asbestos warning signage and barricade taping;
- 200 µm thick polyethylene asbestos waste bags;
- Black 200µm plastic lining;
- Water system capable of generating a light mist at low pressure;
- General personal hygiene equipment (e.g. wipes, brushes etc);
- Airborne Asbestos Monitoring (AAM) equipment (provided by the qualified occupational hygienist); and
- Waste transport system.

### 13.2.2 Personal Protective Equipment

The following personal protective equipment (PPE) is required on the project:

- Steel capped safety boots / steel capped gum boots.
- Disposable gloves.
- Disposable boot covers (if required).
- Safety Hard Hat.
- Disposable coveralls (type 5, category 3 (EN ISO 13982–1) or equivalent that would meet this standard (if required).

- Coveralls worn should be made from either 100% synthetic material or a mixed natural / synthetic fabric capable of providing adequate protection against fibre penetration. All fabrics must be capable of preventing the penetration of asbestos fibres down to a diameter of 0.5µm and to a maximum 1% penetration of all airborne asbestos fibres. Once worn, disposable overalls are not to be reused or laundered.
- Disposable half-face particulate respirator (P2 or P3 rated dependant on type of removal): The respirator must conform to the requirements of AS/NZS 1716:2009 Selection, Use and Maintenance of Respiratory Protective Devices or its equivalent. These disposable respirators must be replaced at each decontamination event.

#### 13.2.3 Bulk Excavation Works

In regard to excavation, soil movement and placement of asbestos contaminated soil within the site, AG recommends the following:

- At least 5 days prior to commencing works, a SafeWork NSW Notification for Friable Asbestos Removal Works will be lodged by the appointed Licensed Asbestos Removalist;
- All excavation, soil movement and capping of the asbestos contaminated soil should be carried out under the supervision of a LAA or suitably qualified occupational hygienist and Class A licensed removalist contractor team;
- The LAA or qualified occupational hygienist will supervise the removal works to ensure that all removal procedures are implemented in accordance with the NSW Code of Practice: How to Safely Remove Asbestos (2019) and requirements set out in this document;
- Asbestos Air Monitoring will be carried out for the entirety of the works to ensure adequacy of control measures within the work site;
- A nominated decontamination area for plant and machinery will be erected outside the boundary of the removal areas during any friable asbestos removal / handling works;
- At the end of each shift, the source area and any temporary placement will be made safe using geofabric or appropriate plastic sheeting;
- At the end of each shift, the LAA or qualified occupational hygienist shall undertake an asbestos clearance / make-safe inspection to ensure that each area has been made safe. Records of these inspections will be provided to Spaceframe Constructions by the LAA / qualified occupational hygienist once completed;
- Following the removal of all asbestos contaminated soil, interim validation inspections and sampling of the source area will be carried out by a LAA, qualified occupational hygienist and / or Environmental Consultant;
- At the completion of asbestos works, all plant and machinery used during the works are to be decontaminated by the licensed removalist contractor;
- At the completion of the works, a validation report will then be prepared and issued in accordance with the appropriate legislation and guidelines (where required).

AG anticipates that areas validated will be fenced off from the remaining areas to be remediated, in order to reduce the risk of contaminated materials being tracked onto validated areas.

### 13.3 Soil & Stormwater Management

#### 13.3.1 Soil Access/ Egress

Vehicle access and egress to the site will be stabilised to prevent tracking of sediment onto roads and footpaths. Soil, mud and other similar materials will be removed from the roadway adjacent the access/egress point by sweeping, shovelling or a means other than washing, on a daily basis, or as required.

Trucks will be loaded adjacent to the nominated waste dispatch area or to the remediation excavation (where practical). Spills of excavated soil will be scraped / swept up and combined with the soil being disposed offsite.

Soil and sediment will be broomed or washed off vehicle/plant tyres and tracks, prior to vehicles/plant leaving the remediation works zone. This soil and sediment will be scraped / swept up and managed onsite or disposed of, depending on its contamination status.

AG recommends a site-specific sediment and erosion control plan be prepared and maintained by the remediation contractor, to suit staging of the remediation works. Erosion and sediment control measures will be maintained in a functional condition. Sediment laden stormwater runoff will be controlled using measures outlined in Landcom 2004, '*Managing Urban Stormwater – Soils and Construction'* (the Blue Book).

### 13.3.2 Stockpiles

Stockpiles of soil or other materials:

- will not be placed on footpaths or nature strips, unless approved by Council;
- will be placed away from gutters, stormwater pits and other drainage lines;
- will be kept moist at all time;
- will be stored in a secure area and be covered if remaining on site for more than 24 hours; and
- will generally be constructed as low elongated mounds on level surfaces.

The **remediation contractor** will retain following material tracking information in relation to stockpiles onsite. A stockpile register should be implanted which will include the following minimum information:

- stockpile identification (i.e. stockpile number);
- estimated volume of stockpile;
- tracking of materials source; and
- fate of stockpile (i.e. tipping facility it will be sent to).

For materials that are proposed for reuse on site, internal material movement and stockpile tracking shall be undertaken.

### 13.3.3 Excavation Pump Out

Should excavations require pumping out, water will be analysed for total suspended solids, pH, metals and petroleum hydrocarbons. Should analytical results be less than relevant marine water ecosystem groundwater investigation levels in ANZG 2018, and meets the Council requirements for stormwater discharge then the excavation water (if any) may be discharged to stormwater.

Should analytical results exceed ANZG 2018 criteria, other options for disposal will be considered, including:

- discharge to sewer (with prior approval from Sydney Water with a Trade Waste Agreement); and
- removal and offsite disposal by a liquid waste contractor.

### 13.3.4 Rehabilitation and Landscaping

Stabilisation of exposed areas on the site, where required, will be undertaken in a progressive manner, as stages of remediation works are completed. Stabilisation will be maintained until such time as site redevelopment works commence.

Site redevelopment works may be undertaken in conjunction with remediation works. In this instance, revegetation of the site is considered unlikely to be required.

## 13.4 Waste management

Removal of materials from site for recycling and/or disposal, will be undertaken with reference to the relevant provisions of the Protection of the Environment Operations Act 1997, SafeWork NSW (2019) and NSW EPA (2014).

The remediation contractor will maintain detailed records of materials removed from the site, including date/time of removal, quantities of materials, transport company details and vehicle registration details.

The remediation contractor will retain records verifying lawful disposal of the materials, including weighbridge / tipping dockets from the waste receiver.

The remediation contractor will retain following material tracking information, they are as follows.

For waste classification:

- Waste classification document;
- Material source and description;
- Sampling density, pattern, COPCs;
- Result summary, including appropriate table with comparison to acceptance criteria; and
- Waste classification.

For offsite disposal works:

- Source location;
- Estimated volume (based on excavation size);
- Actual volume of disposal;
- Waste classification;
- Transporter;
- Final destination, PoEO licence;
- Reconciliation of waste dockets with actual disposal volume; and
- Reconciliation of actual disposal volume and the estimated volume of disposal (based on excavation size).

For imported material:

Volume of imported material;

- Source site;

- VENM certificate or certificate applicable for NSW EPA exemptions (e.g. ENM certificate);
- Placement location; and
- Transporter.

## 13.5 Groundwater Management

Should dewatering of true groundwater be required, development consent may be required from the planning consent authority. Dewatering may also require approvals from the NSW Department of Primary Industry – Water and WaterNSW.

## 13.6 Noise Control

Noise levels from the site during the project will not exceed the limits indicated in AS2436-2010.

No 'offensive noise' as defined under the Protection of the Environment Operations Act 1997 will be created during remediation works/activities.

Plant and equipment will be fitted with noise attenuation devices (e.g. mufflers on exhausts). Consideration will be given to use of reversing alarms other than the standard pulsed tonal alarms.

Vehicle access roads will be designed in such a way to minimise the need for plant and vehicles to reverse (e.g. provision of a turning circle adjacent to the remediation works zone).

## 13.7 Dust Control

Dust may be generated during remediation works and associated tasks. To mitigate risk of dust emissions migrating beyond the site boundary, consideration will be given to implementing the following procedures:

- erection of dust screens around the perimeter of the site (e.g. fencing with shade cloth attached);
- securely covering all loads entering or exiting the site;
- use of water sprays across the site to suppress dust;
- covering stockpiles of contaminated soil remaining on site for more than 24 hours;
- keeping excavation surfaces moist;
- wetting down of placed fill material during spreading;
- sweeping of hardstand surfaces;
- minimising soil disturbance works during windy days; and
- retaining stabilised site access/egress points for vehicles.

Any remedial works associated with asbestos are to be carried out in accordance with SafeWork NSW (2019) Code of Practice – How to Safety Remove Asbestos.

## 13.8 Odour Control

Generation of significant odours during the remediation works is considered to be unlikely.

If odours are generated, odours will be monitored at the site boundary. Should unacceptable odours be detected at the site boundary, consideration will be given to implementing the following procedures:

- use of appropriate covering techniques such as plastic sheeting to cover excavation faces or stockpiles;
- use of fine mist sprays (which may incorporate deodorizing agents);
- use of hydrocarbon mitigating agents on impacted areas/materials; and
- adequate maintenance of equipment and machinery to minimise exhaust emissions.

A record of unacceptable odours and corrective/preventative action taken, will be maintained by the remediation contractor.

### 13.9 Traffic Management

Haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site will be selected by the remediation contractor and will meet the following objectives:

- compliance with all traffic road rules;
- minimisation of noise, vibration and odour to adjacent premises; and
- utilisation of state roads and minimisation of use of local roads.

The remediation contractor will ensure that site vehicles:

- conduct deliveries of soil, materials, equipment or machinery during the hours of remediation work identified in **Section 13.14**;
- securely cover all loads to prevent dust or odour emissions during transportation;
- exit the site in a forward direction; and
- do not track soil, mud or sediment onto the road.

### 13.10 Vibration Management

Vibration emissions during remediation works will be controlled to mitigate risk of potential damage to assets on adjacent properties, and to mitigate unreasonable loss of amenity to nearby residents.

### 13.11 Fill Importation

Material proposed to be imported to site as engineered fill, will be limited to materials certified as:

- Virgin Excavated Natural Material (VENM);
- Excavated Natural Material (ENM);
- Recycled aggregate (DGB20);
- Landscaping soil materials; and
- Landscaping pebbles (quarried).

VENM certification will be undertaken with reference to NSW EPA (1995). ENM certification will be undertaken with reference to NSW EPA Excavated Natural Material Exemption.

The concentrations of potential contaminants in VENM and ENM proposed to be imported to site, will be compared against NSW EPA Waste Classification Guidelines 2014 and NSW EPA Excavated Natural Material Order 2014.

Certification will be required to confirm imported engineering materials has been classified with reference to a relevant resource recovery exemption and is fit for purpose on site.

Imported fill will be compatible with existing soil characteristics for site drainage purposes.

The remediation contractor will maintain detailed records of all fill imported to the site, including details of the supplier, the source of the fill, the quantities of the fill, vehicle registration numbers and the dates/times the fill was received on site. Validation sampling as per **Table 11.4** to apply to each relevant material type.

## 13.12 Work Health and Safety

### 13.12.1 Safe Work Methos Statement

Each contractor and sub-contractor undertaking remediation works, or working within a remediation works zone, will prepare a project specific safe work method statement (SWMS), which will include, but not be limited to:

- the tasks to be undertaken;
- hazards identified for each of the tasks to be undertaken;
- an assessment of risk for each hazard, considering likelihood and consequence; and
- control measures to eliminate or mitigate risks associated with each identified hazard.

### 13.12.2 Personal Protective Equipment

Given that asbestos has been identified onsite, the following minimum personal protective equipment (PPE) should be worn by all persons working in or visiting these remediation works zone:

- long sleeves and long pants or overalls (when required);
- high visibility vests (or clothing);
- a dust mask or respirator (depending on the hazard) must be worn when hazardous substances are present;
- safety boots and boot covers (when required);
- hard hats
- gloves; and
- eye protection (e.g. safety glasses).

Additional PPE may be required in accordance with task specific control measures in SWMS (refer **Section 11.11.1**).

### 13.12.3 Decontamination of Personnel

Personnel undertaking remediation tasks, or entering the remediation works zone, be required to decontaminate upon exiting the remediation works zone. Decontamination procedures will include:

- cleaning down of protective footwear (including removal of soil from the soles); and

- washing of hands.

The following minimum personal protective equipment (PPE) should be worn by any persons the remediation works zone:

- gloves;
- safety boots;
- hard hats;
- high visibility vests or clothing; and
- safety glasses.

### 13.13 Site Signage

A sign will be posted on the boundary of the site, adjacent to the site access point, which will include 24-hour contact details of the remediation contractor. This sign will be maintained onsite until all remediation works are complete.

### 13.14 Site Security

Site security will be maintained throughout the duration of the remediation works, with appropriate boundary fencing and gate locks. This will include areas/ stages that are awaiting validation sign-off or have previously been validated.

Other security measures may be implemented, if the need arises.

### 13.15 Site Hours of Operation

Remediation works will be undertaken on Monday to Friday between the hours of 7:00am to 5:00pm, and Saturday between the hours of 8:00am and 1:00pm.

Remediation works will not be undertaken outside the hours stated above, or on Sundays or public holidays.

### 13.16 Community Relations and Complaints

Owners, occupants and tenants of properties adjoining the site and across the road from the site, will be provided with notification of remediation works, at least two days prior to those works commencing.

Personnel undertaking remediation works on the site, will direct all third-party communications and/or complaints to the Project Manager. The Project Manager will arrange for the communication/complaint to be assessed, a response prepared, corrective/preventative actions implemented (if necessary).

A register will be maintained on site for the recording of communications / complaints from third parties, including but not limited to, local residents and local businesses.

### 13.17 Emergency Preparedness

An emergency assembly point will be established at the site egress point. This point will be communicated to all site workers and visitors, during relevant site induction processes.

In the event of an emergency, site workers and visitors will assemble here and await further instructions from the site supervisor, project manager or emergency services.

In the event of soil and/or groundwater contamination as a result of a spill and/or fire, the steps described in **Appendix E** 'Unexpected Finds Protocol' Should be followed and implemented.

Spill control kits and fire extinguishers will be located on site, as and where required.

Contact details to be used in the event of an emergency, are presented in **Section 13.17**.

## 13.18 Register of Contacts

A register of contacts for the project is presented in **Table 13.17**

**Table 13.17 Register of Contacts**

| Project Role | Person | Organisation | Contact |
|---|---|---|---|
| Emergency Services | - | Fire / Police / Ambulance | 000 |
| Site Owner | - | TBC | - |
| Principal Contractor | - | TBC | - |
| Planning Consent Authority | | City of Canterbury-Bankstown | 9707 9000 |
| WHS Regulatory Authority | - | SafeWork NSW | 131 050 |
| Environment Protection Authority | - | NSW EPA | 131 500 |
| Remediation Contractor | - | TBC | - |
| Environmental Consultant | - | Alliance Geotechnical | 1800 288 188 |

# 14 Long-term Environmental Management Plan Requirements

As discussed in **Section 8** and **Section 10**, the practicality and feasibility of containing contaminated soils on-site will be assessed in a revised RAP following the outcomes of the data gap closure assessment and once detailed development design is known and discussed with local Council.

Should it be required, a long-term Environmental Management Plan (LT-EMP) will be prepared (or modified) by the Environmental Consultant following completion of the remediation work. The LT-EMP will include a characterisation of the nature and location of contamination remaining on-site that requires management. The LT-EMP will outline how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

The LT-EMP will be required to be recorded on the planning certificate issued under Section 10.7 of the EP&A Act 1979 or a covenant registered on the title to land under section 88B of the Conveyancing Act 1919. The long-term EMP shall include the following:

- A summary of the location, nature and types of contamination remining at the site;
- The assumptions on which exposure settings and risk management protocols are based;
- A long-term maintenance and monitoring/inspection program to maintain the effectiveness of:
    - vegetation covers
    - isolation/capping layers
    - passive access restriction features
- Persons/entities responsible for the implementation of the LT-EMP;
- Controls and requirements during:
    - excavations and subsurface ground works that may penetrate the isolation/capping layer;
    - lawn mowing and landscaping activities; and
    - other unexpected penetration of isolation/capping layer.
- Signages and administrative controls;
- An unexpected-finds protocol; and
- Contingency management plan.

Specifically, the following items will need to be considered/incorporated:

- The practicality and/or mechanism for enforcing the LT-EMP at the site following the completion of the proposed redevelopment. Council must confirm that containment of contamination is a suitable strategy on land that is to be reverted to Council and the strategy developed to enforce the LT-EMP.
- An Asbestos Management Plan should be prepared by a Licensed Asbestos Assessor and be attached/incorporated into the LT-EMP. Given the presence of asbestos (bonded and friable), any future disturbance of the contaminated materials below the isolation/capping layer must be managed by a Class A Licensed Asbestos Removalist and verified by a Licensed Asbestos Assessor to provide air monitoring and asbestos clearances where applicable.
- Administrative controls will be required to prevent accidental penetration or damage of the isolation/capping layer. Appropriate signage will need to be erected and site rules will need to be displayed.

- A periodic maintenance and inspection program will be required to regularly assess the integrity of the vegetation layer and the ground cover. Dieback of vegetation will need to be reinstated with erosion or ground depressions repaired where required. Damages or cracks on pavements will also be required to be repaired.

It is recognised that contamination risks may remain on the site. If so, a LT-EMP will document areas where residual contamination is present on the site, and information on management measures that have been adopted. Provisions contained in the LT-EMP will need to have a mechanism to be legally enforceable and will be publicly notified. A revised RAP will be prepared to document where and how management measures will be implemented, and how a LTEMP can be made legally enforceable.

# 15 Conclusions

Based on the information presented in the historical contamination assessment reports and AG's observations on site, AG concludes that the remedial strategies and goals can be achieved and the site made suitable in informing future land use planning and rendering the site suitable for proposed land use, subject to:

- Preparation of a SAQP prior to commencement of data gap assessment.
- Implementation of the strategies, methodologies and measures set out in this RAP.
- Should newly identified unacceptable land contamination risks be identified during supplementary assessment works, an addendum to this RAP may be required. The addendum should be prepared by a suitably experienced environmental consultant.
- Prior to any removal of soils from site for offsite disposal during remedial works, waste classification for those soils should be prepared by a suitably experienced environmental consultant. Residual impacted fill materials must also be appropriately characterised as per the strategy outlined in this RAP.
- AG recommends that any waste classifications, remediation monitoring and validation works be undertaken by a suitably experienced environmental consultant.
- It is recognised that contamination risks may remain on the site. If so, a LT-EMP will document areas where residual contamination is present on the site, and information on management measures that have been adopted. Provisions contained in the LT-EMP will need to have a mechanism to be legally enforceable and will be publicly notified. A revised RAP will be prepared to document where and how management measures will be implemented, and how a LTEMP can be made legally enforceable.

This report must be read in conjunction with the ***Important Information About This Report*** statements at the front of this report.

# 16 References

AG 2020, 'Detailed Site Investigation, Bullecourt Avenue, Milperra NSW ', Report ref: 9996-ER-1-1, dated 30 January 2020;

Coffey 2011, 'Phase 2 Environmental Site Assessment – Student Residence Development University of Western Sydney, Bankstown Campus', Report ref: GEOTLCOV24163AG-AB, DATED 25 August 2011;

EIS 2016, 'Preliminary Contamination Screening and Waste Classification, Proposed Oval Facilities, UWS Bankstown Campus, 2 Bullecourt Avenue, Milperra', dated 7 April 2016;

HEPA 2020, 'PFAS National Environmental Management Plan', dated January 2020, version 2.0;

JBS&G 2018, 'Phase 1 Environmental Assessment Report, Bullecourt Avenue, Milperra NSW', Report ref: 54086-110124 (Rev 1), dated 7 February 2018;

NAA 2011, 'Soil Contamination Investigation, University of Western Sydney – Bankstown Campus Bullecourt Avenue, Milperra NSW', Report Ref: SJ0085:95458, dated October 2011;

National Environment Protection Council (NEPC) 2013a, *Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater*, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013;

National Environment Protection Council (NEPC) 2013b, *Schedule B(2) Guideline on Site Characterisation*, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013;

NSW EPA 1995, *Contaminated Sites: Sampling Design Guidelines*;

NSW EPA 2014, *Waste Classification Guidelines – Part 1: Classifying waste,* Environment Protection Authority of New South Wales, Doc. EPA 2014/0796, November 2014;

NSW EPA 2015, *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*, NSW EPA, Doc. EPA 2015/0164, September 2015;

NSW EPA 2017, *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme*;

NSW EPA 2020a, *Contaminated Land Management: Consultants Reporting on Contaminated Land*;

NSW EPA 2020b, Assessment and Management of Hazardous Ground Gases, Contaminated Land Guidelines;

WA DOH 2009, *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, dated May 2009;

*Contaminated Land Management Act 1997;*

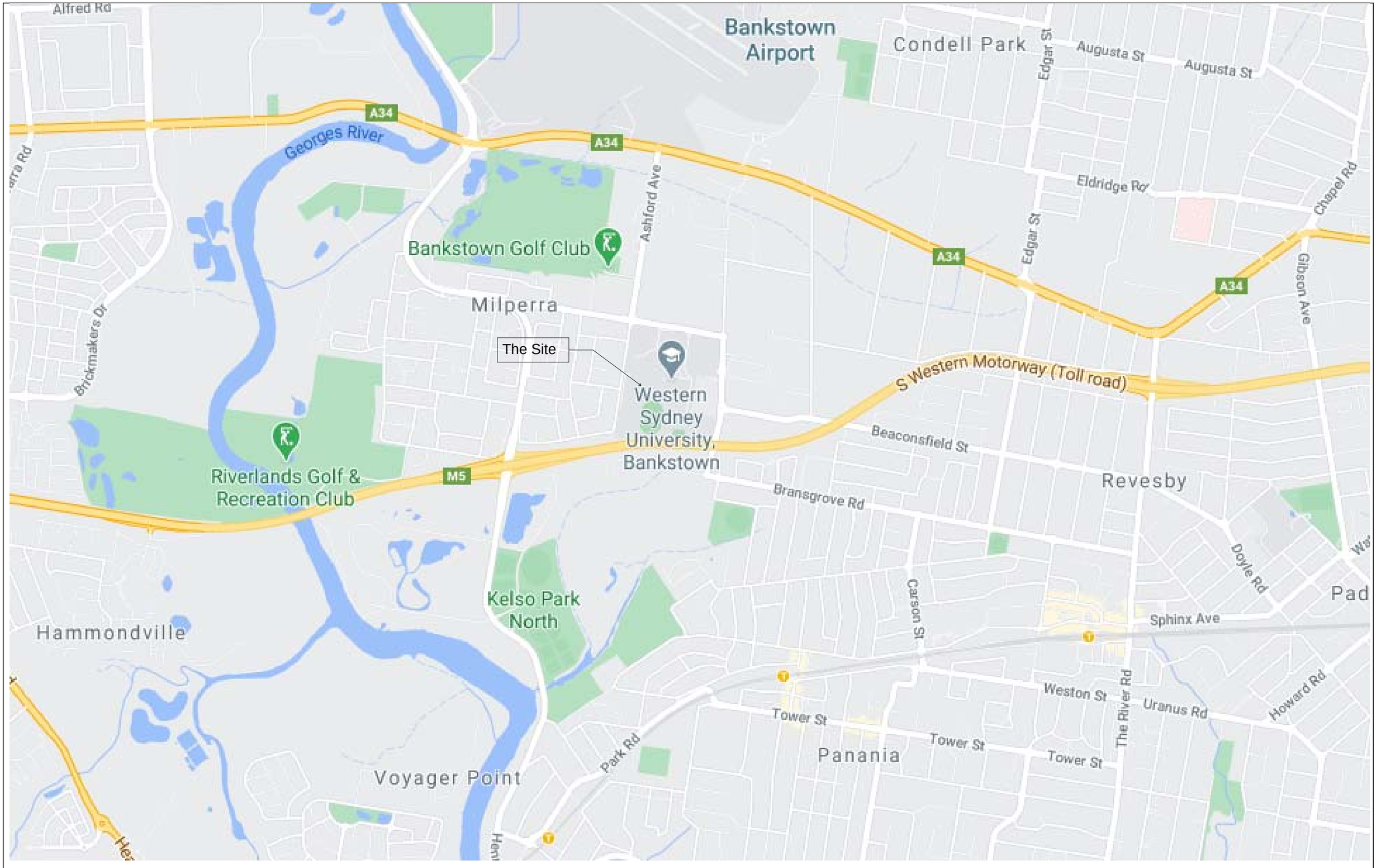
*Protection of the Environment Operations Act 1997;*

*State Environmental Planning Policy (SEPP) Hazards and Resilience (2021);*

*Work Health and Safety Act 2011;*

*Work Health and Safety Regulation 2017.*

## FIGURES

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**Site Locality**

| | | | |
|---|---|---|---|
| Client Name: | Mirvac Homes NSW PTY Ltd | Figure Number: | 1 |
| Project Name: | Remediation Action Plan | Figure Date: | 23 November 2020 |
| Project Location: | Western Sydney University – Milperra Campus – 2 Bullecourt Avenue, Milperra NSW | Report Number: | 9996-ER-2-1 |

N


| Alliance Geotechnical<br>ENGINEERING \| ENVIRONMENTAL \| TESTING<br>Manage the earth, eliminate the risk | Site Layout Plan | | | | |
|---|---|---|---|---|---|
| | Client Name: | Mirvac Homes NSW PTY Ltd | N | Figure Number: | 2 |
| | Project Name: | Remediation Action Plan | | Figure Date: | 23 November 2020 |
| | Project Location: | Western Sydney University – Milperra Campus – 2 Bullecourt Avenue, Milperra NSW | | Report Number: | 9996-ER-2-1 |

**LEGEND**

**AEC01** - Asbestos (Friable) Impacted Soils

**AEC01a** - Lead, Cadmium and Zinc Impacted Soils

**AEC02** - Asbestos (Friable) Impacted Soils

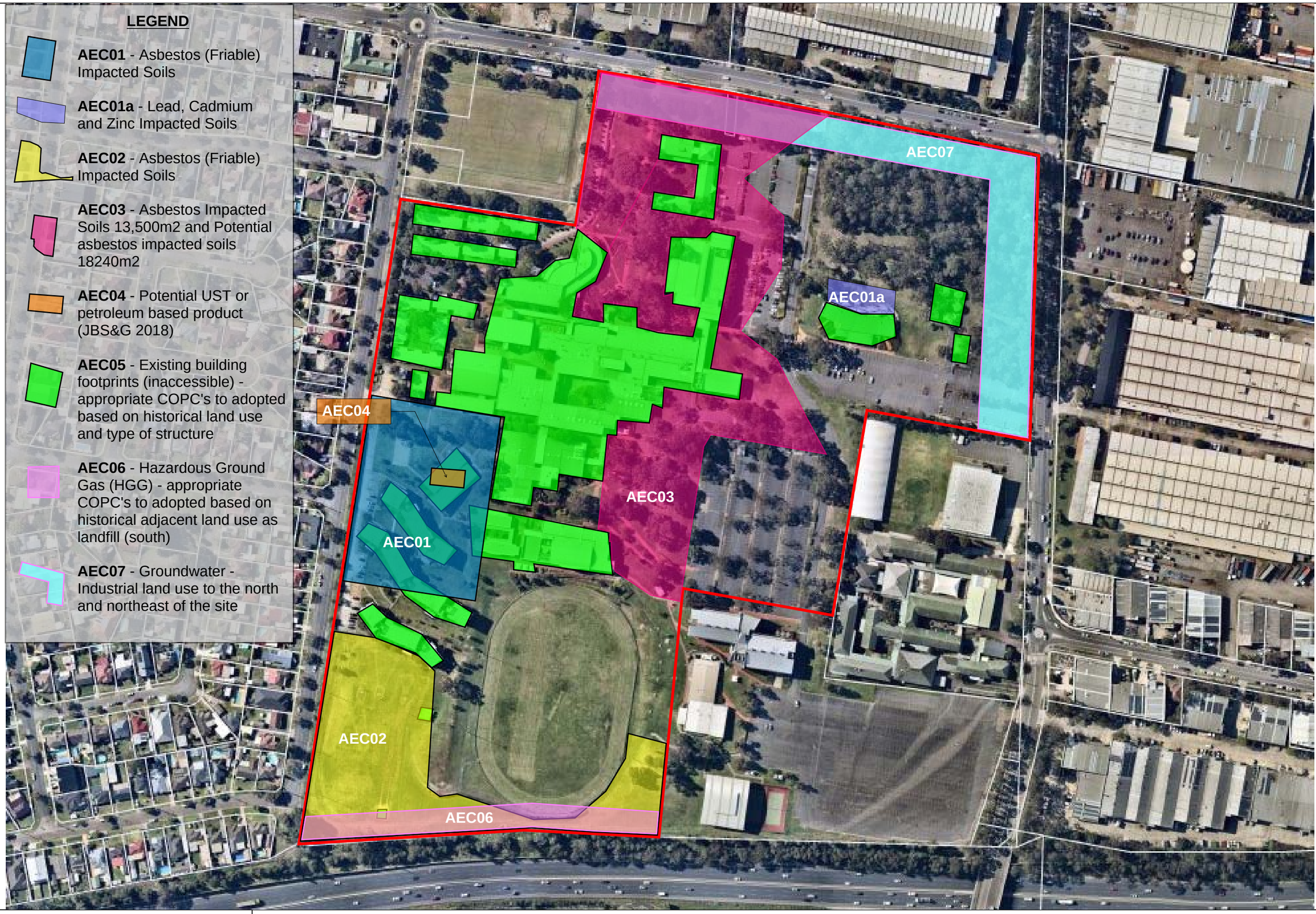
**AEC03** - Asbestos Impacted Soils 13,500m2 and Potential asbestos impacted soils 18240m2

**AEC04** - Potential UST or petroleum based product (JBS&G 2018)

**AEC05** - Existing building footprints (inaccessible) - appropriate COPC's to adopted based on historical land use and type of structure

**AEC06** - Hazardous Ground Gas (HGG) - appropriate COPC's to adopted based on historical adjacent land use as landfill (south)

**AEC07** - Groundwater - Industrial land use to the north and northeast of the site

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**Areas of Environmental Concern**

| | | | |
|---|---|---|---|
| Client Name: | Mirvac Homes NSW PTY Ltd | Figure Number: | 3 |
| Project Name: | Remediation Action Plan | Figure Date: | 20 November 2020 |
| Project Location: | Western Sydney University – Milperra Campus – 2 Bullecourt Avenue, Milperra NSW | Report Number: | 9996-ER-2-1 |

N

Legend

- Approximate Test Pit Locations (AG 2020)
- Approximate Borehole Locations (AG 2020)
- Approximate Sampling Point Locations (Coffey 2011)
- Approximate Sampling Point Locations (NAA 2011)
- Approximate Sampling Point Location (JBS&G 2018)

Lead at 4400mg/kg
Zinc at 6800mg/kg

Lead at 1800mg/kg

BH03

S-2

Friable asbestos detected at 0.8m bgl

ACM on surface

BH59

Friable asbestos detected at 0.5m bgl

AF/FA = 0.02%w/w at 0m to 0.1m

EBH1

EBH3

BH39

SS10

FA = 0.043%w/w at 0m to 0.2m

EBH2

Friable asbestos detected at 0.4m bgl

EBH5

Friable asbestos detected at 0.2m bgl

TP56

ACM in fill

TP53

Friable asbestos detected at 0.2m bgl

FA detected at <0.001% w/w

BH21

EBH25

EBH24

Friable asbestos detected at 1.1m bgl

TP101/ BH101

TP09

ACM on surface

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**Exceedances of Criteria**

| | | | |
|---|---|---|---|
| Client Name: | Mirvac Homes NSW PTY Ltd | Figure Number: | 4 |
| Project Name: | Remediation Action Plan | Figure Date: | 20 November 2020 |
| Project Location: | Western Sydney University – Milperra Campus – 2 Bullecourt Avenue, Milperra NSW | Report Number: | 9996-ER-2-1 |

N


Scale: 100.00 m

AG 2020 Sampling Location Layout

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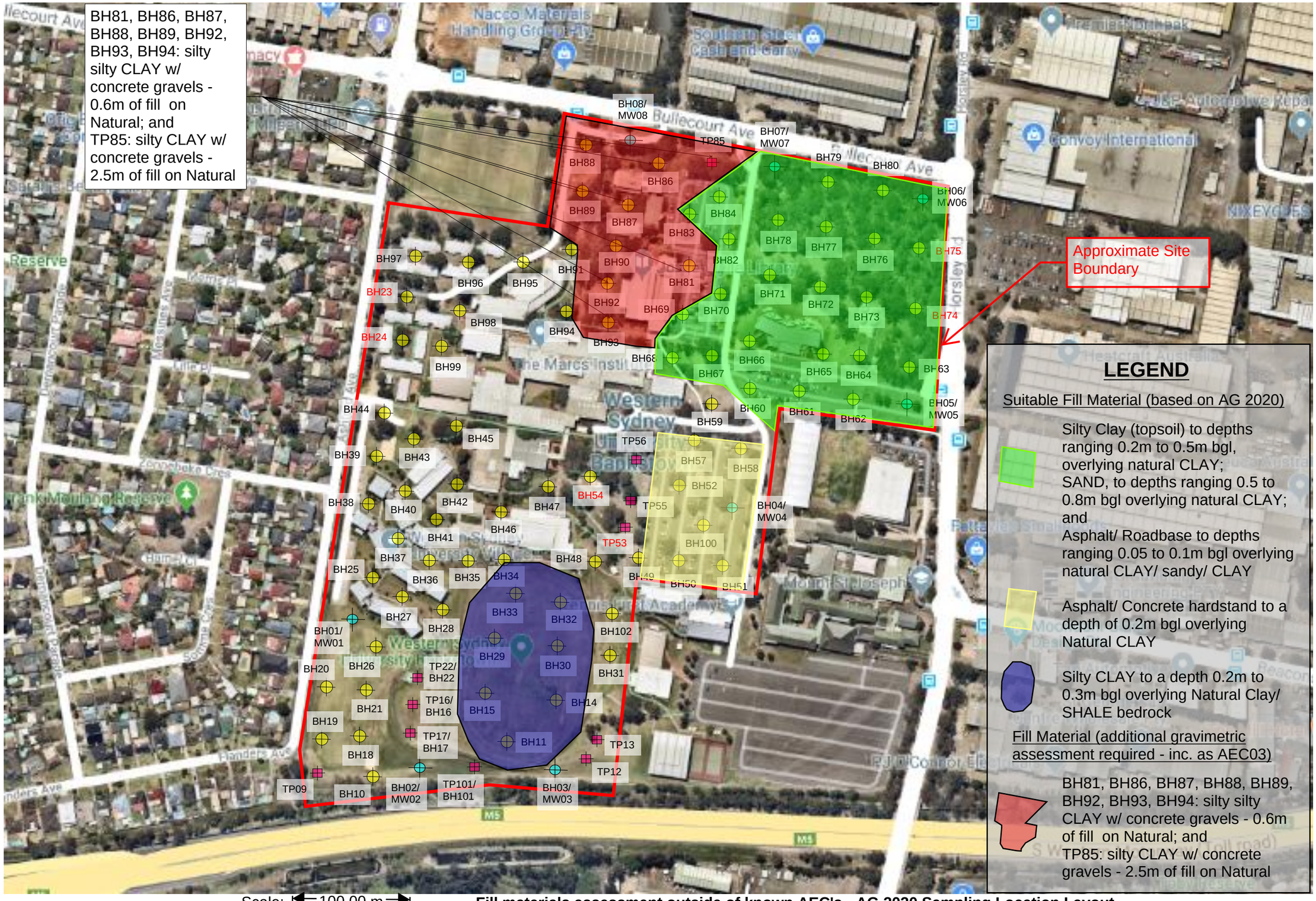
| | | | |
|---|---|---|---|
| Client Name: | Mirvac Homes NSW PTY Ltd | Figure Number: | 5 |
| Project Name: | Remediation Action Plan | Figure Date: | 10 December 2020 |
| Project Location: | Western Sydney University – Milperra Campus – 2 Bullecourt Avenue, Milperra NSW | Report Number: | 9996-ER-2-1 |




Scale: 100.00 m

**Fill materials assessment outside of known AEC's - AG 2020 Sampling Location Layout**

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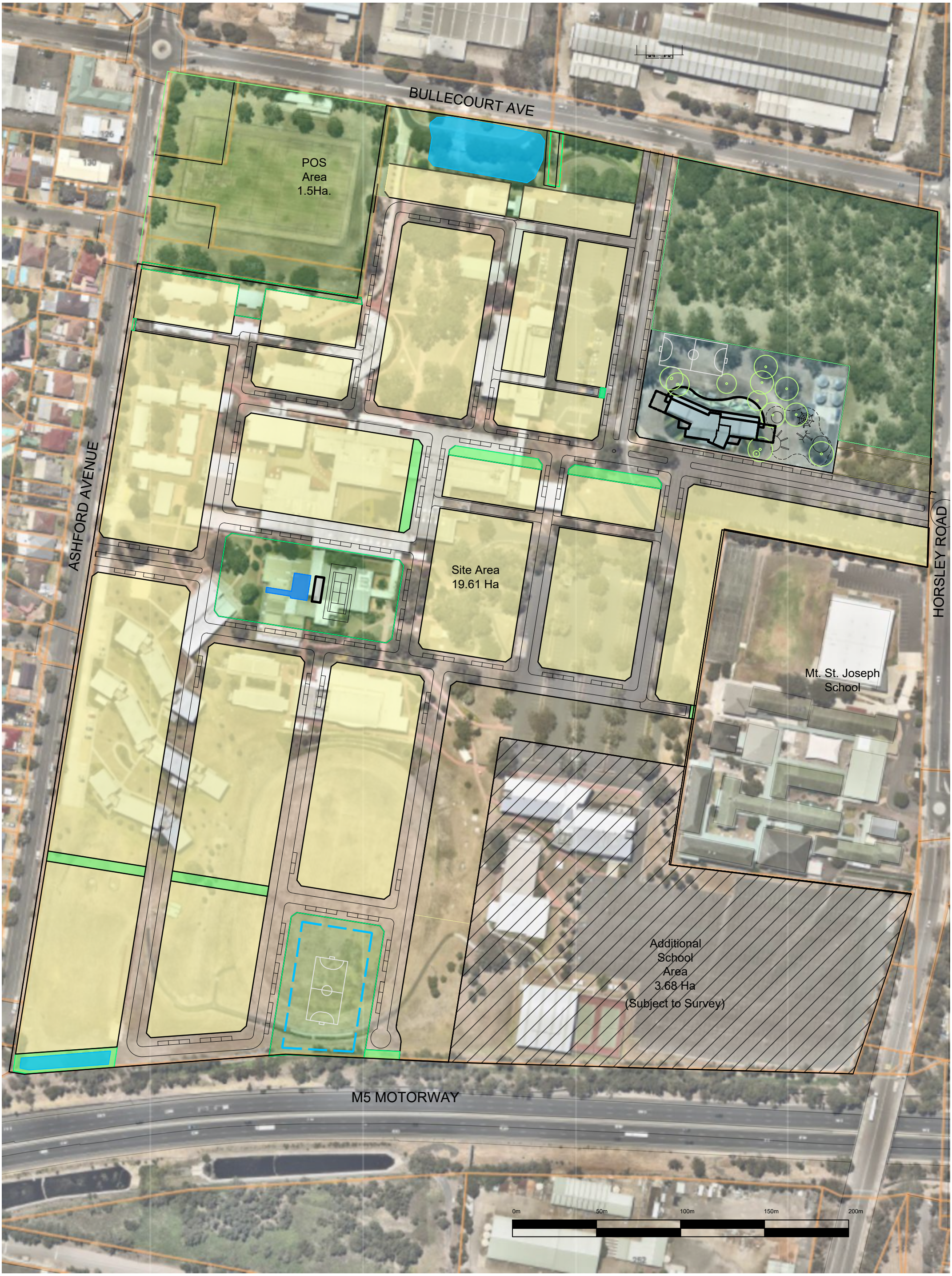
| | | | | |
|---|---|---|---|---|
| Client Name: | Mirvac Homes NSW PTY Ltd | N | Figure Number: | 6 |
| Project Name: | Remediation Action Plan | | Figure Date: | 10 December 2020 |
| Project Location: | Western Sydney University – Milperra Campus – 2 Bullecourt Avenue, Milperra NSW | | Report Number: | 9996-ER-2-1 |

# APPENDIX A – PROPOSED DEVELOPMENT PLANS

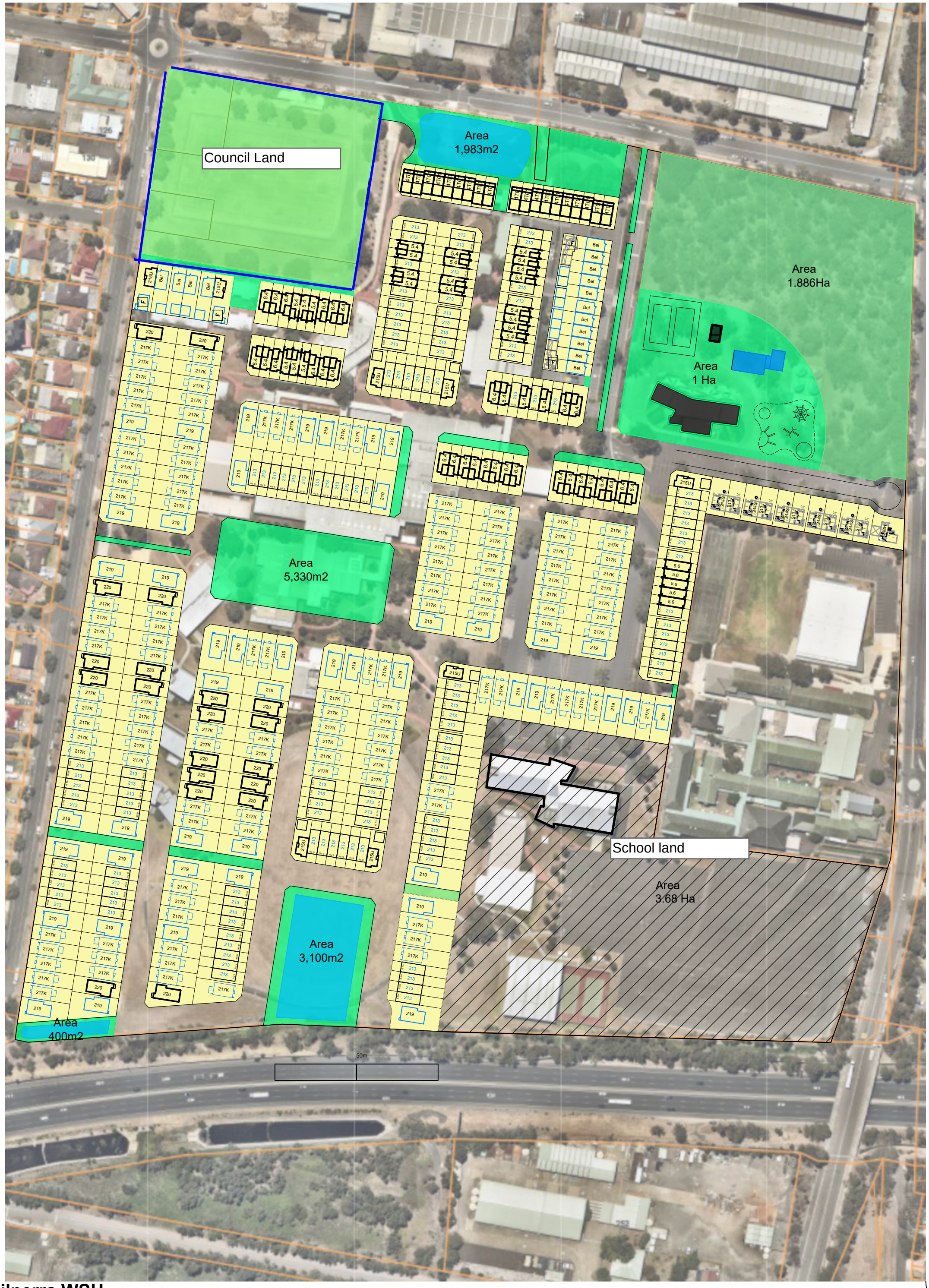



# MILPERRA WSU

Current Masterplan

22.10.19

MIRVAC DESIGN




**Milperra WSU**

Layout- Option 1h8b

21.06.19

# APPENDIX B – Conceptual Site Model

BULLECOURT AVE
Bus Bay
Hockey Club
DP 91953
SINAI AVE
Student Residence
DP 547674
FIRST AVENUE
IAN SMITH AVENUE
MERRIS PL
LILLE PL
MESSINES AVE
ASHFORD AVE
Student Residence
DERNANCOURT PDE
THIRD AVENUE
HORSLEY RD
ZONNEBEKE AVE
Volleyball Court
HAMEL CL
SOMME CR
Javelin, Hammer & Shot put fields
Storage Containers
Cricket Oval Football Field Running Track
Long Jump Fields
Covered Courts
Tennis Courts
Mt St Joseph Catholic School
FLANDERS AVE
SOUTH WESTERN MOTORWAY
DP 231721
DP 236028
DP 237192
DP 237191
DP 230101
DP 239008
DP 232889
DP 232608
DP 228751
DP 230022
DP 229631
DP 229888
DP 603074
DP 238384
DP 752013
SP 67073
DP 533380
DP 752013
DP 1093355
DP 1027307
DP 514918
DP 516522
DP 1096110
DP 526235
DP 228751
DP 225714
DP 512619
DP 1092293
DP 327986
DP 73
SP 64626
DP 16010
DP 132496
DP 554515
DP 16010
DP 16010
SP 62916
DP 16010
DP 732013
DP 221860
50 100 200

# APPENDIX C – CONCEPTUAL SITE MODEL

# Conceptual Site Model

With reference to NEPM (2013) *Schedule B2,* AG developed a conceptual site model (CSM) to provide a framework for the review of the reliability and useability of the data collected, and to identify data gaps in existing site characterisation.

## Sources of Contamination

Potential sources of contamination that have been identified during review of site history records include:

- historical uncontrolled filling;
- historical uncontrolled demolition;
- historical farming practices;
- building rubble burial area;
- underground storage or petroleum-based product; and
- industrial land use to the north and northeast of the site.

## Contaminants of Potential Concern

Potential sources of contamination were revealed, with potential to contaminate the site. Given the above sources, the COPC are:

- Soil – the eight priority heavy metals (HMs): arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc, total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH), benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN), organochlorine pesticides (OCP), polychlorinated biphenyls (PCB), Volatile Organic Compounds (VOC's) and asbestos.

## Source – Pathway – Receptor Linkages

A summary of potential source – pathway – receptor linkages identified for the site and proposed redevelopment is presented in **Table B-1**.

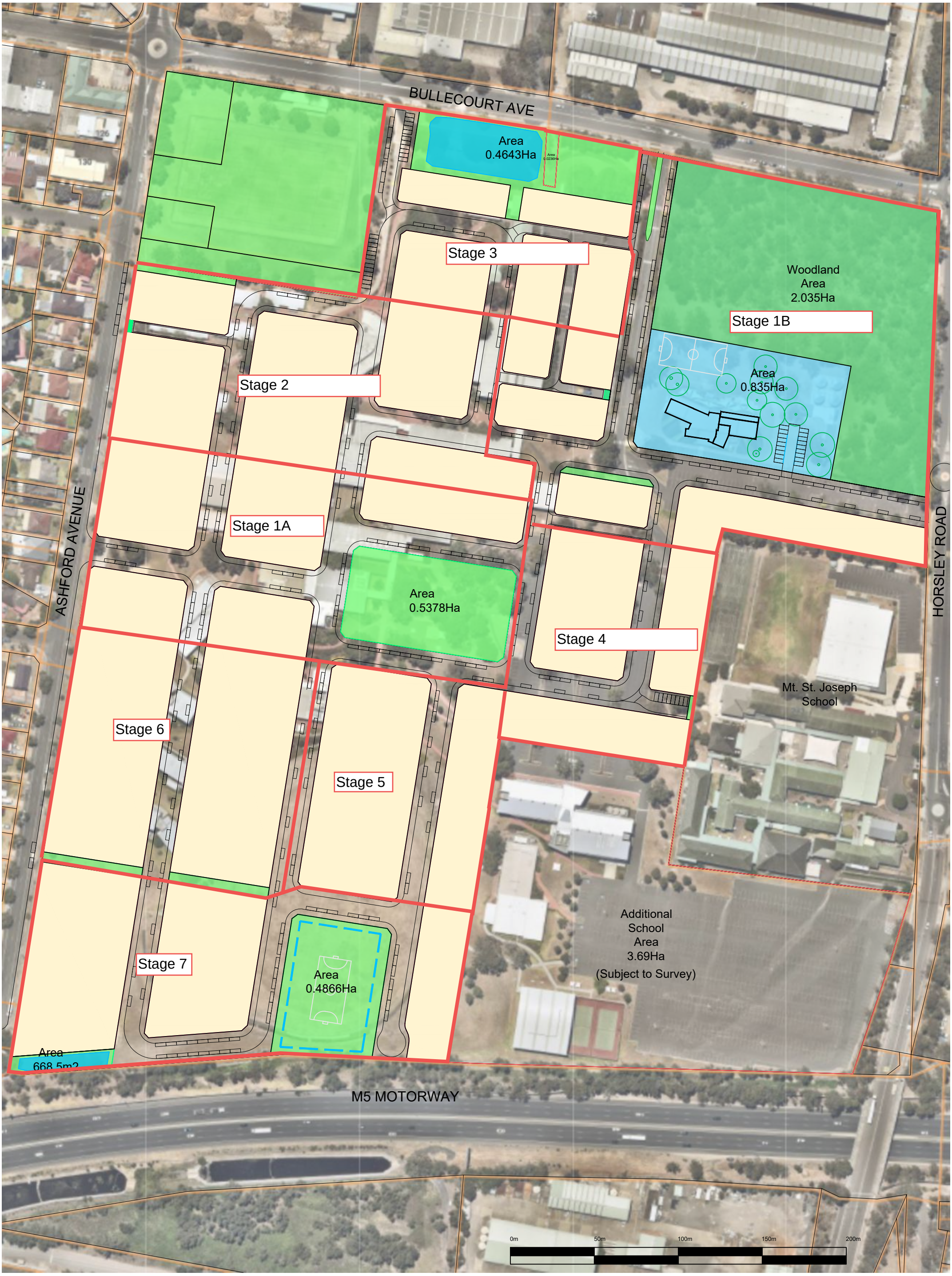
**Table B-1. Source – Pathway – Receptor Linkages**

| AEC's | Potential Sources | Impacted Media | Contaminants of Potential Concern | Transport mechanism | Exposure Pathway | Potential Receptors |
|---|---|---|---|---|---|---|
| AEC01 | historical uncontrolled demolition, uncontrolled filling and regrading, historical farming practices. BH39, EBH1, EBH2, EBH3, EBH5 and BH59 | Soil | Asbestos (0.001%). | Disturbance of surface and subsurface soils during site redevelopment and future use of the site post-redevelopment | Ingestion Inhalation of dust particulates Mechanical transport | Construction workers End users of the site post-redevelopment |

| | | | | | | |
|---|---|---|---|---|---|---|
| AEC01a | historical uncontrolled demolition, uncontrolled filling and regrading, historical farming practices. BH03 and S2 | Soil | Metals – Lead, Cadmium and Zinc | Disturbance of surface and subsurface soils during site redevelopment, and future use of the site post-redevelopment. Plant uptake of contamination present in root zone | Ingestion Dermal contact Biota uptake | Construction workers End users of the site post-redevelopment Future ecological receptors (e.g., site vegetation in landscaped areas post redevelopment) |
| AEC02 | Building Rubble Burial Area (refer Coffey 2011 & JBS&G 2018). BH21, EBH24 and EBH25 | Soil | Asbestos (0.001%). | Disturbance of surface and subsurface soils during site redevelopment, and future use of the site post-redevelopment | Ingestion Inhalation of dust particulates Mechanical transport | Construction workers End users of the site post-redevelopment |
| AEC03 | Uncontrolled large-scale filling/ bulk soil storage. BH/TP101, TP09, TP53, TP56 | Soil | Asbestos (0.001%). | Disturbance of surface and subsurface soils during site redevelopment, and future use of the site post-redevelopment | Ingestion Inhalation of dust particulates Mechanical transport | Construction workers End users of the site post-redevelopment |
| AEC04 | Underground storage or petroleum-based product onsite (refer JBS&G 2018). | Soil and Groundwater | Metals, TRH, BTEX, PAH and VOC's. | Disturbance of surface and subsurface soils during site redevelopment, and future use of the site post-redevelopment | Ingestion Dermal contact Inhalation/ vapour intrusion | Construction workers End users of the site post-redevelopment |

| | | | | | | |
|---|---|---|---|---|---|---|
| AEC05 | Existing Building Footprints (inaccessible) | Soil | Metals, TRH, BTEX, PAH, PCB, OCP/OPP, Phenols and Asbestos (0.001%). | Disturbance of surface and subsurface soils during site redevelopment and future use of the site post-redevelopment | Ingestion<br>Dermal contact<br>Inhalation of dust particulates | Construction workers<br>End users of the site post-redevelopment |
| AEC06 | Deep uncontrolled filling adjacent the southern portion of the site – landfill activities | Soil | Methane, H2S, Carbon monoxide and Carbon dioxide | Deep filled areas could generate methane, hydrogen sulphide and other hazardous ground gases, which could potentially ingress into proposed buildings | Inhalation/ vapour intrusion | Construction workers in trenches<br>End users of the site post-redevelopment |
| AEC07 | Industrial land use to the north and northeast of the site | Groundwater | Heavy metals, TRH, BTEX, PAH, VOCs, OCP/OPP, PCB, PFAS and inorganic compounds | Encountering groundwater during site redevelopment (deep excavation)<br><br>Vapour which could potentially ingress into proposed buildings | Direct Contact<br>Inhalation/ vapour intrusion | Construction workers<br>End users of the site post-redevelopment<br>Aquatic ecosystems |

# APPENDIX D – STAGED DEMOLITION AND BULK EARTHWORKS PLAN




# MILPERRA WSU

Masterplan - New Park

Rev 4b - 19.03.21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# Unexpected Finds Protocol