REPORT TO

LORETO NORMANHURST SCHOOL

ON

REMEDIATION ACTION PLAN

FOR

PROPOSED STAGE 1 WORKS AREA

AT

LORETO NORMANHURST GIRLS SCHOOL, 91-93 PENNANT HILLS ROAD, NORMANHURST, NSW

Date: 12 January 2021
Ref: E31772PLrpt6-RAPrev1

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DOCUMENT REVISION RECORD

Report Reference	Report Status	Report Date
E31772KLrpt6-RAP	Final report	29 May 2019
E31772PLrpt6-RAPrev1	Final report, revised to account for additional Stage 1 work areas	12 January 2021

Executive Summary

Loreto Normanhurst School ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed Stage 1 Works at Loreto Normanhurst Girls School, 91-93 Pennant Hills Road, Normanhurst, NSW. The site location is shown on Figure 1 and the RAP applies to the site boundaries as shown on Figure 2 in Appendix A. For the purpose of this report, 'the site' includes the areas defined by the Stage 1 Works, whilst the whole property has been referred to as 'the school'.

This report has been prepared to support the requirements outlined by the Department of Planning and Environment (DPE) as part of the Development Application (DA) lodgement.

The goal of the remediation is to reduce human health and environmental risks associated with actual and potential site contamination to an acceptable level, in order to render the site suitable for the proposed development from a contamination viewpoint. The primary aims of the remediation are to manage risks associated with contamination and to remediate the known contamination that was assessed in the Detailed Site Investigation (DSI) to pose a potential risk.

The objectives of this RAP are to:

- Provide a rationale to support the extent of the proposed remediation and the remedial/site validation approach;
- Document a methodology that is to be implemented to remediate and validate the site;
- Document a strategy that can be implemented in the event of uncovering any unexpected, contamination-related finds; and
- Provide a framework for validation that can be used to facilitate staged validation of the site.

Previous investigations identified localised areas of contaminated soils impacted by bonded asbestos containing material (ACM), chromium and polycyclic aromatic hydrocarbons (PAHs). The proposed remedial strategy includes various methods to mitigate the risks associated with these soils, including: excavation and off-site disposal; cap and containment; and treatment of ACM at the surface via picking/removal.

Remediation is to occur in a staged manner, concurrently with the staged development of the site. A validation report is to be prepared for each stage to demonstrate that the remediation was successful and to confirm that the area is suitable for the proposed development from a contamination viewpoint. An Environmental Management Plan (EMP) will also be prepared for those areas where contaminated soil is capped as these areas will be managed over the long-term so that risks remain low and acceptable.

JKE are of the opinion that the site can be made suitable for the proposed development provided this RAP is implemented.

We understand that heritage items are located within the school grounds and a large portion of the school falls within the Significant Biodiversity (tree and vegetation preservation) Planning Area in the Hornsby Local Environmental Plan (LEP) 2013. On this basis, we have assessed that the remediation work may fall under Category 1 remediation. This should be confirmed with the client's planning expert.

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Abbreviations

Asbestos Fines/Fibrous Asbestos	**AF/FA**
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Ambient Background Concentrations	**ABC**
Asbestos Containing Material	**ACM**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
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Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millilitres	**ml or mL**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Percentage	**%**
Percentage weight for weight	**%w/w**

1 INTRODUCTION

Loreto Normanhurst School ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed Stage 1 Works at Loreto Normanhurst Girls School, 91-93 Pennant Hills Road, Normanhurst, NSW. The site location is shown on Figure 1 and the RAP applies to the site boundaries as shown on Figure 2 in Appendix A. For the purpose of this report, 'the site' includes the areas defined by the Stage 1 Works, whilst the whole property has been referred to as 'the school'.

This report has been prepared to support the requirements outlined by the Department of Planning and Environment (DPE) as part of the Development Application (DA) lodgement.

1.1 Previous investigations

JKE (formerly trading as Environmental Investigation Services – EIS) has previously undertaken a number of preliminary investigations/assessments at the site and the reports are referenced as follows:

- E31772KLrpt, dated 24 October 2018[1];
- E31772KLrpt2, dated 11 February 2019[2]; and
- E31772KLrpt3, dated 30 April 2019[3].

The preliminary investigations/assessments were undertaken for targeted parts of the Stage 1 Works area as well as for the wider school property in order to address statutory planning considerations for both the Stage 1 development and the wider school Master Plan. A summary of this information has been included in Section 2.

JKE has also undertaken a Detailed Site Investigation (DSI) for the Stage 1 Works area (Ref: E31772PLrpt7, dated 15 December 2020)[4] which recently included sampling in additional areas captured under the proposed Stage 1 Works. A summary of this information has also been included in Section 2. The DSI has been used as a basis to develop this revised RAP.

This RAP is to be read in conjunction with the JK Geotechnics (JKG) Geotechnical Investigation Report (Ref: 31772L2rpt, dated 17 December 2020)[5].

[1] EIS, (2018). *Report to TTW on Preliminary Site Investigation (PSI) for Proposed New School Buildings at Loreto Normanhurst Girls School, 91-93 Pennant Hills Road, Normanhurst* (referred to as EIS 2018 PSI)

[2] EIS, (2019a). *Report to Allen Jack + Cottier Architects on Preliminary Stage 1 Environmental Site Assessment (ESA) for Loreto Normanhurst Girls School Master Plan at Loreto Normanhurst Girls School, 91-93 Pennant Hills Road, Normanhurst, NSW* (referred to as EIS 2019a ESA)

[3] EIS, (2019b). *Report to Allen Jack + Cottier Architects on Preliminary Site Investigation (PSI) for Loreto Normanhurst Girls School Master Plan at Loreto Normanhurst Girls School, 91-93 Pennant Hills Road, Normanhurst, NSW* (referred to as EIS 2019b PSI)

[4] JKE, (2020). *Report to Loreto Normanhurst School on Detailed Site Investigation for Proposed Stage 1 Works Area at Loreto Normanhurst Girls School, 91-93 Pennant Hills Road, Normanhurst, NSW* (referred to as the DSI)

[5] JKG, (2020). *Report to Loreto Normanhurst School on Geotechnical Investigation for Proposed Car Parks and Through Link at 91-93 Pennant Hills Road, Normanhurst, NSW* (referred to as JKG 2020)

1.2 Proposed Development Details

From the supplied State Significant Development Application (SSDA) Concept Proposal Plans (updated 8 December 2020) JKE understands the Stage 1 Works area will be developed as follows:

- Stage 1A – Includes the construction of a new boarding house located on the eastern boundary of the school. It is proposed that the new building will comprise four levels including one partial basement level. The building will be cut into the existing batters to the north and east elevations to create the partial basement level for car parking and common areas;
- Stage 1B – Includes the landscaping renovation of the Mary Ward Wing located in the centre of the northern section of the school. It is proposed that part of the existing building will be demolished and the area be developed as a landscape feature; and
- Stage 1C – Includes the garden plaza development located immediately to the east of the Mary Ward Wing. It is proposed that the area will be developed as a garden plaza with a combination of landscaped garden beds and paved footpaths.

At the time of preparing the DSI, the updated plans included the following additional areas that in the Stage 1 Works area:

- P3A car park;
- P4A car park;
- P1A car park; and
- Site through link.

The development areas/stages and relevant building areas are shown on Figure 2.

1.3 Remedial Goal, Aims and Objectives

The goal of the remediation is to reduce human health and environmental risks associated with actual and potential site contamination to an acceptable level, in order to render the site suitable for the proposed development from a contamination viewpoint.

The primary aims of the remediation are to manage risks associated with contamination and to remediate the known contamination that was assessed in the DSI to pose a potential risk.

The objectives of this RAP are to:

- Provide a rationale to support the extent of the proposed remediation and the remedial/site validation approach;
- Document a methodology that is to be implemented to remediate and validate the site;
- Document a strategy that can be implemented in the event of uncovering any unexpected, contamination-related finds; and
- Provide a framework for validation that can be used to facilitate staged validation of the site.

1.4 Scope of Work

The RAP was prepared in accordance with a JKE proposal (Ref: EP52766PL) of 30 September 2020 and written acceptance from the client of 23 October 2020. The scope of work included a review of the DSI and preparation of a RAP.

The scope of work was undertaken with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[6], other guidelines made under or with regards to the Contaminated Land Management Act (1997)[7] and State Environmental Planning Policy No.55 – Remediation of Land (1998)[8]. A list of reference documents/guidelines is included in the appendices.

[6] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

[7] Contaminated Land Management Act 1997 (NSW) (referred to as CLM Act 1997)

[8] *State Environmental Planning Policy No. 55 – Remediation of Land 1998* (NSW) (referred to as SEPP55)

2 SITE INFORMATION

2.1 Background and Summary of Site History

A summary of the historical land uses and activities identified during the preliminary investigations/ assessments (EIS 2018 PSI, EIS 2019a ESA, EIS 2019b PSI) is presented in the following table:

Table 2-1: Summary of Historical Land Uses

Year(s)	On-site - Potential Land Use / Activities	Off-site - Potential Land Use / Activities
Pre-1933	The majority of the school was vacant grassed land in the south section with residential properties in the northern section of the site. The site was owned by various individuals with professions unlikely to be associated with on-site activities.	The immediate surrounds have historically been used for agricultural and low-density residential purposes.
1933	The site was purchased by The Loreto Property Association.	
1933-2018	The site has been operational as Loreto Normanhurst School since 1933 with construction and various additions to the school buildings during this time.	

The site history assessments identified imported fill material, use of pesticides and hazardous building materials as potential contamination sources. The intrusive investigation undertaken for the EIS 2018 PSI is summarised as follows:

- Soil sampling was undertaken from six locations within the Stage 1A boarding house area and extended to a maximum depth of 14.0m. Fill material (i.e. historically imported soil) was encountered at the surface or beneath the pavement in all boreholes and extended to depths of between 0.1m to 2.4m. The fill material typically consisted of silty sandy clay with inclusions of ironstone gravel, ash and roots;
- Natural silty clay was encountered in BH2 to BH6 and extended to depths of between 0.6m to 4.8m; and
- Elevated concentrations of carcinogenic polycyclic aromatic hydrocarbons (PAHs), above the human-health based site assessment criteria (SAC), were encountered in the fill sample collected from BH2 (0.04-0.2m).

The DSI included sampling of the soil from approximately 40 locations (see attached Figure 2) and groundwater over several stages, then consolidation of the data into a single report for the site. Hydrocarbons (PAHs and TRHs) and asbestos were detected in fill (soil) at concentrations above the adopted human health-based SAC. TRHs and heavy metals were also encountered in fill (soil) at concentrations above the adopted ecological-based SAC. Minor elevations of some metals in groundwater were identified above the ecological SAC, however these were considered to be consistent with regional/background groundwater conditions. The exceedances of the SAC are shown on the attached Figure 3.

Based on the Tier 1 risk assessment, the PAHs, asbestos, TRHs and heavy metals were assessed to pose a low risk in the current site configuration. However, remediation was recommended so that risks from PAHs and asbestos remain low and acceptable during construction and in the context of the proposed development.

The primary data gaps identified in the DSI were that sampling occurred from boreholes which limited the assessment of asbestos in soil, and also that the occurrence of asbestos in soil was a trigger to increase the sampling density for asbestos. This RAP outlines requirements for inspections and data gap investigations following demolition works so that these gaps are sufficiently closed out.

2.2 Site Identification

Table 2-2: Site Identification

Current Site Owner (certificate of title):	Trustees of the Loreto Property Association
Site Address:	91-93 Pennant Hills Road, Normanhurst, NSW
Lot & Deposited Plan:	Part of Lot 3 in DP1217496 Part of Lots 16, 20, 21 and 22 in DP6612 Part of Lot 1 in DP809066 Part of Lots 1, 2 and 3 in DP1218765
Current Land Use:	School
Proposed Land Use:	School
Local Government Authority:	Hornsby Shire Council
Current Zoning:	R2 – Low Density Residential
Site Area (m^2) (approx.):	21,660m^2
RL (AHD in m) (approx.):	179m-193m
Geographical Location (decimal degrees) (approx.):	Latitude: -33.726726 Longitude: 151.098743
Site Location Plan:	Figure 1
Sample Location Plan:	Figure 2

2.3 Site Location and Regional Setting

The site is located in a predominantly residential area of Normanhurst. The school is bound by Pennant Hills Road to the north, Mount Pleasant Avenue to the east and south and Osborn Road to the west.

2.4 Topography

The regional topography is characterised by an east facing hillside that falls towards Mount Pleasant Avenue. The school is located towards the mid-slope of the hillside and has a gentle slope towards the east and south-east at approximately 2° to 3°. Parts of the site have been levelled to account for the slope and accommodate the existing school development.

2.5 Site Inspection

A walkover inspection of the site was undertaken by JKE on 2 November 2020. The inspection was limited to accessible areas of the site and immediate surrounds. An internal inspection of buildings was not undertaken.

A summary of the inspection findings is outlined in the following subsections:

2.5.1 Current Site Use and/or Indicators of Former Site Use

At the time of the inspection, the majority of the site was occupied by school buildings, paved driveways and footpaths, landscaped areas and a tennis court. The surrounding areas within the school were occupied by school buildings including covered outdoor learning areas (COLAs). The southern section of the school was occupied by a recreational area that included car parking, playing fields and bushland. The boarding houses located in the north-east section of the school appeared to have been former residential buildings converted for school use.

2.5.2 Buildings, Structures and Roads

The north-eastern section of the school consisted of the main boarding house and the central section contained classrooms, amenities and administration offices. The buildings were mostly of brick construction with potential asbestos containing fibre cement sheeting noted on the external areas of the buildings. All buildings and structures appeared in good condition.

2.5.3 Boundary Conditions, Soil Stability and Erosion

The school was bounded by metal security fencing along most boundaries with the exception to the east of the boarding house which was bounded by a small brick retaining wall. There were no visible signs of erosion or soil instability along the school boundaries.

2.5.4 Presence of Drums/Chemical Storage and Waste

The maintenance yard located in the northern area of the school housed minor quantities of various chemicals and fuel for general maintenance of the school grounds. The yard appeared properly contained and the chemicals stored correctly with no direct pathway to reach bare soil or grass.

2.5.5 Evidence of Cut and Fill

The playing fields and tennis courts located centrally in the school ground appeared to have been historically cut and filled to achieve existing levels. Paved footpaths and landscaped garden beds within the site itself appeared to have been cut and filled in various locations to ensure a reasonably level platform for the footpaths. This is particularly evident towards the south-east section of the site, with a 1m-2m high retaining wall running adjacent the driveway leading down towards the playing fields.

2.5.6 Visible or Olfactory Indicators of Contamination (odours, spills etc)

During the 2019 works, a fibre cement fragment (FCF) was encountered on the ground surface within the site, adjacent the Loreto Community House (see Figures 2 and 3). The fragment was sampled and is identified as AMF1.

2.5.7 Drainage and Services

Stormwater pits were located across the low-level areas of the school and were assumed to be connected to the local stormwater system. The surface run-off was assumed to follow the general gradient of the site towards the south and east.

2.5.8 Sensitive Environments

Sensitive environments such as wetlands, ponds, creeks or extensive areas of natural vegetation were not identified within the site.

2.5.9 Landscaped Areas and Visible Signs of Plant Stress

Various raised garden beds, grassed areas and ground-level garden beds were identified across the school grounds. The vegetation present included large (>10m) native trees, exotic and native grasses and exotic shrubs. No visible signs of plant stress or dieback was noted during the site inspection.

2.6 Surrounding Land Use

During the site inspection, JKE observed the following land uses in the immediate surrounds:

- North – Cumberland Highway and Normanhurst Public School;
- South – Mount Pleasant Avenue and an aged care facility;
- East – Mount Pleasant Avenue and residential properties; and
- West – Osborn Road and residential properties.

JKE did not observe any land uses in the immediate surrounds that were identified as potential contamination sources for the site.

2.7 Summary of Geology and Hydrogeology

2.7.1 Geology and Acid Sulfate Soil (ASS)

Regional geological information presented in the EIS 2018 report indicated that the site is underlain by Ashfield Shale of the Wianamatta Group, which typically consists of black to dark grey shale and laminite.

The acid sulfate soil (ASS) risk map prepared by Department of Land and Water Conservation (1997)[9] indicated that the site is not located within a risk area. ASS information presented in the Lotsearch report (attached in the appendices) indicated that a Class 5 area is located directly to the south of the site. The proposed development will not lower the water table in nearby ASS risk areas and therefore the proposed works do not pose a risk in terms of ASS disturbance.

2.7.2 Hydrogeology

Groundwater observations made during drilling and from temporary monitoring wells indicated that groundwater is generally expected to be associated with perched seepage above and/or within fractured bedrock. A monitoring well was installed for the DSI and groundwater at this location was identified at a depth of over 5mBGL. Water levels reported by JKG (2020) ranged from 1.55mBGL to 7.48mBGL, however these levels may have been influenced by water introduced into the boreholes during coring of the bedrock.

The information reviewed for the 2018 PSI indicated that there was a total of 10 registered bores within 2,000m of the site. The nearest registered bore was located approximately 235m from the site and was utilised for recreational purposes (probably irrigation of sports fields). The next closest bore was located 1,415m west of the site and was utilised for monitoring purposes.

The information indicated that that the subsurface conditions at the site are likely to consist of relatively low permeability residual soils overlying shallow bedrock. The potential for viable groundwater abstraction and use of shallow groundwater under these conditions is considered to be low. There is a reticulated water supply in the area and consumption of groundwater is not expected to occur at the site or in the vicinity. Use of groundwater is not proposed as part of the development.

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Coups Creek located approximately 350m to the east of the site.

[9] Department of Land and Water Conservation, (1997). *1:25,000 Acid Sulfate Soil Risk Map (Series 9130N3, Ed 2)*

3 CONCEPTUAL SITE MODEL / SITE CHARACTERISATION

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. An iteration of the CSM and the site characterisation details based on the findings of the DSI are presented in the following sub-sections.

3.1 Contamination Sources and Contaminants of Concern

The contamination sources and contaminants of concern are presented in the following table:

Table 3-1: Known and Potential Contamination Sources

Contamination Source	Contaminants of Concern / Contaminants of Potential Concern (CoPC)
Known: fill/soil or surface impacts from former demolition, resulting in surficial ACM at the northern end of the proposed boarding house (Stage 1A).	Asbestos (ACM)
Known: fill/soil in the proposed boarding house area, impacted by PAHs (Stage 1A).	PAHs
Potential: fill/soil in the P3A carpark area, impacted by asbestos.	Asbestos (as ACM) CoPC: asbestos as asbestos fines (AF)
Potential: fill/soil in the P1A carpark area at location BH209, impacted by chromium. Initial analysis was for total chromium and it is not yet known whether the elevated chromium result is for chromium VI.	CoPC: Chromium VI
Potential/Unknown: fill/soil across all development areas at the site potentially impacted by asbestos, and surficial fill/soil beneath buildings potentially impacted by pesticides.	CoPC: Asbestos (as ACM), heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc), organochlorine pesticides (OPPs) and organophosphorus pesticides (OPPs). Identification of unexpected finds (e.g. staining, hydrocarbon odours) will trigger a need to consider additional CoPC such as hydrocarbons.

We have considered the potential for the occurrence of per- and polyfluoroalkyl substances (PFAS) at the site with regards to the Heads of EPAs Australia and New Zealand (HEPA) PFAS National Environmental Management Plan (2020)[10]. The previous historical assessments did not identify any on-site or nearby off-site activities associated with sources of PFAS contamination as listed in Appendix B of NEMP 2020.

[10] HEPA, (2020). *PFAS National Environmental Management Plan*. Version 2.0 dated January 2020 (referred to as NEMP 2020)

3.2 Mechanism for Contamination, Affected Media, Receptors and Exposure Pathways

The mechanisms for contamination, affected media, receptors and exposure pathways relevant to the potential contamination sources/AEC are outlined in the following CSM table:

Table 3-2: CSM

Mechanism for contamination	The mechanism for known contamination is 'top-down' impact from imported materials and/or historical demolition activities.
Affected media	Soil has been identified as the affected medium. However, it is noted that asbestos fibres can also affect the air and this will be considered as part of the site management during remediation and validation.
Receptor identification	Human receptors include current and future site occupants/users (including adults and children), construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users within the wider school and also in the adjoining residential areas.
Exposure pathways and mechanism	The primary exposure pathway relevant to the receptors includes inhalation of airborne asbestos fibres. Such fibres could be generated and exposure could occur during disturbance of soil containing asbestos. Dermal contact and inhalation of dust are also applicable to soil impacted by chromium and PAHs. The investigations have not identified contamination expected to result in exposure via the inhalation of vapours.

3.3 Data Gaps

The primary data gaps include:

- Previous sampling occurred from boreholes which limited the assessment of asbestos in soil;
- The occurrence of asbestos in soil (as identified in the DSI) is a trigger to increase the sampling density for asbestos. This sampling has not yet occurred due to access constraints; and
- Sampling has not occurred within the existing building footprints.

Section 4 of this RAP outlines requirements for inspections and data gap investigations following demolition works so that these gaps are sufficiently closed out.

4 DATA GAP INVESTIGATION REQUIREMENTS

Data gap investigations must occur for all areas of the site as access becomes available. These investigations will be staged to align with the proposed development stages. Based on typical turnaround times, data gap investigations and finalisation of the associated reports may take approximately 3-4 weeks. The client and project manager are to factor this into the project timeline.

A Sampling, Analysis and Quality Plan (SAQP) must be prepared for each staging area in accordance with NEPM 2013 and the NSW EPA Consultants reporting on contaminated land, Contaminated Land Guidelines (2020)[11]. Each SAQP is to account for the following:

- The investigation area is to be established in order to justify the sampling density/number of sample locations;
- A detailed walkover inspection is to occur after demolition in each area in order to confirm there are no unexpected finds (or otherwise);
- The sampling density for asbestos is to meet the minimum requirements for sites where asbestos is "known" to be present, in accordance with NEPM 2013 and the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009)[12] (endorsed in NEPM 2013);
- All soil sampling is to occur from test pits. The test pits are to be excavated to the base of the fill and approximately 0.5m into the natural soil/bedrock;
- Bulk (10L) samples are to be screened in the field for asbestos and 500ml samples are also to be submitted for gravimetric analysis of asbestos at the laboratory in accordance with the WA DoH 2009 and NEPM 2013 methods;
- A minimum of one sample location is to be position in the footprint of each building that is demolished for the purpose of assessing OCPs, OPPs and heavy metals in fill/soil. For buildings that are to be retained, the sample location is to be positioned immediately adjacent to the floor slab/edge of the building;
- Where required (i.e. if there is a surplus of materials requiring off-site disposal of waste), additional sampling, analysis and reporting is to occur to provide a waste classification;
- Sampling in the P1A carpark in the north of the site is to include a sample and 're-test' at the former BH209 location where the chromium exceedance occurred, plus four locations around this area (spaced say 5-7m from the former location BH209), in order to assess the occurrence of hexavalent chromium (chromium VI) in the soil; and
- Appropriate Quality Control/Quality Assurance (QA/QC) samples/analysis.

[11] NSW EPA, (2020). *Consultants reporting on contaminated land, Contaminated Land Guidelines.* (referred to as Reporting Guidelines)

[12] Western Australian (WA) Department of Health (DoH), (2009). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.* (referred to as WA DoH 2009)

5 EXTENT OF REMEDIATION

The extent of remediation for each development stage is to be confirmed following the data gap investigation described in Section 4. In the event that the nature and/or extent of remediation differs from that outlined in this RAP, an updated/addendum RAP or Remedial Works Plan (RWP) must be prepared to outline the remediation and validation requirements.

The extent of remediation based on the currently available data is discussed in the following subsections and reference is to be made to Figures 3 and 4 in Appendix A for further details.

5.1 PAHs in Fill Area

The PAHs in fill area is in Stage 1A (proposed boarding house). The fill encountered in the JKE boreholes in this area extended to depths ranging from 0.4mBGL to 1.2mBGL (vertical extent). The area has been estimated to cover approximately 600m^2 (horizontal extent). The horizontal extent has been established by the western site boundary in this area and by BH104 and BH107 which did not encounter PAHs in fill above the SAC.

5.2 P3A Carpark (ACM in Fill) Area

The P3A carpark is the south western-most area of the site. The fill in this area extends to depths ranging from 0.3mBGL in the northern end of the area, to 2.8mBGL in the south-eastern corner of the area (vertical extent). The area has been estimated to cover approximately 6,200m^2 (horizontal extent). The horizontal extent has been defined by the entire P3A development area.

5.3 Surface ACM Area

The surface ACM area is in Stage 1A (proposed boarding house), however it is unclear whether this area also encroaches into Stage 1B. The impacts are associated with the surficial soils over an area estimated to cover approximately 600m^2 (horizontal extent). At this point in time, the horizontal extent has been defined by previous boreholes BH3, BH108 and BH110 where no asbestos was identified.

5.4 P1A Carpark (Chromium in Fill) Area

The chromium fill area is in the P1A carpark in the northern part of the site. The fill in this area is shallow and extends to a depth of 0.1mBGL at the BH209 location, and to depths ranging from 0.2-0.3mBGL in the surrounds (vertical extent). A nominal 225m^2 area has been established as the horizontal extent at BH209 (approximately 15m by 15m with BH209 at its centre).

6 REMEDIATION OPTIONS

6.1 Soil Remediation

The NSW EPA follows the hierarchy set out in NEPM 2013 for the remediation of contaminated sites. The preferred order for soil remediation and management is as follows:

1. On-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated material so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;

Or if the above are not practicable:

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

For simplicity herein, the above hierarchy are respectively referred to as Option 1, Option 2, Option 3 etc.

In addition to the above, important considerations in assessing the acceptability of an asbestos remediation proposal includes the following (based on WA DoH 2009 which is endorsed under the NEPM 2013):

- Minimisation of public risk;
- Minimisation of contaminated soil disturbance; and
- Minimisation of contaminated material/soil moved to landfill.

6.2 Consideration of Remediation Options

The table below discusses a range of remediation options:

Table 6-1: Consideration of Remediation Options

Option	Discussion	Applicability
Option 1 **On-site treatment of contaminated soil**	On-site treatment can provide a mechanism to reuse the processed material, and in some instances, avoid the need for large scale earthworks. Treatment options are contaminant-specific and can include bio-remediation, soil washing, air sparging and soil vapour extraction, thermal desorption and physical removal of bonded ACM fragments. Depending on the treatment option, licenses may be necessary for specific individual waste streams due to the potential for air pollution and the formation of harmful by-products during incineration processes. Licences for re-use of treated material/waste may also be required.	Applicable for ACM in or on soil. Not applicable for friable asbestos or friable asbestos in soil. Not technically achievable or economically viable for small quantities of soil contaminated with PAHs/chromium.

Option	Discussion	Applicability
Option 2 **Off-site treatment of contaminated soil**	Contaminated soils are excavated, transported to an approved/licensed treatment facility, treated to remove/stabilise the contaminants then returned to the subject site, transported to an alternative site or disposed to an approved landfill facility. This option is also contaminant-specific. The cost per tonne for transport to and from the site and for treatment is considered to be relatively high. The material would also have to be assessed in terms of suitability for reuse as part of the proposed development works under the waste and resource recovery regulatory framework.	Not likely to be economically viable for when dealing with relatively small quantities of contaminated soil.
Option 3 **Consolidation and isolation of impacted soil by cap and containment**	This would include capping material in-situ beneath appropriate barriers, or the consolidation of contaminated soil within an appropriately designed cell, followed by the placement of an appropriate barrier over the material to reduce the potential for future disturbance. The capping and/or containment must be appropriate for the specific contaminants of concern. Depending on the concentrations of contaminants being encapsulated, an ongoing Environmental Management Plan (EMP) may be required and an EMP would need to be publicly notified and made to be legally enforceable (e.g. via listings in the Section 10.7 planning certificate and on the land title).	Applicable and likely to be the most economically viable option for the P3A carpark (ACM in fill) area. Also appropriate for the remaining contamination.
Option 4 **Removal of contaminated material to an appropriate facility and reinstatement with clean material**	Contaminated soils would be classified in accordance with NSW EPA guidelines for waste disposal, excavated and disposed of off-site to a licensed landfill. The material would have to meet the requirements for landfill disposal. Landfill gate fees (which may be significant) would apply in addition to transport costs.	Applicable for all areas and contaminants. However, the approach is not likely to be economically viable in the event that large quantities of soil are contaminated.
Option 5 **Implementation of management strategy**	Contaminated soils would be managed in such a way to reduce risks to the receptors and monitor the conditions over time so that there is an on-going minimisation of risk. This may occur via the implementation of monitoring programs, potentially also involving capping systems.	Applicable concurrently with Option 3.

6.3 Rationale for the Preferred Option for Remediation

6.3.1 Preferred Options

The preferred options for remediation are summarised in the following table:

Table 6-2: Preferred Options for Remediation

Area	Preferred Option and Rationale
PAHs in Fill	Option 3/5 – Cap and Contain and Long-term Management The PAHs in fill area is located within the proposed boarding house development area. The majority of the remediation area is to be overlain by the boarding house and therefore the soils will be inaccessible. Eliminating access/exposure to the soil will adequately mitigate the risks posed by PAHs during future use of the site. This approach also reduces unnecessary costs associated with excavation and disposal of materials to landfill, and is considered to be environmentally sustainable.
P3A Carpark (ACM in Fill)	Option 3/5 – Cap and Contain and Long-term Management Carparks are well suited to cap and contain remediation. Capping is an appropriate method to eliminate exposure to asbestos in the area during future use of the site. This approach also reduces unnecessary costs associated with excavation and disposal of materials, and is considered to be environmentally sustainable.
Surface ACM	Option 1 – Treatment/Removal of ACM at the Surface Via Picking Treatment to remove visible ACM will remove the risks associated with disturbance of asbestos during future use of the site. This area will be partially covered by the proposed boarding house and is likely to be paved and/or newly landscaped.
P1A Carpark (Chromium in Fill)	Option 4 – Excavation and off-site Disposal The chromium in fill area is located within the P1A carpark development area. Excavation and off-site disposal is the preferred remediation method as it is considered likely that the quantity of contaminated fill will be minimal. Removing this material will eliminate the need for capping and on-going management of an additional contaminant (i.e. in addition to PAHs and asbestos).

6.3.2 Contingency Option

The cap and contain approach outlined in the RAP is based on in-situ capping of materials at their current location. Section 9 includes a contingency plan for constructing a purpose-built containment cell for contaminated soil which can be implemented in the event that in-situ capping is not achievable, or in the event that there is a surplus of contaminated soil that needs to be removed to facilitate the in-situ capping process.

7 REMEDIATION DETAILS

The remediation can be undertaken in a staged manner to coincide with the staged development of the site. The client is to engage with the consent authority at the time of the DA lodgement so that the development approval includes suitable conditions to facilitate this.

7.1 Roles and Responsibilities

Table 7-1: Roles and Responsibilities

Role	Responsibility
Client/Developer and Project Manager	Loreto Normanhurst School Carmichael Tompkins Property Group (ctpg) The client/project manager is required to appoint the project team for the remediation and must provide all investigation reports including this RAP to the remediation contractor, consent authority and any other relevant parties involved in the project. The project manager is required to review all documents prepared for the project and manage the implementation of the procedures outlined in this RAP. The project manager is to take reasonable steps so that the remediation contractor and others have understood the RAP and will implement it in its totality. The project manager will review the RAP and other documents and will update the parties involved of any changes to the development or remediation sequence (in consultation with the validation consultant). Further details are outlined in the sections below.
Remediation Contractor	To be appointed. The remediation contractor is required to review all documents prepared for the project, apply for any relevant removal licences or permits and implement the remediation requirements outlined in this RAP. The remediation contractor is required to collect all necessary documentation associated with the remediation activities and forward this documentation onto the client and project manager as they become available. Further details are outlined in the sections below.
Validation Consultant	To be appointed The validation consultant[13] provides consulting advice and validation services in relation to the remediation. The validation consultant is required to review any deviation to this RAP or in the event of unexpected finds if and when encountered during the site work. The validation consultant is to have a Licensed Asbestos Assessor on staff to provide the necessary surface clearance inspections and certificates for the project. The validation consultant is required to liaise with the client, project manager and remediation contractor on all matters pertaining to the site contamination, remediation and validation.

[13] The consultant must be a certified practitioner (specialising in site contamination), under one of the NSW EPA endorsed certification schemes

7.2 Pre-commencement

The project team is to have a pre-commencement meeting to discuss the sequence of remediation, and the remediation and validation tasks. The site management plan for remediation works (see Section 10) is to be reviewed by project manager and remediation contractor, and appropriate steps are to be taken to ensure the adequate implementation of the plan.

7.3 Remediation and Associated Tasks

The following general sequence of works is anticipated for each development stage:

- Site establishment;
- Demolition of structures;
- Data gap investigation (Section 4); and
- Remediation and validation (Sections 7.3 and 8).

7.3.1 Site Establishment and Demolition

The remediation contractor is to establish on site as required to facilitate the remediation. Consideration must be given to the work sequence and extent of remediation so that the site establishment (e.g. site sheds, fencing, access points etc) does not inhibit the works. Any materials imported onto site during the site establishment (e.g. 40.70 or DGB gravels for driveways and site shed areas etc) must be validated in Accordance with Section 8.

Prior to demolition, a hazardous building materials survey is to be undertaken. The buildings are to be demolished with regards to the findings of the hazardous building materials survey and in accordance with the relevant codes and standards. All demolition waste from the buildings/structures are to be disposed off-site to facilities that are appropriately licensed to receive the waste.

Any hazardous building materials in the existing structures such as the amenities building should be assessed prior to the commencement of demolition, demolished in accordance with the relevant codes and standards. A clearance certificate is to be obtained by the demolition contractor following the removal of any hazardous materials.

All waste from the demolition is to be disposed to facilities that are licenced by the NSW EPA to accept the waste. The demolition contractor is to maintain adequate records and retain all documentation for such activities including:

- A summary register including details such as waste disposal dates, waste materials descriptions, disposal locations (i.e. facility details) and reconciliation of this information with waste disposal docket numbers; and
- Waste tracking records and transport certificates (where waste is required to be tracked/transported in accordance with the regulations, e.g. WasteLocate for asbestos); and
- Disposal dockets for the waste.

The above information is to be supplied to the validation consultant for assessment and inclusion in the site validation report.

7.3.2 Remediation – Cap and Contain

Based on the current dataset, the cap and contain approach is to be implemented for the PAHs in fill area and the P3A carpark (ACM in fill) area (see Figure 4). The detailed validation plan relevant to this aspect of the remediation is provided in Section 8.

The premise for remediating these areas of the site is based around capping the fill/soil beneath appropriate (clean) capping layers in order to eliminate exposure to the fill/soil. The proposed capping system requires consideration during the detailed design process so that the minimum capping requirements are achieved.

A summary of the proposed capping strategy is provided in the following table. These requirements must be reviewed by the project team prior to finalising the design, and all relevant design drawings must include the capping specification details.

Table 7-2: In-situ Capping Specification

Area	Capping Specification^
Areas of continuous pavement/hardstand (e.g. new buildings, concrete footpaths, carparks etc)	Installation of: • Geotextile marker layer over the contaminated fill; and • Overlain by any required (validated) basecourse materials and the pavement/floor slab.
Unpaved areas or areas of non-continuous pavement (e.g. landscaped zones, softfall, brick pavers etc)	Installation of: • Geotextile marker layer over the contaminated fill; and • Minimum of 500mm of clean (validated) material.
New plantings (trees, shrubs etc) and underground services	All new plantings and underground services are to be placed above the contaminated fill (i.e. above the marker layer).
Tree Protections Zones (TPZs)	An appropriate capping procedure for TPZs is to be developed by the validation in consultant with the project arborist.

^ The capping specification relates to the remediation only and has not considered engineering design requirements for the site.

The remediation procedure is provided below:

Table 7-3: Remediation – In-situ Capping

Step	Procedure
1.	<u>Bulk earthworks/site preparations:</u> The remediation contractor is to complete the earthworks required to facilitate the proposed capping of the site. Where piling is required, piling is to occur prior to capping to minimise the potential for cross-contamination. Any imported materials used are to be validated by the validation consultant in accordance with Section 8. This may include but is not limited to coarse gravels (e.g. 40/70) for driveways, DGB, material used to create a piling platform etc.

Step	Procedure
2.	Survey of site levels: A pre-capping levels survey is to be completed by the relevant contractor. This must occur after the installation of the geotextile marker layer, but before the installation of any overlying capping layers. The purpose of the survey is to provide a record of the site levels across the top of the geotextile marker layer. Survey points are to be recorded with a spacing of not more than 10m between adjacent points. Additional survey points will be required in the vicinity of changes in surface slope.
3.	Capping: The cap is to be constructed in accordance with the capping specification (Table 7-2). A post-capping levels survey is to be completed by the relevant contractor. This must occur after the installation of the capping layers. The purpose of the survey is to provide a record of the site levels across the top of the cap. This survey can be supplemented by as built drawings if the drawings provide details of the finished levels. Survey points are to be recorded with a spacing of not more than 10m between adjacent points. Additional survey points will be required in the vicinity of changes in surface slope. Any imported materials used are to be validated by the validation consultant in accordance with Section 8. The validation consultant is required to inspect the capping works and imported materials in accordance with the validation plan.

7.3.3 Remediation – Treatment

Based on the current dataset, the treatment approach is to be implemented for the surface ACM area (see Figure 4). It is assumed that there will be minimal visible ACM (i.e. less than 10m^2) and the work will not require a licenced asbestos removalist.

On completion of the demolition, the area is to be inspected by a Licenced Asbestos Assessor and a surface pick/removal of visible ACM at the ground surface is to occur. Any suspected ACM picked from the surface is to be handled in accordance with the relevant codes and standards, and is to be disposed of to a facility licenced by the NSW EPA to accept the waste. A docket for the disposal is to be provided to the validation consultant for inclusion in the validation report.

On completion of the pick the Licenced Asbestos Assessor (i.e. the validation consultant) is to undertake a surface clearance inspection for asbestos and is to provide an asbestos clearance certificate for the area.

7.3.4 Remediation – Excavation and off-site Disposal

Based on the current dataset, the excavation and of-site disposal approach is to be implemented for the P1A (chromium in fill) area (see Figure 4). The detailed validation plan relevant to this aspect of the remediation is provided in Section 8.

The remediation procedure is outlined below:

Table 7-4: Remediation Details – Excavation and disposal of contaminated fill

Step	Procedure
1.	Personal Protective Equipment (PPE) and Work Health and Safety (WHS): The minimum PPE required for the remediation includes covered clothing, gloves and steel cap boots. Other site/project specific PPE may be required including hard hat, eye protection etc and will be dependent on the requirements of the remediation contractor.
2.	Removal of contaminated fill: Excavation of the remediation area will be undertaken as follows: • Prepare waste classification documentation for the material in accordance with the NSW EPA guidelines; • Submit an application to dispose the fill (in accordance with the assigned waste classification) to a landfill licensed by the NSW EPA to receive the waste and obtain authorisation to dispose; • A water system will need to be in place to spray the excavated soil during excavation/ remediation works and to decontaminate trucks entering the work area. The general site area should be kept damp during remediation works to minimise the generation of dust; • The remediation area is to be excavated to the base of the fill and down to the surface of the underlying natural soil (or bedrock, whichever is encountered first); • Load the fill onto trucks and dispose in accordance with the assigned waste classification to the receiving landfill facility; and • All documents including landfill dockets must be retained and forwarded to the client and validation consultant for inclusion into the validation report.
3.	Validation of Excavation Base and Walls: • Once all fill is removed, the base and walls of the excavation are to be validated (by the validation consultant) in accordance with Section 8; • If the validation fails, the contaminated area must be chased out (under the guidance of the validation consultant) and re-validated until the validation is successful; and • If the validation is successful, the excavation can be continued to achieve the finished levels, or reinstated with clean (validated) imported or site-won material.

7.4 Remediation Documentation

The remediation contractor must retain all documentation associated with the remediation, including but not limited to:

- Waste/surplus soil disposal dockets (see additional details below);
- Imported materials information (see additional details below in Section 7.4.2 and Appendix B);
- Asbestos management documentation, including all relevant notifications, monitoring reports and asbestos clearance certificates;
- Photographs of remediation works;
- Waste tracking documentation (see additional details below in Section 7.4.1 and Appendix B).

Copies of these documents must be forwarded to the validation consultant on completion of the remediation for inclusion in the validation report.

7.4.1 Waste

All waste removed from the site is to be appropriately tracked and managed in accordance with the relevant regulations. The remediation contractor (and/or their nominated construction contractor) is to maintain adequate records and retain all documentation for waste disposal activities including:

- A summary register (in Microsoft Excel format) including details such as waste disposal dates, waste materials descriptions, disposal locations (i.e. facility details) and reconciliation of this information with the associated waste classification documentation and the waste disposal docket numbers; and
- Waste tracking records and transport certificates (where waste is required to be tracked/transported in accordance with the regulations); and
- Disposal dockets for the waste.

Any soil waste classification documentation is to be prepared in accordance with the reporting requirements specified by the NSW EPA as outlined in the Reporting Guidelines.

7.4.2 Imported Materials

The remediation contractor (and/or their nominated construction contractor) is to maintain for the duration of the project an imported material register. This must include a register (in Microsoft Excel format) with details of each imported material type, supplier details, summary record of where the imported materials were placed on site, and importation docket numbers and a tally of quantities (separated for each import stream). Dockets for imported materials are to be provided electronically so these can be reconciled with the register.

The above information is to be provided to the validation consultant for inclusion in the validation report. It is recommended that the register be set up at the beginning of the project and provided to the validation consultant regularly (say on a monthly or two-monthly basis) so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

7.5 Preliminary Remediation Area and Soil Volume Estimates

A summary of the areas and soil volumes for remediation is provided in the following table and is based on the extent of remediation outlined in Section 5:

Table 7-5: Remediation Area and Soil Volume Estimates

Remediation Area	Estimated Area (m^2)	Estimated Soil Volume (m^3)
PAHs in Fill	600	480, calculated assuming average fill depth of 0.8m
P3A Carpark (ACM in Fill)	6,200	7,440, calculated assuming average fill depth of 1.2m
Surface ACM	600	Not applicable
P1A Carpark (Chromium in Fill)	225	45, calculated assuming fill depth of 0.2m
TOTAL	**7,625**	**7,965**

This information is to be reviewed by the validation consultant on completion of the works and an assessment of the quantities of soil disposed off-site (e.g. comparison with the estimated and actual volumes) is to be included in the waste classification report(s). A review of the disposal facility's Environment Protection Licence (EPL) issued under the Protection of the Environment Operations (POEO) Act (1997)[14] is to be undertaken to assess whether the facility is appropriately licensed to receive the waste.

[14]NSW Government, (1997)). *Protection of Environment Operations Act.* (referred to as POEO Act 1997)

8 VALIDATION PLAN

Validation is necessary to demonstrate that remedial measures described in the RAP have been successful and that the site is suitable for the intended land use. The sampling program for the validation is outlined in Section 8.1. This is the minimum requirement based on the remedial strategies provided.

8.1 Validation Sampling and Documentation

The table below outlines the validation requirements for the site:

Table 8-1: Validation Requirements

Aspect	Sampling	Analysis	Observations and Documentation
Cap and Contain (Section 7.3.2)			
Survey of site levels	Not required	Not required	**Remediation contractor** to obtain the survey information. It is also expected that the remediation contractor will provide design/as-built drawings for the project which document the capping layers.
Inspections	Not required	Not required	**Validation consultant** to carry out inspections to document the installation of the cap. Key hold points for inspections include: - Geotextile marker installation; - During importation of materials used to construct the cap; and - Finished surface levels. A photographic record is to be maintained by the **remediation contractor** and **validation consultant**.
Validation of imported materials	As indicated below	As indicated below	As indicated below
Treatment (Section 7.3.3)			
Treatment of ACM at ground surface	Not required	Not required	**Remediation contractor** to provide waste disposal documentation for any ACM removed during the surface pick. **Validation consultant**/Asbestos assessor to issue an asbestos clearance certificate for the ground surface.
Excavation and Off-site Disposal (Section 7.3.4)			
Validation sampling after fill removal	One sample per 100m^2 at the base of the excavation (i.e. on a 10m by 10m grid) and one sample per 5m lineal along the	Chromium VI	**Validation consultant** is to: - Document observations to confirm fill removal is acceptable; - Photograph the excavation; and - Evaluate waste disposal information.

Aspect	Sampling	Analysis	Observations and Documentation
	excavation walls. Wall samples are to target the upper fill in the 0-0.1m interval (measured from the top of the wall) and from any subsequent fill profiles/stratum changes.		**Remediation contractor** to provide documentation relating to waste disposal.
Imported Materials – validation of imported materials is required for any materials imported onto the site during the remediation and to the point in time that the site validation report is prepared (e.g. general fill to raise the site levels, imported materials to create piling platform, gravels for site preparation, material used for capping layers etc).			
Imported Virgin Excavated Natural Material (VENM) backfill	Minimum of three samples per source. One additional sample per 200m^3 for quantities in excess of 500m^3.	Heavy metals (as above), total recoverable hydrocarbons (TRHs), benzene, toluene, ethylbenzene and xylenes (BTEX), PAHs, OCPs, polychlorinated biphenyls (PCBs) and asbestos (500ml). Additional analysis may be required depending on the site history of the source property.	**Remediation contractor** to supply existing VENM documentation/report (report to be prepared in accordance with the NSW EPA waste classification reporting requirements). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Material is to be inspected upon importation by the **validation consultant** to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Photographic documentation and an inspection log are to be maintained. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing VENM documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the Validation Assessment Criteria (VAC).
Imported engineering materials such as recycled aggregate, road base etc or Excavated Natural Material (ENM)	Minimum of three samples per source. One additional sample per 200m^3 for quantities in excess of 500m^3. Additional testing may be required for ENM to	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml quantification). Additional testing may be required for ENM (e.g. foreign	**Remediation contractor** to provide product specification and documentation to confirm the material has been classified with reference to a relevant Resource Recovery Order/Exemption. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the facility's EPL.

Aspect	Sampling	Analysis	Observations and Documentation
	meet the specification within the ENM Order.	materials, pH and electrical conductivity) depending on available documentation.	Material is to be inspected by the **validation consultant** upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Imported engineering materials comprising only natural quarried products.	At the validation consultant's discretion based on robustness of supplier documentation and the initial inspection.	At the validation consultant's discretion based on robustness of supplier documentation and the initial inspection.	**Remediation contractor** to provide documentation from the supplier confirming the material is a product produced using only virgin natural soil or rock (i.e. natural quarried product). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the quarry's EPL. Material is to be inspected by the **validation consultant** upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Landscaping materials	Minimum of three samples per source. One additional sample per 200m^3 for quantities in excess of 500m^3.	Asbestos (500ml)	**Remediation contractor** to provide product specification and documentation to detail the material types being imported. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps.

Aspect	Sampling	Analysis	Observations and Documentation
			Material is to be inspected by the **validation consultant** upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Where check sampling occurs by the **validation consultant** for asbestos, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; and - Analytical reports and tabulated results with comparison to the VAC.

8.2 Validation Assessment Criteria and Data Assessment

The VAC to be adopted for the validation assessment are outlined in the table below:

Table 8-2: VAC

Validation Aspect	VAC
Data Gap Investigations (Section 4)	VAC are to include the land use 'A' criteria based on Schedule B1 of NEPM 2013. The urban residential and public open space criteria for ecological assessment and the management limits are also to be adopted.
Cap and Contain (Section 7.3.2)	Survey and inspections to confirm that the minimum capping requirements have been achieved. Minimum 500mm clean cap required in unpaved areas.
Treatment (Section 7.3.3)	Confirmation that the area inspected is free of visible asbestos/ACM at the ground surface.
Excavation and Off-site Disposal (Section 7.3.4)	Chromium VI concentrations are to be <100mg/kg. This criterion is based on the HIL-A criteria outlined in Schedule B1 of NEPM 2013.
Imported materials	All results for imported materials are to be compared to the HIL/HSL-A criteria to check they do not pose a risk to human health in the proposed land use scenario. Material imported as general fill must only be VENM or ENM. Results for VENM and other imported materials will need to be consistent with expectations for those materials. For VENM, it is expected that: - Heavy metal concentrations are to be less than the most conservative Added Contaminant Limit (ACL) concentrations for an urban residential and public open space exposure setting presented in Schedule B1 of the NEPM 2013; and - Organic compounds are to be less than the laboratory Practical Quantitation Limits (PQLs) and asbestos to be absent. Recycled materials are to meet the criteria of the relevant exemption/order under which they are produced.

Validation Aspect	VAC
	Aesthetics: soils to be free of staining and odours.

Laboratory data should initially be assessed as above or below the VAC. Statistical analysis may be applied if deemed appropriate by the consultant and undertaken in accordance with the NEPM 2013.

8.3 Validation Report

As part of the validation process, a site validation report will be prepared by the validation consultant. It is anticipated that several validation reports will be prepared to align with the development stages. The reports will present the results of the validation assessment and will be prepared in accordance with the Reporting Guidelines.

An EMP will be required to manage the contamination that is to be capped at the site and the EMP will be documented as part of the overall validation process. Public notification and enforcement mechanisms for the EMP are to be arranged and Hornsby Shire Council is to be provided with a draft copy of the EMP for consultation prior to finalisation of the document.

The notification and enforcement mechanisms are to include notation on the planning certificate under Section 10.7 of the Environmental Planning and Assessment Act (1979) and a covenant registered on the title to land under Section 88B of the Conveyancing Act (1919).

The EMP will include requirements for passive management of the capping system that will focus on maintaining the capping layers to minimise the potential of exposure to the underlying fill. The EMP will also include contingencies for managing intrusive works in the event that the capping system is breached. Given that the validation will occur in a staged manner, the EMP is to be prepared where necessary for the relevant stage of work, then updated as further stages are completed to supersede the previous version of the document (i.e. rather than preparing multiple/separate EMPs for different parts of the site).

8.4 Data Quality

Appropriate QA/QC samples are to be obtained during the validation (where applicable) and analysed for the same suite of contaminants as the primary samples. As a minimum, QA/QC sampling should include duplicates (5% inter-laboratory and 5% intra-laboratory), trip spikes and trip blanks. Rinsate samples are to be obtained if re-usable sampling equipment is utilised.

Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) should be clearly outlined and assessed as part of the validation process. A framework for the DQO and DQI process is outlined below and should be reflected in the validation report. DQOs have been broadly established for the validation with regards to the seven-step process outlined NEPM (2013). The seven steps include the following which are detailed further in the following subsections:

- State the problem;

- Identify the decisions/goal of the study;
- Identify information inputs;
- Define the study boundary;
- Develop the analytical approach/decision rule;
- Specify the performance/acceptance criteria; and
- Optimise the design for obtaining the data.

DQIs are to be assessed based on field and laboratory considerations for precision, accuracy, representativeness, completeness and comparability.

8.4.1 Step 1 - State the Problem

Validation data is required to demonstrate that the remediation is successful and that the site is suitable for the proposed land use described in Section 1.2.

8.4.2 Step 2 - Identify the Decisions of the Study

The remediation goal, aims and objectives are defined in Section 1.3. The decisions to be made reflect these objectives and are as follows:

- Was the remediation undertaken in accordance with the RAP?
- If there were any deviations, what were these and how do they impact the outcome of the validation?
- Are any of the validation results above the VAC?
- Is the site suitable for the proposed development from a contamination viewpoint?

8.4.3 Step 3 - Identify Information Inputs

The primary information inputs required to address the decisions outlined in Step 2 include the following:

- Existing relevant data from previous reports;
- Site information, including site observations, inspections, survey information, as-built drawings, waste and imported materials registers;
- Validation sampling of remedial excavations where excavation and disposal methods are utilised;
- Validation sampling of imported materials; and
- Field and laboratory QA/QC data.

8.4.4 Step 4 - Define the Study Boundary

The remediation and validation will be confined to the site boundaries as shown in Figure 2 in Appendix A and will be limited vertically to the depth of the contaminated soil. Site boundaries are to be established for each stage of the development and reflected in the data gap SAQPs (Section 4) then carried forward into the validation reports.

8.4.5 Step 5 - Develop an Analytical Approach (or Decision Rule)

8.4.5.1 VAC

The validation data will be assessed in accordance with the requirements outlined in Section 8.2.

8.4.5.2 Field and Laboratory QA/QC

Field QA/QC is to include analysis of inter-laboratory duplicates (5% frequency), intra-laboratory duplicates (5% frequency), trip spike, trip blank and rinsate samples (one each for the assessment to demonstrate adequacy of standard sampling/handling procedures). Field QA/QC samples are to be analysed for the contaminants of concern, except asbestos. The trip spike will only be analysed for BTEX.

DQIs for field and laboratory QA/QC samples are defined below:

Field Duplicates

Acceptable targets for precision of field duplicates will be 30% or less, consistent with NEPM (2013). RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the concentrations used to calculate the RPD (i.e. RPD exceedance where concentrations are close to the PQL are typically not as significant as those where concentrations are reported at least five or 10 times the PQL), sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Trip Blanks

Acceptable targets for trip blank samples will be less than the PQL for organic analytes. Metals will be considered on a case-by-case basis with regards to the reference material used as the blank medium.

Trip Spikes

Acceptable targets for trip spike samples will be 70% to 130%.

Laboratory QA/QC

The suitability of the laboratory data will be assessed against the laboratory QA/QC criteria. These criteria are developed and implemented in accordance with the laboratory's NATA accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

A summary of the typical limits is provided below:

RPDs

- Results that are <5 times the PQL, any RPD is acceptable; and
- Results >5 times the PQL, RPDs between 0-50% are acceptable.

Laboratory Control Samples (LCS) and Matrix Spikes

- 70-130% recovery acceptable for metals and inorganics; and
- 60-140% recovery acceptable for organics.

Surrogate Spikes

- 60-140% recovery acceptable for general organics.

Method Blanks

- All results less than PQL.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence will be reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is to be undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, the validation consultant is to adopt the most conservative concentration reported.

8.4.5.3 Appropriateness of PQLs

The PQLs of the analytical methods are to be considered in relation to the VAC to confirm that the PQLs are less than the VAC. In cases where the PQLs are greater than the VAC, a discussion of this is to be provided.

8.4.6 Step 6 – Specify Limits on Decision Errors

To limit the potential for decision errors, a range of quality assurance processes are adopted. A quantitative assessment of the potential for false positives and false negatives in the analytical results is to be undertaken with reference to Schedule B(3) of NEPM (2013) using the data quality assurance information collected.

8.4.7 Step 7 - Optimise the Design for Obtaining Data

The design is to be optimised via the collection of validation data to demonstrate the success of the key aspects of the remediation. Data collection will be via various methods including inspections and sampling.

8.4.8 Sampling Plan

The proposed sampling plan for the validation is described in Section 8.1.

9 CONTINGENCY PLAN

The following subsections include contingencies for remediation that are to be implemented in the event that the proposed remediation strategies are not preferred or are unachievable based on the final design of the project. An unexpected finds protocol is also included.

9.1 Containment Cell

The RAP acknowledges that in-situ capping may not be achievable in all areas and the ability to cap contaminated soil in situ will depend largely on the depths of contaminated soil and the proposed design levels for the site. This contingency plan is to be implemented if a containment cell is to be constructed for contaminated soil, as an alternative to or in conjunction with the in-situ capping.

An appropriate area is to be identified for the location of the containment cell. If there is no available information on the subsurface conditions in this area, an investigation must occur to establish the depth of fill, natural soil and bedrock, and the potential occurrence of groundwater. It is noted that any constructed cell should not be below the groundwater table or regularly/permanently inundated with water.

Once the preferred location of the cell is established, the remediation contractor is to prepare a Remedial Works Plan (RWP) to the satisfaction of the project manager/client and the validation consultant. The RWP is to include, as a minimum:

- Survey plans indicating the nominated area for the cell, including survey coordinates for the horizontal extent of the cell;
- Design details including relative levels (RLs) for the base of the cell, top of the contaminated soil to be placed within it, RLs to the top of the clean soil cap, and details regarding the site features and surface finishes to be constructed over the cell as part of the proposed development (e.g. pavements etc);
- Details for the earthworks, including geotechnical requirements (including but not limited to compaction of the cell contents and capping layers, batter requirements, and consideration of root-affected/organic content in root-affected soils to be excavated), locations of access ramps, temporary stockpiling locations for material excavated from the cell area during its construction, and materials management practices to minimise the potential for cross contamination with the remediation areas;
- A process so that some of the virgin excavated natural material (VENM) excavated to create the cell is preferably re-used to cap the cell;
- A specification for a clean soil cap over the cell to reflect the capping requirements specified in Section 7.3.2; and
- A contingency plan in the event that additional capacity is required, including the location of secondary cells or areas where the original cell could be expanded.

The containment cell is to be constructed as outlined in the following table. A detailed validation plan is to be established by the validation consultant based on the requirements of the RWP. The generalised remediation steps for the cell are outlined in the following table:

Table 9-1: Remediation – Construction of Containment Cell

Step	Procedure
1.	Waste Classification: Prior to commencement of excavation, the validation consultant is to undertake a waste classification assessment for any surplus materials to be excavated and disposed off-site during the cell construction. Preferably, site-won VENM (i.e. excavated to construct the cell) is to be used to cap the cell to reduce the off-site disposal of waste.
2.	Implementation of RWP to construct the cell: The cell is to be excavated/constructed in accordance with the RWP. As-built details for the cell are to be documented on construction drawings by the remediation contractor.

9.2 Excavation and Off-site Disposal

In the event of an unexpected find, or if the project stakeholders prefer not to cap and contain and manage contaminated soil on site, the excavation and off-site disposal methodology is to be implemented. This is to occur utilising the methodologies outlined in Section 7.3.4.

9.3 Unexpected Finds

Residual hazards that may exist at the site would generally be expected to be detectable through visual or olfactory means. At this site, these types of hazards may include: sub-surface drainage or irrigation pipes made from ACM; odorous or stained hydrocarbon impacted soils; or ACM outside the nominated areas of remediation. The procedure to be followed in the event of an unexpected find is presented below:

- In the event of an unexpected find, all work in the immediate vicinity should cease and the contractor should contact the validation consultant and the project manager;
- Temporary barricades should be erected to isolate the area from access to workers;
- The validation consultant is to attend the site, adequately characterise the contamination and provide advice in relation to remediation. In the event that remediation differs from that outlined in this RAP, an addendum RAP or RWP must be prepared in consultation with the project stakeholders and submitted to the consent authority; and
- Contamination should be remediated and validated in accordance with the advice provided, and the results should be included in the validation report.

9.4 Importation Failure for VENM or other Imported Materials

Where material to be imported onto the site does not meet the importation VAC detailed in Section 8.2, the material should not be imported. Alternative material must be sourced that meets the importation requirements.

10 SITE MANAGEMENT PLAN FOR REMEDIATION WORKS

The information outlined in this section of the RAP is for the remediation work only. The client should make reference to the development consent for specific site management requirements for the overall development of the site.

10.1 Asbestos Management Plan (AMP)

Prior to the commencement of any soil disturbance involving asbestos, an AMP is to be prepared by the validation consultant to document the asbestos-related management requirements for the remediation.

10.2 Interim Site Management

No interim site management measures are considered necessary at this stage.

10.3 Project Contacts

Emergency procedures and contact telephone numbers should be displayed in a prominent position at the site entrance gate and within the main site working areas. The contact details of key project personnel are summarised in the following table:

Table 10-1: Project Contacts

Role	Company	Contact Details
Project Manager	Carmichael Tompkins Property Group (ctpg)	Contact: Luke Gladwish P: 9160 6311
Remediation Contractor	To be appointed	-
Validation Consultant	To be appointed	-
Certifier	To be appointed	-
NSW EPA	Pollution Line	131 555
Emergency Services	Ambulance, Police, Fire	000

10.4 Security

Appropriate fencing should be installed as required to secure the site and to isolate the remediation areas. Warning signs should be erected, which outline the PPE required for remediation work.

10.5 Timing and Sequencing of Remediation Works

The anticipated sequence of remediation works is outlined in Section 7.3. It is anticipated that remediation will occur in a staged manner concurrently with the development stages.

10.6 Site Soil and Water Management Plan

The remediation contractor is to prepare a detailed soil and water management plan prior to the commencement of site works. Silt fences should be used to control the surface water runoff at all appropriate locations of the site and appropriate measures are to be implemented to manage soil/water disturbance to the satisfaction of the regulator/consent authority. Reference should be made to the consent conditions for further details.

All stockpiled materials should be placed within an erosion containment boundary with silt fences and sandbags employed to limit sediment movement. The containment area should be located away from drainage lines/low-points, gutters, stormwater pits and inlets and the site boundary. No liquid waste or runoff should be discharged to the stormwater or sewerage system without the approval of the appropriate authorities.

10.7 Noise and Vibration Control Plan

The guidelines for minimisation of noise on construction sites outlined in AS-2460 (2002)[15] should be adopted. Other measures specified in the consent conditions should also be complied with. Noise producing machinery and equipment should only be operated between the hours approved by the consent authority (refer to consent documents).

All practicable measures should be taken to reduce the generation of noise and vibration to within acceptable limits. In the event that short-term noisy operations are necessary, and where these are likely to affect residences, notifications should be provided to the relevant authorities and the residents by the project manager, specifying the expected duration of the noisy works.

10.8 Dust Control Plan

All practicable measures should be taken to reduce dust emanating from the site. Factors that contribute to dust production are:

- Wind over a cleared surface;
- Wind over stockpiled material; and
- Movement of machinery in unpaved areas.

Visible dust should not be present at the site boundary. Measures to minimise the potential for dust generation include:

- Use of water sprays on unsealed or exposed soil surfaces;

[15] Australian Standard, (2002). *AS2460: Acoustics - Measurement of the Reverberation Time in Rooms.*

- Covering of stockpiled materials and excavation faces (particularly during periods of site inactivity and/or during windy conditions) or alternatively the erection of hessian fences around stockpiled soil or large exposed areas of soil;
- Establishment of dust screens consisting of a 2m high shade cloth or similar material secured to a chain wire fence;
- Maintenance of dust control measures to keep the facilities in good operating condition;
- Stopping work during strong winds;
- Loading or unloading of dry soil as close as possible to stockpiles to prevent spreading of loose material around the development area; and
- The expanse of cleared land should be kept to a minimum to achieve a clean and economical working environment. Geofabric could be placed over exposed soils in the event that excavation is staged.

If stockpiles are to remain on-site or soil remains exposed for a period of longer than several days, dust monitoring should be undertaken at the site. If excessive dust is generated all site activities should cease until either wind conditions are more acceptable or a revised method of excavation/remediation is developed. Reference is also to be made to the AMP in this regard.

Dust is also produced during the transfer of material to and from the site. All material should be covered during transport and should be properly disposed of on delivery. No material is to be left in an exposed, un-monitored condition.

All equipment and machinery should be brushed or washed down before leaving the site to limit dust and sediment movement off-site. In the event of prolonged rain and lack of paved areas all vehicles should be washed down prior to exit from the site, and any soil or dirt on the wheels of the vehicles removed. Water used to clean the vehicles should be collected and tested prior to appropriate disposal under the Waste Classification Guidelines.

10.9 Dewatering

Temporary dewatering is not anticipated to be required as part of the remediation works. If a rain event occurs during the construction of a containment cell, this water should be managed appropriately on site in accordance with the remediation contractor's soil and water management plan. This water should not be pumped to stormwater or sewer unless a prior application is made and this is approved by the relevant authorities.

10.10 Air Monitoring

Reference is to be made to the AMP for details regarding asbestos air fibre monitoring. Air monitoring must only be carried out by personnel registered and accredited by NATA (National Association of Testing Authorities). Filter analysis must only be carried out within a NATA certified laboratory. The monitoring results must conform to the requirements of the NOHSC Guidance note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC:3003 (2005)].

The monitoring program will be used to assess whether the control procedures being applied are satisfactory and that criteria for airborne asbestos fibre levels are not being exceeded. The following levels will be used as action criteria during the air monitoring:

- <0.01 Fibres/ml: Work procedures deemed to be successful;
- 0.01 to 0.02 Fibres/ml: Inspection of the site and review of procedures; and
- >0.02 Fibres/ml: Stop work, inspection of the site, review of procedures, clean-up, rectification works where required and notify the relevant regulator.

10.11 Odour Control Plan

All activities undertaken at the site are to be completed in a manner that minimises emissions of smoke, fumes and vapour into the atmosphere and any odours arising from the works or stockpiled material should be controlled. Control measures may include:

- Maintenance of construction equipment so that exhaust emissions comply with the Clean Air Regulations issued under the POEO Act 1997;
- Demolition materials and other combustible waste should not be burnt on site;
- The spraying of a suitable proprietary product to suppress any odours that may be generated by excavated materials; and
- Use of protective covers (e.g. builder's plastic).

All practicable measures should be taken to reduce fugitive emissions emanating from the site so that associated odours do not constitute a nuisance and that the ambient air quality is not adversely impacted.

The following odour management plan should be implemented to limit the exposure of site personnel and surrounding residents to unpleasant odours:

- Excavation and stockpiling of material should be scheduled during periods with low winds if possible;
- A suitable proprietary product could be sprayed on material during excavation and following stockpiling to reduce odours (subject to an appropriate assessment of the product by the validation consultant);
- All complaints from workers and neighbours should be logged and a response provided. Work should be rescheduled as necessary to minimise odour problems;
- The site foreman should consider the following odour control measures as outlined in NEPM:
  - reduce the exposed surface of the odorous materials;
  - time excavation activities to reduce off-site nuisance (particularly during strong winds); and
  - cover exposed excavation faces overnight or during periods of low excavation activity.
- If continued complaints are received, alternative odour management strategies should be considered and implemented.

10.12 WHS Plan

A site specific WHS plan is to be prepared by the remediation contractor for all work to be undertaken at the site. The WHS plan should meet all the requirements outlined in SafeWork NSW WHS regulations.

As a minimum requirement, personnel must wear appropriate protective clothing, including long sleeve shirts, long trousers, steel cap boots and hard hats. Additional asbestos-related PPE will be required and this will be specified in the AMP. Washroom and lunchroom facilities should also be provided to allow workers to remove potential contamination from their hands and clothing prior to eating or drinking.

10.13 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the remediation contractor should develop a waste management or recycling plan to minimise the amount of waste produced by the site. This should, as a minimum, include measures to recycle and re-use natural excavated material wherever possible.

10.14 Incident Management Contingency

The validation consultant should be contacted if any unexpected conditions are encountered at the site. This should enable the scope of remedial/validation works to be adjusted as required. Similarly, if any incident occurs at the site, the validation consultant should be advised to assess potential impacts on contamination conditions and the remediation/validation timetable.

10.15 Hours of Operation

Hours of operation should be between those approved by the consent authority under the development approval process.

10.16 Community Consultation and Complaints

The remediation contractor should provide details for managing community consultation and complaints within their site management plans.

11 CONCLUSION

Previous investigations have identified localised areas of contaminated soils impacted by bonded ACM, chromium and PAHs. The proposed remedial strategy includes various methods to mitigate the risks associated with these soils, including: excavation and off-site disposal; cap and containment; and treatment of ACM at the surface via picking/removal.

Remediation is to occur in a staged manner, concurrently with the staged development of the site. A validation report is to be prepared for each stage to demonstrate that the remediation was successful and to confirm that the area is suitable for the proposed development from a contamination viewpoint. An EMP will also be prepared for those areas where contaminated soil is capped as these areas will be managed over the long-term so that risks remain low and acceptable.

JKE are of the opinion that the site can be made suitable for the proposed development provided this RAP is implemented.

11.1 Regulatory Requirements

The regulatory requirements applicable for the remediation are discussed in the following table:

Table 11-1: Regulatory Requirement

Guideline / Legislation / Policy	Applicability
SEPP55	We understand that heritage items are located within the school grounds and a large portion of the school falls within the Significant Biodiversity (tree and vegetation preservation) Planning Area in the Hornsby Local Environmental Plan (LEP) 2013. On this basis, we have assessed that the remediation work may fall under Category 1 remediation. This should be confirmed with the client's planning expert. Under Clause 17 of SEPP55, a notice of completion of remediation work is to be given to Hornsby Shire Council (and to the consent authority if the consent authority is a different entity) within 30 days of completion of the work. The notice of completion of remediation works must be in accordance with Clause 18 of SEPP55.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner. Appropriate waste tracking is required for all waste that is disposed off-site. Activities should be carried out in a manner which does not result in the pollution of waters.
POEO (Waste) Regulation 2014	Part 7 of the POEO Waste Regulation 2014 set outs the requirements for the transportation and management of asbestos waste and Clause 79 of the POEO Waste Regulation requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10 square meters of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use WasteLocate.

Guideline / Legislation / Policy	Applicability
	Clause 78 of the POEO Waste Regulation requires that a person who transport asbestos waste must ensure that: • Any part of any vehicle in which the person transports the waste is covered, and leak-proof, during the transportation; and • If the waste consists of bonded asbestos material—it is securely packaged during the transportation; and • If the waste consists of friable asbestos material—it is kept in a sealed container during transportation; and • If the waste consists of asbestos-contaminated soils—it is wetted down. Asbestos waste in any form cannot be re-used or recycled.
SafeWork NSW Code of Practice: How to manage and control asbestos in the workplace (2019)	Sites with asbestos become a 'workplace' when work is carried out there and require a register and AMP. Appropriate SafeWork NSW notification will be required for asbestos removal works or handling. Contractors are also required to be appropriately licensed for the asbestos-related remediation works undertaken (i.e. Class B licence for non-friable/bonded asbestos work).

12 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. JKE should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Important Information About This Report

These notes have been prepared by JKE to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

JKE/J&K will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report

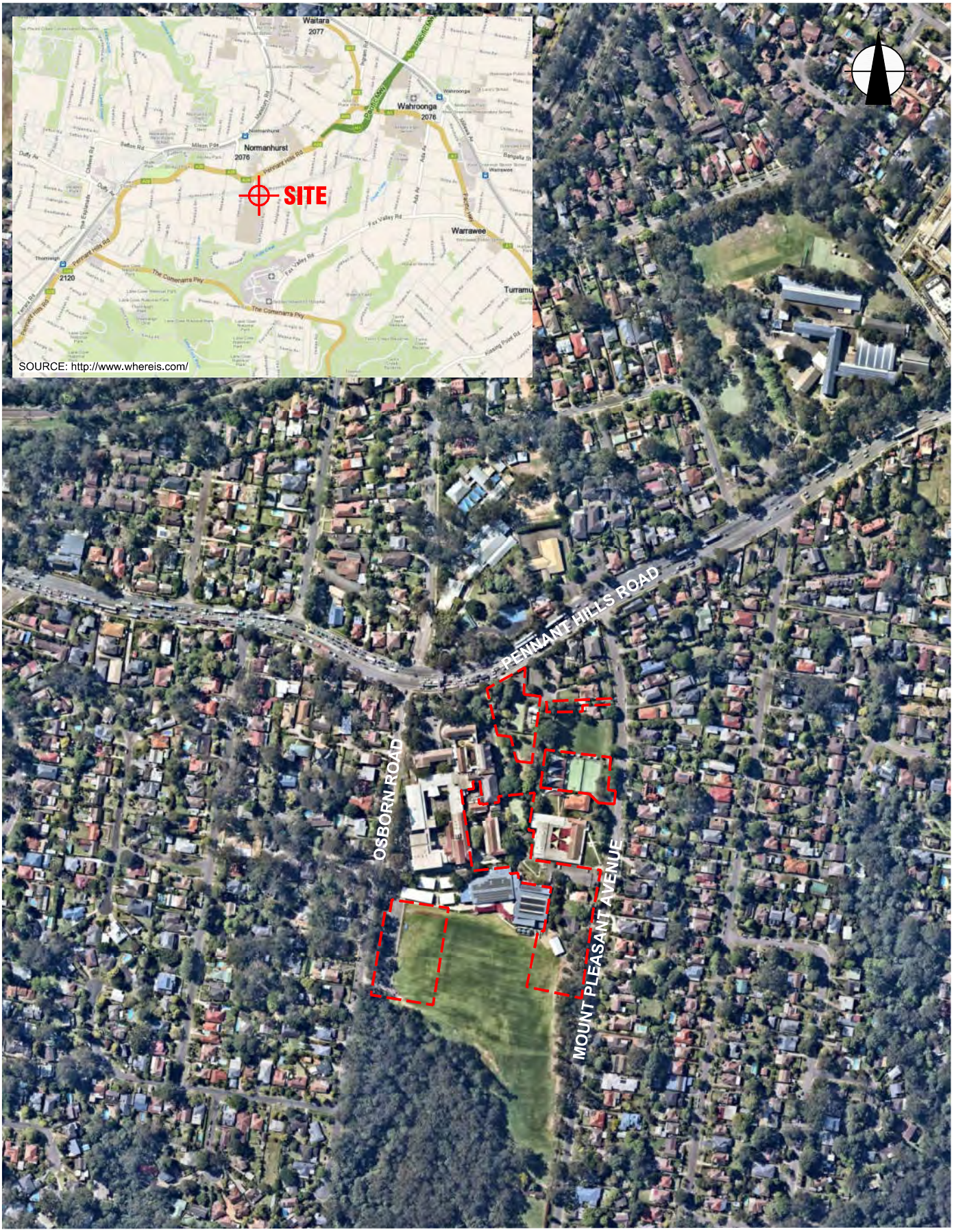
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures



APPROXIMATE SITE BOUNDARIES

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title: **SITE LOCATION PLAN**

Location: LORETO NORMANHURST,
91-93 PENNANT HILLS ROAD, NORMANHURST, NSW

Project No: E31772PL

Figure No: 1

JKEnvironments

PLOT DATE: 15/12/2020 9:37:36 AM DWG FILE: Z:\5 EIS\5C EIS JOBS\31000\SE31772KL NORMANHURST\CAD\E31772PL.DWG

AMF1	Surface
Chrysotile Asbestos	DETECTED

LEGEND

APPROXIMATE SITE BOUNDARY	
BH(Fill Depth)	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)
BH/MW(Fill Depth)	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m)

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 15 30 45 60 75

SCALE 1:1500 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAMPLE LOCATION PLAN**

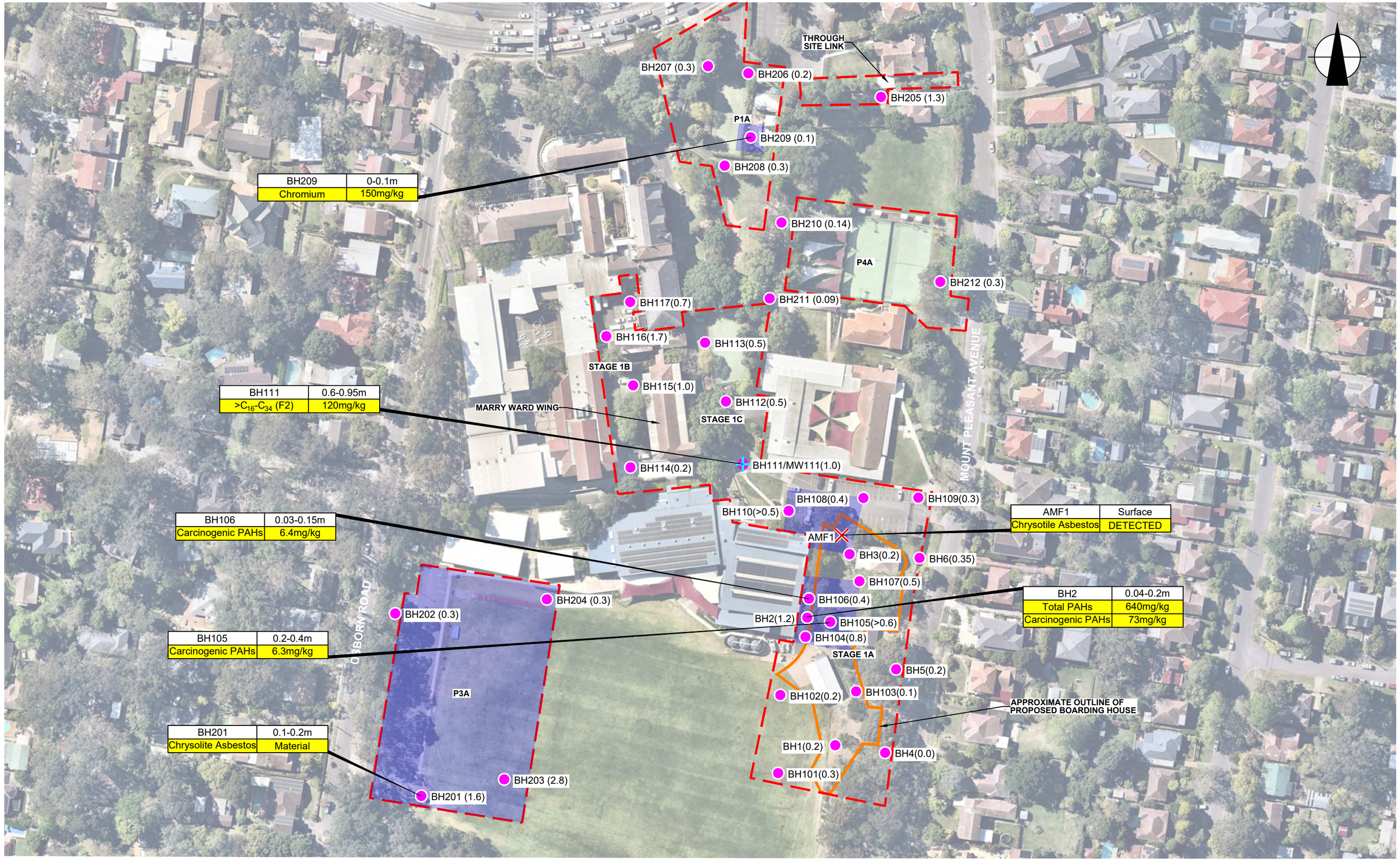
Location: LORETO NORMANHURST, 91-93 PENNANT HILLS ROAD, NORMANHURST, NSW

Project No: E31772PL

Figure No: 2

JKEnvironments

PLOT DATE: 15/12/2020 9:39:10 AM DWG FILE: Z:\6 EIS\5C EIS JOBS\31000\SIE31772KL NORMANHURST\CAD\E31772PL.DWG



LEGEND

- APPROXIMATE SITE BOUNDARY
- BH(Fill Depth) — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)
- BH/MW(Fill Depth) — BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE ABOVE HUMAN HEALTH SAC

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 15 30 45 60 75

SCALE 1:1500 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **CONTAMINATION LOCATION PLAN**

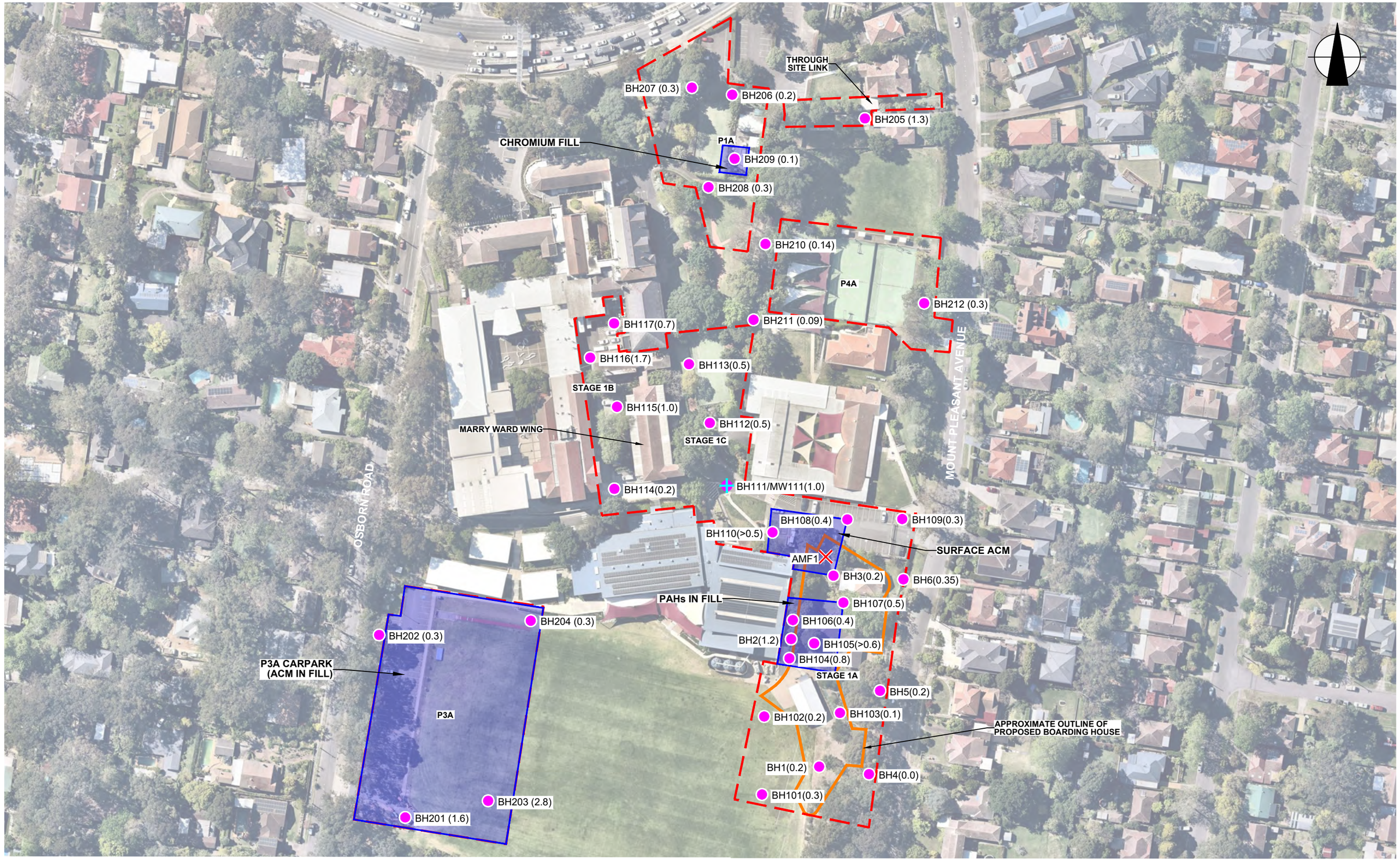
Location: LORETO NORMANHURST, 91-93 PENNANT HILLS ROAD, NORMANHURST, NSW

Project No: E31772PL

Figure No: 3

JKEnvironments

PLOT DATE: 23/12/2020 3:33:03 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\31000'S\E31772KL NORMANHURST\CAD\E31772PL.DWG



LEGEND

APPROXIMATE SITE BOUNDARY	
BH(Fill Depth)	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)
BH/MW(Fill Depth)	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m)
	REMEDIATION AREA

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 15 30 45 60 75

SCALE 1:1500 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **REMEDIATION AREA**

Location: LORETO NORMANHURST, 91-93 PENNANT HILLS ROAD, NORMANHURST, NSW

Project No: E31772PL

Figure No: 4

JKEnvironments

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Appendix B: Imported Materials and Waste Registers

Imported Materials Register

Supplier	Date	Docket/Invoice #	Product Type	Quantity (specify m3 or tonnes)	Area where Material was Placed

Exported (Waste) Materials Register

Load	Date	Material Type / Classification	Site Area where Waste was Generated	Waste Classification Report Reference	Disposal Facility	Tipping Receipt/Docket Number	Tracking Number (where relevant)	Tonnage

Appendix C: Guidelines and Reference Documents

Contaminated Land Management Act 1997 (NSW)

Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)

NSW EPA, (1995). Contaminated Sites Sampling Design Guidelines

NSW EPA, (2014). Waste Classification Guidelines - Part 1: Classifying Waste

NSW EPA, (2015). Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997

NSW EPA, (2017). Guidelines for the NSW Site Auditor Scheme, 3rd Edition

NSW EPA, (2020). Consultants Reporting on Contaminated Land, Contaminated Land Guidelines

NSW SafeWork, (2019). Code of Practice: How to Safely Remove Asbestos.

NSW SafeWork, (2019). Code of Practice: How to Manage and Control Asbestos in the Workplace.

National Environment Protection Council (NEPC), (2013). National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)

Protection of the Environment Operations Act 1997 (NSW)

Protection of the Environment Operations (Waste) Regulation 2014 (NSW)

State Environmental Planning Policy No.55 – Remediation of Land 1998 (NSW)