REPORT TO

SHIRE CHRISTIAN SCHOOL

ON

REMEDIATION ACTION PLAN

FOR

PROPOSED BASEMENT CARPARK

AT

16A ALLIES ROAD, BARDEN RIDGE, NSW

Date: 8 September 2023
Ref: E34118PWrpt3-RAP

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E34118PWrpt3-RAP DRAFT	Draft Report	6 September 2023
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Executive Summary

Shire Christian School ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed basement carpark at 16A Allies Road, Barden Ridge, NSW. The proposed development area is referred to as 'the site' within this plan and the site location is shown on Figure 1 in Appendix A. The RAP applies to the land within the site boundaries as shown on Figure 2.

A detailed investigation at the site by JKE identified bonded (non-friable) asbestos in soil associated with fragments of fibre cement. Remediation of the site is required to mitigate potential risks associated with the disturbance of asbestos in soil and to render the site suitable for the proposed development. A summary of the previous investigation findings is provided in Section 2.

This RAP has been prepared to support the lodgement of a Development Application (DA) (Ref: DA22/0995) with Sutherland Shire Council and includes a methodology to remediate and validate the site, to demonstrate that the site can be made suitable for the proposed development from a contamination viewpoint. The proposed development broadly includes the construction of a basement carpark and reconstruction of the sports field above the carpark. Specific details are provided in Section 1.1.

The goal of the remediation is to reduce asbestos contamination-related risks to human health and to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation at the site is to mitigate risks from asbestos in soil. The objectives of this RAP are to:

- Provide a framework to undertake an additional 'pre-remediation' investigation to increase the overall soil sampling density for asbestos assessment and provided additional data to support the proposed extent of remediation;
- Provide a rationale to support the extent of proposed remediation and the remedial/validation approach;
- Provide a methodology to remediate and validate the site;
- Provide a contingency plan for the remediation works;
- Outline site management procedures to be implemented during remediation work; and
- Provide an unexpected finds protocol to be implemented during the development works.

The Detailed Site Investigation (DSI) identified bonded asbestos in soil at two locations in the southern area of the site (see Figure 3 in Appendix A). The proposed remediation strategy includes 'excavation and off-site disposal' of contaminated fill/soil to a suitably licensed landfill. This process aligns closely with the proposed development works which includes excavation for a proposed basement. The strategy is therefore easy to implement and is expected to be effective and successful to mitigate contamination risks.

We are of the opinion that the site can be made suitable for the proposed development via remediation and the implementation of this RAP. A site validation report is to be prepared on completion of remediation activities and submitted to the consent authority to demonstrate that the site is suitable for the proposed development following completion of remediation/validation.

As the site applicable to this RAP has been defined by the proposed development area, it is acknowledged that additional asbestos impacted soil may extended beyond the site boundaries. In particularly, we consider that it is likely that asbestos-impacted fill will remain between the southern site boundary and the cadastral property boundary for the wider school that extends along Allies Road (this area currently includes a treed embankment and associated tree protection zone). The client must engage a suitably qualified consultant to prepare an Asbestos Management Plan (AMP) to manage the potential occurrence of asbestos in this area until (or unless) it can be demonstrated that no additional asbestos in soils exists.

Reference must be made to the discussion provided in Section 9.1 regarding the remediation category with Regards to Chapter 4 of State Environmental Planning Policy (Resilience and Hazards) 2021.

The conclusions and recommendations should be read in conjunction with the limitations presented in the body of this report.

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Attachments

Abbreviations

Asbestos Containing Material	**ACM**
Asbestos Removal Control Plan	**ARCP**
Asbestos Management Plan	**AMP**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Below Ground Level	**BGL**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Before You Dig Australia	**BYDA**
Contaminated Land Management	**CLM**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Development Application	**DA**
Development Control Plan	**DCP**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Detailed Site Investigation	**DSI**
Ecological Investigation Level	**EIL**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
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Fibre Cement Fragment(s)	**FCF**
Health Investigation Level	**HIL**
Health Screening Level	**HSL**
International Organisation of Standardisation	**ISO**
JK Environments	**JKE**
Lab Control Spike	**LCS**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Parsons Brinckerhoff	**PB**
Polycyclic Aromatic Hydrocarbons	**PAH**
Polychlorinated Biphenyls	**PCB**
Photo-ionisation Detector	**PID**
Protection of the Environment Operations	**POEO**
Practical Quantitation Limit	**PQL**
Quality Assurance	**QA**
Quality Control	**QC**
Residential Aged Care	**RAC**
Remediation Action Plan	**RAP**
Relative Percentage Difference	**RPD**
Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
State Environmental Planning Policy	**SEPP**
Source, Pathway, Receptor	**SPR**
Standing Water Level	**SWL**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**

Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
Validation Assessment Criteria	**VAC**
Work Health and Safety	**WHS**

Units

Kilometres	**km**
Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millilitres	**ml or mL**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Parts Per Million	**ppm**
Percentage	**%**
Percentage weight for weight	**%w/w**

1 INTRODUCTION

Shire Christian School ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed basement carpark at 16A Allies Road, Barden Ridge, NSW. The proposed development area is referred to as 'the site' within this plan and the site location is shown on Figure 1 in Appendix A. The RAP applies to the land within the site boundaries as shown on Figure 2.

A detailed investigation at the site by JKE identified bonded (non-friable) asbestos in soil associated with fragments of fibre cement. Remediation of the site is required to mitigate potential risks associated with the disturbance of asbestos in soil and to render the site suitable for the proposed development. A summary of the previous investigation findings is provided in Section 2.

This RAP has been prepared to support the lodgement of a Development Application (DA) (Ref: DA22/0995) with Sutherland Shire Council and includes a methodology to remediate and validate the site, to demonstrate that the site can be made suitable for the proposed development from a contamination viewpoint.

This RAP must be read concurrently with the geotechnical investigation reports prepared by JK Geotechnics (JKG) (JKG Project Ref: 34118PD).

1.1 Proposed Development Details

Based on the review of the DA plans (Ref: DA0001, DA1001, DA1003, DA1101, 2101, DA3101, DA3102 and DA3400, issue D, dated 9 June 2023), the proposed development includes the construction of a basement carpark within the existing grass sports field area. The approximate outline of the proposed carpark is shown on Figure 2. We understand that the proposed development includes the following:

- Construction of a 69-space basement carpark;
- Reinstatement of the sports field located at the roof of the basement carpark;
- Raising/filling of the surrounding site levels to match the finished level of the basement carpark roof slab;
- Construction of transition slabs at the northern, eastern and western aspects of the proposed basement for the integration of the surrounding levels with the basement roof and sports field over;
- Construction of an access driveway at the south-western aspect of the proposed basement; and
- Minor works to the west of the main sports field area to modify three existing parking bays to accommodate two accessible parking spaces (we understand this will largely include new markings on existing pavements), and a new vehicular access point just beyond the north-western corner of the proposed field (requiring minor soil disturbance and pavement resurfacing).

We understand that the proposed basement carpark roof slab will be supported by concrete columns which will be founded in suitable bearing material. Excavation to a maximum depth of approximately 3.5m below ground level (BGL) will be required to achieve the lowest finished floor level (FFL) of the basement level at RL 111.46m Australian Height Datum (AHD). The surrounding site levels will be raised for the integration of the FFL of the basement roof at RL 115.5m AHD.

The sports field overlying the basement and adjoining the basement (within the site boundaries) will be re-turfed as part of the reinstatement.

The DA plans issues to JKE at the time of the preparation of the RAP are attached in Appendix B.

1.2 Remediation Goal, Aims and Objectives

The goal of the remediation is to reduce asbestos contamination-related risks to human health and to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation at the site is to mitigate risks from asbestos in soil. The objectives of this RAP are to:

- Provide a framework to undertake an additional 'pre-remediation' investigation to increase the overall soil sampling density for asbestos assessment and provided additional data to support the proposed extent of remediation;
- Provide a rationale to support the extent of proposed remediation and the remedial/validation approach;
- Provide a methodology to remediate and validate the site;
- Provide a contingency plan for the remediation works;
- Outline site management procedures to be implemented during remediation work; and
- Provide an unexpected finds protocol to be implemented during the development works.

1.3 Scope of Work

The RAP was prepared generally in accordance with a JKE proposal (Ref: EP59181P) dated 9 August 2023 and an approval from the client dated 24 August 2023. The scope of work included an initial meeting with the project team, review of the previous reports 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)[1], Consultants Reporting on Contaminated Land (2020)[2] guidelines, other guidelines made under or with regards to the Contaminated Land Management Act (1997)[3] and Chapter 4 of State Environmental Planning Policy (Resilience and Hazards) 2021[4] (formerly known as SEPP55). A list of reference documents/guidelines is included in the appendices.

[1] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)
[2] NSW EPA, (2020). *Consultants reporting on contaminated land, Contaminated Land Guidelines.* (referred to as Consultants Reporting Guidelines)
[3] Contaminated Land Management Act 1997 (NSW) (referred to as CLM Act 1997)
[4] *State Environmental Planning Policy (Resilience and Hazards) 2021* (NSW) (referred to as SEPP Resilience and Hazards 2021)

2 SITE INFORMATION

2.1 Summary of Previous Investigations

JKE has previously prepared the following reports for the site and the wider school property which are summarised in the following subsections:

- Preliminary Soil Contamination Screening (Ref: E34118BDrpt, dated 28 July 2021)[5] for the Master Plan development at the wider school property;
- Preliminary (Stage 1) Site Contamination Investigation (PSI) (Ref: E34118Brpt2, dated 30 September 2022)[6] for the proposed development at the site; and
- Detailed Site Investigation (DSI) (Ref: E34118PWrpt2, dated 16 August 2023)[7] for the proposed development at the site.

2.1.1 Soil Contamination Screening

The Soil Contamination Screening was undertaken for the wider Shire Christian School campus for the proposed 2030-2035 Masterplan development. The screening included a review of site information including: regional geology and acid sulfate soil (ASS) risk mapping; soil sampling from three boreholes; analysis of soil results for a range of potential contaminants; interpretation of the soil analytical results against adopted human health and ecological-based Site Assessment Criteria (SAC); and preparation of a report. We note that one borehole (BH103) was drilled within the site applicable to the proposed development, as shown on Figure 2.

The sub-surface conditions encountered in the boreholes drilled for the contamination screening generally included sandy fill to depths of approximately 0.4mBGL to 0.8mBGL, underlain by sandstone and siltstone bedrock. The fill typically contained inclusions of ironstone and sandstone gravel, root fibres and ash. The sandstone bedrock extended to depths of approximately 3.5mBGL to 4.7mBGL prior to transitioning into siltstone bedrock at depth. In two of the boreholes, siltstone bedrock extended to the termination of the boreholes at a maximum depth of approximately 7.5mBGL. Groundwater was not encountered within the boreholes drilled for the screening.

Based on the results of the screening, the report concluded that there was a low potential for widespread site contamination. In light of the sensitive land use of the site, the report recommended that the potential for site contamination be further assessed once specific development details are confirmed.

2.1.2 PSI

JKE undertook a PSI for the proposed development at the site in September 2022. The PSI included a review of site and site history information, a walkover inspection, soil sampling from four boreholes (BH201 to BH204 inclusive) and groundwater sampling from one groundwater monitoring well (MW204). The PSI sample locations are shown on Figure 2 attached in the appendices.

[5] JKE, (2021). *Report to Allen Jack + Cottier on Preliminary Soil Contamination Screening for Proposed Shire Christian School Masterplan development at 16A Allies Road, Barden Ridge, NSW* (referred to as the Soil Contamination Screening)
[6] JKE, (2022). *Report to Shire Christian School on Preliminary (Stage 1) Site Contamination Investigation (PSI) for Proposed Basement Carpark at 16A Allies Road, Barden Ridge, NSW* (referred to as the PSI)
[7] JKE, (2023). *Report to Shire Christian School on Detailed Site Investigation (DSI) for Proposed Basement Carpark at 16A Allies Road, Barden Ridge, NSW* (referred to as the DSI)

The site history information indicated that the site was vacant prior to 1940. Between the 1940s and 1980s, the site was possibly used for agricultural purposes. The site was re-developed for use as a school (Shire Christian School) circa 1980.

Based on the scope of work undertaken for the PSI investigation, JKE identified the following potential contamination sources/areas of environmental concern (AEC):

- Fill material (i.e. imported soil);
- Historical agricultural use;
- Use of pesticides; and
- Electricity transmission tower within approximately 50m up/cross-gradient of the site.

The sub-surface conditions encountered in the boreholes drilled for the PSI included sandy fill underlain by silty clay natural soil, and sandstone and siltstone bedrock. Fill was encountered at the site to depths of approximately 0.1mBGL to 3.3mBGL. Groundwater seepage was encountered in one borehole (BH201) during drilling at a depth of approximately 1.8mBGL. A standing water level (SWL) at approximately 7.81mBGL was recorded in the monitoring well (MW204) installed at the site.

The soil laboratory results did not identify any contamination that were above the human health-based and ecological health-based SAC. Heavy metals (copper and zinc) and pH were found to be above the ecological-based SAC in groundwater and pH was also outside of the human health-based SAC. However, this was considered to be attributed to wider regional background concentrations rather than onsite or off-site contamination.

The PSI identified the need for a DSI. It is noted that subsequent to the PSI, the site area was expanded slightly and the DSI captured additional areas to the west of the original PSI boundary and at the south-western corner of the proposed car park. The boundary changes were assessed to not alter the conclusions of the PSI.

2.1.3 DSI

The DSI included a review of existing project information in the previous JKE reports, a site inspection, soil sampling from 13 test pits and groundwater sampling from three monitoring wells installed as part of the JKG geotechnical investigation. Imported fill material, historical agricultural use, use of pesticides and off-site electricity transmission tower had been identified as potential sources of site contamination.

The test pits encountered fill to depths of approximately 0.2mBGL to >1.5mBGL, underlain by natural (residual) silty clay and sandy clay soil or sandstone bedrock. The fill comprised sandy clay, clayey sand, silty sand and silty sandy clay with inclusions of ironstone and igneous gravel, sandstone gravels and cobbles, plastic, root fibres and building rubble (metal, bricks, concrete, glass, tile fragments, ceramic fragments, rubber, fibre cement fragments).

Bonded asbestos containing material (ACM) was identified in six bulk asbestos quantification field screening samples collected from two test pits located within the southern portion of the site. The asbestos concentrations that exceeded the human health (HSL-A) SAC are shown on Figure 3 in Appendix A.

Copper, nickel and zinc were encountered above the ecological SAC in groundwater, however these heavy metals were considered to be attributed to wider regional conditions and were not assessed to pose an unacceptable risk to ecological receptors to the extent that remediation was required in the context of the RAP.

A copy of the DSI data summary tables is included in Appendix C.

The DSI concluded that remediation of the site will be required to address the occurrence of asbestos in soil and stated that the following recommendations must be implemented:

- Prepare an interim Asbestos Management Plan (AMP) to manage asbestos in soil in the context of the on-going use of the site as a school. The AMP will need to be in place until the redevelopment occurs;
- Prepare and implement a RAP. The RAP must include appropriate inspection and validation procedures to address the asbestos contamination and the minor data gaps associated with the limited sampling depths in the Sydney Water easement; and
- Validate the implementation of the RAP and prepare a validation report on completion of remediation.

Subsequent to the release of the DSI report and submission of the report to council, Sutherland Shire Council issued a request for additional information letter (dated 29 August 2023). The letter stated that *"The RAP must either treat all fill material as asbestos contaminated or include a delineation investigation to determine the extent of the asbestos-impacted soil"*. The letter also stated that *"……as per the NSW EPA Draft Position Paper on management of asbestos contaminated sites (2023), asbestos contaminated soils cannot be remediated and must be encapsulated onsite or removed off-site as Special Waste (Asbestos)"*.

2.2 Site Identification

Table 2-1: Site Identification

Current Site Owner (certificate of title):	The Sutherland Shire Christian School Association Limited
Site Address:	16A Allies Road, Barden Ridge, NSW
Lot & Deposited Plan:	Part of Lot 3 in DP 777667
Current Land Use:	K-12 school
Proposed Land Use:	Basement carpark with overlying sports field as part of the on-going K-12 school use
Local Government Area:	Sutherland Shire Council
Current Zoning:	SP2 – Infrastructure
Site Area (m^2) (approx.):	4,450
RL (AHD in m) (approx.):	114-115
Geographical Location (decimal degrees) (approx.):	Latitude: -34.036199 Longitude: 151.010444

Site and Previous Investigation Location Plans:	Appendix A

2.3 Site Location and Regional Setting

The site is located within the south-eastern portion of the Shire Christian School Campus (see Figure 1) in a predominantly residential area of Barden Ridge. The site is bound by Allies Road to the south. Woronora River is located approximately 500m to the east of the site, with its closest tributary located approximately 180m to the south-east of the site.

2.4 Topography

The regional topography is characterised by a south-east facing hillside that falls towards Woronora River. The site is located towards the mid-slope of the hillside and has a gentle slope towards the south-east at approximately 1°-2°. Parts of the site have been levelled to account for the slope and accommodate the existing development. Sandstone outcrops were observed towards the north-east of the site.

Steeper batter slopes fall away from the site towards the south and east, to the respective property boundaries for the wider school.

2.5 Summary of Site Inspections

A walkover inspection of the site was undertaken by JKE 11 and 12 July 2023 during the DSI field work. The site conditions were generally similar to the observations made during the JKE inspection undertaken for the PSI in July 2022, with key observations summarised below:

- The site was occupied by an existing grass surfaced sports field utilised as part of the wider Shire Christian School campus. The site accommodated a range of sporting activities and outdoor recreation use for the school. No indicators of former site use were observed;
- The western-most extent of the site included part of an existing asphaltic concrete (AC) paved car park;
- The site was unfenced and open to the wider school campus. No signs of erosion or soil instability were observed at the site during the inspection;
- Fill material was observed at the surface in areas of exposed soil at the site. The south and east site boundaries were elevated from the surrounding surface levels. The south-eastern extent of the site was elevated up to approximately 3m above the adjacent street level. The majority of the site was considered likely to have been filled to accommodate the existing development (filling was confirmed via the JKE investigations);
- An off-site in-ground stormwater detention (OSD) tank was located to the north-east of the site. The OSD appeared to be used for stormwater detention and was not of concern from a contamination viewpoint;
- Surface water was expected to infiltrate permeable site surface. Runoff from the site was expected to flow towards the south-east in keeping with the site topography. An onsite open stormwater drain was located within the south-eastern corner of the site. Surface runoff received by onsite stormwater infrastructure was assumed to discharge into the regional stormwater system;

- The closest tributary of the Woronora River was located approximately 180m to the south-east and down-gradient of the site; and
- Exotic grass covered the majority of the site. Native trees up to approximately 10m high were located along the site boundaries. No signs of dieback or phyto-toxic stress were observed from the onsite vegetation based on a cursory examination.

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

- North – Wider Shire Christian School campus including further grassed areas, outdoor seating an electrical transmission tower;
- South – Allies Road and residential properties beyond (though there is a strip of land between most of the southern site boundary and the road which falls within the wider Shire Christian School campus);
- East – Strip of land associated with the wider Shire Christian School campus, then the retained boundary of the school which falls away further east onto residential properties. Vacant bushland and the Woronora River located further to the east; and
- West – AC paved carpark used as part of the wider Shire Christian School campus including and Christian Reformed Church of Sutherland further to the west.

It is acknowledged that during the PSI, the off-site electrical transmission tower located to the north of the site was noted as a potential off-site contamination source. However, the DSI noted that it is an unlikely contamination source that would impact the site.

2.6 Underground Services

The 'Before You Dig Australia' (BYDA) plans were reviewed for the DSI in order to establish whether any major underground services exist at the site or in the immediate vicinity that could act as a preferential pathway for contamination migration. A Sydney Water easement extends through the western part of the site as shown on Figure 2.

A review of this information in the context of the DSI indicated that that there is a potential for preferential contamination migration along such major pipelines if significant (i.e. high concentrations of mobile contaminants) are present. Fill can also be associated with these areas. JKE did not identify any mobile contamination issues in the immediate vicinity that were considered likely to be problematic in the context of preferential migration. The DSI only included limited (i.e. surface) sampling in this area. The proposed excavation works will not disturb the deeper soils in this area, and the potential for undetected contamination in this area will be managed via the implementation of the unexpected finds protocol outlined in this RAP.

2.7 Summary of Geology and Hydrogeology

2.7.1 Regional Geology and On-site Conditions

Regional geological information reviewed for the PSI indicated that the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses.

A summary of the subsurface conditions encountered during the DSI is presented in the following table. Reference should be made to the test pit and borehole logs attached in Appendix C for further details.

Table 2-2: Summary of Subsurface Conditions

Profile	Description
Fill	Fill was encountered at the surface in all test pits and extended to depths of approximately 0.2mBGL to 1.5mBGL. TP305, TP309, TP131, TP314 and TP316 were terminated in the fill at a maximum depth of approximately 1.3mBGL. Fill was encountered in the boreholes drilled for the JKG geotechnical investigation and extended to depths of approximately 0.25mBGL to 2.6mBGL. BH302A was terminated in the fill at a maximum depth of approximately 0.3mBGL. The fill encountered in the test pits and boreholes typically comprised sandy clay, clayey sand, silty sand and silty sandy clay with inclusions of ironstone and igneous gravel, sandstone gravels and cobbles, plastic, root fibres and building rubble (metal, bricks, concrete, glass, tile fragments, ceramic fragments, rubber, fibre cement fragments). The building rubble was generally encountered within the southern portion of the site, along the high side of the oval fill embankment. Staining or odours were not identified in the fill soil during sampling.
Natural Soil	Silty clay and sandy clay natural (residual) soil was encountered beneath the fill within the test pits TP306, TP310, TP311, TP315 and TP317, and extended to depths of approximately 0.4mBGL to 1.5mBGL. TP306, TP310, TP315 and TP317 were terminated in the natural soil at a maximum depth of approximately 2mBGL. Silty clay natural (residual) soil was encountered beneath the fill within the boreholes BH301, BH301A, BH303, BH303A, BH304 and BH304A, and extended to depths of approximately 2.7mBGL to 5.5mBGL. BH301A was terminated in the natural soil as a maximum depth of approximately 2.7mBGL. The natural soil was typically grey mottled red, grey, yellow brown and red brown, and contained inclusions of ironstone gravel, sand and root fibres. Staining or odours were not identified in the natural soil during sampling.
Bedrock	Sandstone bedrock was encountered beneath the fill or natural soil in the test pits TP307, TP308, TP311 and TP312, and extended to the termination depths of these test pits at a maximum depth of approximately 0.7mBGL. Sandstone and inter-bedded siltstone bedrock was encountered beneath the fill or natural soil in the boreholes BH301, BH302, BH303, BH303A, BH304 and BH304A, and extended to the termination depth of the boreholes at a maximum depth of approximately 10.11mBGL. The bedrock was typically grey, red brown and yellow brown and was assessed to be extremely weathered upon initial auger or excavator bucket contact. Staining or odours were not identified in the bedrock during sampling.

2.7.2 Acid Sulfate Soil (ASS) Risk and Planning

The PSI identified that the site is not located in an ASS risk area according to the risk maps prepared by the Department of Land and Water Conservation (1997). An ASS Class 5 risk area is located to the east of the site. Considering the elevation of the site is above RL110m AHD and based on the geological conditions (shallow sandstone bedrock) and ASS risk mapping, risks associated with the occurrence or disturbance of ASS materials at the site in the context of the proposed development were considered to be low. JKE previously stated that an ASS management plan (ASSMP) is not required.

2.7.3 Hydrogeology and Groundwater

Hydrogeological information reviewed for the PSI indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. There was a total of 48 registered bores within the report buffer of 2,000m. In summary:

- The nearest registered bore was located approximately 725m from the site. This was utilised for monitoring purposes;
- The majority of the bores were registered for monitoring purposes;
- There was a bore registered for 'exploration' purposes, however this bore was located over 1,100m away from the site and was not of concern;
- There were no bores within the report buffer registered for domestic or irrigation uses; and
- The drillers log information from the closest registered bores typically identified fill and/or sandy soil to depths of approximately 15mBGL to 17mBGL, underlain by sandstone bedrock. SWLs in the bores ranged from 3.8mBGL to 22mBGL.

The information reviewed for the previous investigations, together with the subsurface conditions encountered, indicated that the subsurface conditions at the site consist of relatively low permeability (residual) soils overlying shallow bedrock. The potential for viable groundwater abstraction and use of 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. Use of groundwater is not proposed as part of the development.

A summary of the groundwater field screening results from the DSI is presented in the following table:

Table 2-3: Summary of Groundwater Field Screening Data from DSI

Aspect	Details
Groundwater Depth & Flow	Groundwater seepage was not encountered in any of the test pits during excavation and a short time after. Groundwater seepage was also not encountered in the boreholes during auger drilling. SWLs measured in the monitoring wells sampled for the DSI (MW302, MW303 and MW304) ranged from 3.73mBGL to 5.44mBGL. Groundwater RLs were calculated based on the measured SWL and field survey data, as summarised below:

<table>
<tr><th>Aspect</th><th>Details</th></tr>
<tr><td></td><td>
<table>
<tr><th>Location</th><th>Ground Surface RL (mAHD)</th><th>SWL (mBGL)</th><th>Groundwater RL (mAHD)</th></tr>
<tr><td>MW302</td><td>114.73</td><td>4.18</td><td>110.55</td></tr>
<tr><td>MW303</td><td>115.05</td><td>5.44</td><td>109.61</td></tr>
<tr><td>MW304</td><td>115.26</td><td>3.73</td><td>111.53</td></tr>
</table>

A contour plot was prepared for the groundwater levels using Surfer v8.08 (Surface Mapping Program) as shown on Figure 4 in Appendix A. Groundwater flow generally occurs in a down gradient direction perpendicular to the groundwater elevation contours. The contour plot indicates that groundwater generally flows towards the south or south-east which is consistent with expectations based on the topography.
</td></tr>
<tr><td>Groundwater Field Parameters</td><td>Field measurements recorded during sampling were as follows:
- pH ranged from 3.83 to 4.63;
- EC ranged from 282.6µS/cm to 519µS/cm;
- Eh ranged from 163.7mV to 206.6mV; and
- DO ranged from 0.2ppm to 3.5ppm.

The PID readings in the monitoring well headspace recorded during sampling ranged from 0.3ppm in MW303 to 3.7ppm in MW304.</td></tr>
<tr><td>LNAPLs petroleum hydrocarbons</td><td>Phase separated product (i.e. LNAPL) was not detected within the wells sampled using the interphase probe during groundwater sampling.</td></tr>
</table>

2.7.4 Water Bodies

The site location and regional topography indicates that excess surface water flows have the potential to enter the tributaries of the Woronora River located to the east of the site. The Woronora River and associated down-gradient tributaries are potential receptors.

3 SITE CHARACTERISATION AND CONCEPTUAL SITE MODEL

NEPM 2013 defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the site information and investigation data to date.

3.1 Summary of Contamination (Site Characterisation)

Asbestos/ACM concentrations exceeded the HSL-A SAC at two locations (TP314 and TP315) as shown on Figure 3. The SAC exceedances for asbestos ranged from 0.022%w/w to 0.166%w/w. The SAC for asbestos (ACM) in soil is 0.01%w/w for sensitive land uses such as primary schools (includes K-12 schools). Asbestos was not detected in any other borehole or test pit at the site.

The DSI identified substantially deeper fill in the southern and south-eastern sections of the site, which was consistent with expectations based on the historical earthworks that occurred to level the site and other parts of the surrounding playing fields. The fill, particularly in the southern and eastern areas of the site, contained inclusions of demolition rubble. The ACM is suspected to have been imported with the fill or mixed in with fill following demolition of former structures within the wider surrounds.

3.2 CSM

The table below includes a review of the CSM which has been used to design the remediation strategy. The CSM will require further review if additional site data becomes available.

Table 3-1: CSM

Contaminant source(s) and contaminants of concern	**Contamination sources:** Fill (soil) in the southern area of the site which contains asbestos at concentrations above the SAC applicable to the site. **Contaminant of concern for remediation includes:** asbestos (as bonded ACM in soil).
Affected media	**Affected medium for remediation:** Fill (soil).
Receptor identification	Human receptors include site occupants/users/visitors (including adults and children), construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users predominantly in residential and educational land use scenarios.
Exposure pathways and mechanisms	The exposure pathway relevant to the human receptors includes inhalation of asbestos fibres, including airborne fibres and fibres within dust.
Evaluation of data gaps	The NEPM 2013 requires a higher density of sampling when asbestos is identified due to the potential for sporadic occurrences of asbestos in soil. Although the DSI met the minimum NSW EPA guidelines with regards to the required sampling density for the site area, additional data is required to confirm the extent of the asbestos in soil. This will be managed via the pre-remediation investigation process documented in Section 5.3.2 of this RAP. A Sydney Water easement extends through the western part of the site. Sampling during the DSI was limited to surficial sampling in this area. As the proposed development works are only expected to involve minor/surficial soil disturbance in this area, the unexpected finds protocol outlined in Section 7.1 of this RAP will be used to compensate for the sampling limitations during the DSI.

3.3 Remediation Extent

The final remediation extent will be confirmed via the collection of data during the pre-remediation investigation process and also during the validation process. Based on the current data from the DSI, the extent of remediation has been nominally defined by delineating an area around the two test pits where asbestos was identified. This area is shown on Figure 5 in Appendix A and extends to the southern site boundary, then to the north, east and west approximately half way to the nearest DSI test pit location where no asbestos was observed.

There was a reasonably clear distinction between the fill in TP314 and TP315 compared to the surrounding test pits sampled for the DSI. The fill in TP314 and TP315 included substantial demolition rubble inclusions such as brick and concrete fragments, metal, tile and glass fragments, and fibre cement. The fill in the nearest surrounding test pits was generally much shallower and demolition rubble inclusions were largely absent.

Remediation of fill will extend to the base of fill and to the surface of the underlying natural/virgin soil or rock (whichever is shallower). Fill depths in the nominated remediation areas are expected to be generally in the order of approximately 1.5-2m along the southern site boundary, decreasing in depth moving northward.

The remediation area defined in this RAP is estimated to be approximately 470m^2. Although the fill depth within this area is expected to be variable, if it were to be assumed that the average fill depth across the area is 1.5m, this would equate to approximately 700m^3 of fill. By applying a relatively conservative conversion factor of say 1.8 tonnes per 1m^3 of in-situ fill, the quantity of fill to be removed from the remediation area may be in the order of 1,300 tonnes. We recommend that the client obtain more accurate estimates following the pre-remediation investigation and via their qualified quantity surveyor so there is greater confidence in the estimates. Contingencies should also be factored in.

The fill depths at the previous investigation locations are shown on Figure 5 in Appendix A. Copies of the previous borehole and test pit logs are included in Appendix C.

4 REMEDIATION OPTIONS AND PREFERRED REMEDIATION STRATEGY

4.1 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.

The NEPM 2013 and the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009)[8] (endorsed in NEPM 2013) prefer the following asbestos remediation hierarchy:

1. Minimisation of public risk;
2. Minimisation of contaminated soil disturbance; and
3. Minimisation of contaminated material/soil moved to landfill.

The NSW EPA Contaminated Land Management Guidelines for the NSW Site Auditor Scheme (3rd Edition) (2017)[9] provides the following additional requirements to be taken into consideration:

- Remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed; and
- Where there are large quantities of soil with low levels of contamination, alternative strategies should be considered or developed.

[8] 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)

[9] NSW EPA, (2017). *Contaminated land Management, Guidelines for the NSW Site Auditor Scheme (3rd ed.).* (referred to as Site Auditor Guidelines 2017)

4.2 Remediation Options Assessment

The table below discusses and assesses a range of remediation options:

Table 4-1: Consideration of Soil Remediation Options

Option	Discussion	Assessment/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, and thermal desorption. Physical removal of fibre cement fragment containing asbestos (i.e. ACM) is also possible, but only in some situations. Depending on the treatment option, licences 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.	Not applicable for this site due to the extent of excavation required for the basement. The NSW EPA also does not endorse the treatment of asbestos in soil via physical removal if the asbestos is associated with imported fill.
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 applicable as noted above.
Option 3 **Consolidation and isolation of impacted soil by cap and containment**	This would include 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 (or capping in-situ beneath appropriate capping layers). The capping and/or containment must be appropriate for the specific contaminants of concern. An ongoing environmental management plan (EMP) would be required and this 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).	This option is suitable to address risks associated with asbestos and is the most sustainable option as it minimises waste disposal to landfill. However, an EMP would burden the site owner with ongoing management requirements for inspecting and maintaining the capping layers, and potentially also lead to additional costs for managing intrusive/maintenance works, should these need to occur in the management areas in future. There is not likely to be sufficient space on site to construct a cell, so any capping solution would likely

Option	Discussion	Assessment/Applicability
		involve capping in-situ which may be problematic depending on the proposed finish levels and the quantity of contaminated material requiring capping. However, capping may be the only viable solution for managing contamination in the Sydney Water easement, should it be encountered as an unexpected find.
Option 4 **Removal of contaminated material (excavation and disposal) 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/tipping fees would apply in addition to transport costs.	This option is the most applicable for remediation as a majority of the contaminated fill falls within the proposed basement footprint and will require excavation/disposal to construct the basement. Excavating and disposing of all contaminated fill will eliminate the need for long-term management of the site via an EMP.
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.	Not applicable considering the extent of the proposed development works.

4.3 Rationale for the Preferred Option for Remediation

The preferred option (and effectively the only option in light of the NSW EPA position relating to asbestos in imported fill) for remediation of the contaminated fill is Option 4 (excavation and off-site disposal). This option is considered to be most appropriate for the proposed development based on the following:

- The proposed development includes substantial excavation of the site which is anticipated to result in a surplus of materials;
- Excavation of the contaminated fill in the remediation area will require the shortest timeframe for the remedial works and will minimise the potential for cross contamination or validation failure to occur; and
- On and off-site treatment technologies are not endorsed by the NSW EPA for asbestos in fill.

5 REMEDIATION DETAILS

5.1 Roles and Responsibilities

Table 5-1: Roles and Responsibilities

Role	Responsibility
Site Owner / Developer	The Sutherland Shire Christian School Association Limited. The site owner is required to appoint the project team for the remediation/validation and must provide all investigation reports including this RAP to the project manager, remediation contractor/principal contractor, consent authority and any other relevant parties involved in the project.
Project Manager	To be confirmed. 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).
Principal Contractor / Remediation Contractor	To be confirmed. The principal contractor is required to review all documents prepared for the project and manage the implementation of the procedures outlined in this RAP. The principal contractor is to take reasonable steps so that the remediation contractor and others have understood the RAP and will implement it in its totality. The principal contractor 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).
Remediation Contractor	To be confirmed. The remediation contractor (this may be the same entity as the principal contractor) is required to review all relevant documents prepared for the project, liaise with the validation consultant so that the pre-remediation investigation and validation tasks are integrated into the project timeline, arrange for final waste classification documentation, apply for any relevant removal licences or permits and implement the remediation requirements and relevant validation requirements (that are the remediation contractor's responsibility) outlined in this RAP. The remediation contractor is required to collect all documentation associated with the remediation activities and forward this documentation onto the principal contractor, client and project manager as they become available. The remediation contractor must be (or must subcontract) a Class B licensed asbestos removalist for the remediation activities associated with removal of ACM.

Role	Responsibility
Validation Consultant	To be confirmed. The validation consultant must be a certified practitioner (specialising in site contamination), under one of the NSW EPA endorsed certification schemes, i.e. CEnvP SC or equivalent. The validation consultant provides consulting advice and validation services in relation to the remediation. The validation consultant undertakes the pre-remediation investigation and associated reporting, inspections during remediation and post-remediation, validation sampling and prepares the validation report. The validation consultant is required to review any deviation to this RAP or any unexpected finds if and when encountered during the site work. The validation consultant is required to liaise with the principal contractor, client, project manager and remediation contractor on all matters pertaining to the site contamination, remediation and validation, carry out the required pre-remediation investigation, validation sampling and inspections. The validation consultant must have a Licensed Asbestos Assessor (LAA) on staff to carry out the required asbestos clearances.

5.2 Pre-commencement Meeting and Arrangements

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 8) must be reviewed by the project manager and remediation contractor, and appropriate steps are to be taken to ensure the adequate implementation of the plan.

5.3 Remediation and Associated Tasks

The following general sequence of works is anticipated:

- Site establishment;
- Pre-remediation investigation and associated reporting; and
- Remediation (and validation) of the site via excavation and off-site disposal of fill, and validation of this process.

Remediation will occur prior to construction of the built form of the development, and this should be considered by the consent authority so that the conditions in the development approval/consent align with the sequence of works and requirements of the RAP. Remediation will be deemed complete following the successful removal of contaminated fill, validation/documentation of this process, and validation of any/all imported materials.

5.3.1 Site Establishment

It is acknowledged that the construction site may not be established prior to the completion of the pre-remediation investigation works outlined in Section 5.3.2. If the investigation occurs prior to site

establishment for construction, reasonable steps must be taken so that risks are adequately managed during the investigation process.

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 remediation works.

The validation consultant must be advised (by the principal contractor) if any soil, gravel or engineering materials (e.g. DGB, roadbase etc) are to be imported for the site establishment works. These materials must be validated by the validation consultant in accordance with Section 6 of this RAP to confirm they are suitable to be imported to site.

5.3.2 Pre-remediation Investigation and Reporting

Prior to the commencement of the pre-remediation investigation, the validation consultant must prepare a detailed Sampling, Analysis and Quality Plan (SAQP) in accordance with the Consultants Reporting Guidelines and NEPM 2013. The investigation must include the following as a minimum:

- Inspection and soil sampling from a minimum of 10 test pit locations (TP401-TP410) as shown on Figure 5 in Appendix A. Prior to sampling, the locations must be checked and cleared for any underground services;
- The test pits must be extended to the base of the fill;
- Bulk (10L) field asbestos quantification sampling must occur from the 10 (minimum) test pit locations, in accordance with the endorsed methods in the NEPM 2013. Any identified fibre cement fragments (FCF) are to be weighed/recorded and analysed for asbestos. If the field assessment of any FCF indicates that the FCF is degraded and can be crushed/pulverised to a powder by hand pressure, a separate 500ml sample must be collected from the soil at any location where such FCF is identified and must be analysed for asbestos using the NEPM 2013 quantification method.

It would be prudent to combine a waste classification assessment with the pre-remediation process so that finalised waste classification documentation can be prepared for the project. The waste classification requirements are to be captured in the SAQP.

On completion of the investigation, a report is to be prepared by the validation consultant in accordance with the Consultants Reporting Guidelines and is to include a Tier 1 risk assessment and review of the CSM. Appropriate SAC for asbestos in soil must be applied with regards to Schedule B1 of the NEPM (2013), based on the HSL-A exposure scenario.

The report must include commentary and must draw conclusions regarding the applicability/suitability of the remediation strategy outlined in this RAP, and the proposed extent of remediation. If the remedial approach requires substantial alteration beyond the scope of this RAP (e.g. a change to the preferred remedial approach of ‘excavation and off-site disposal’), then a Remedial Works Plan (RWP) or revised RAP must be prepared by the validation consultant and submitted to the client/developer, project manager and consent authority (as applicable). The client/developer and project manager must then establish the appropriate course of action in relation to any additional planning/consent requirements prior to making arrangements to carry out the additional works.

The investigation is expected to take approximately two days on-site and then approximately another week or two (minimum) for reporting. This work must be adequately considered in the project timeline and the investigation should be planned then initiated as soon as possible to avoid delays.

5.3.3 Remediation Details – Excavation/Fill Removal

The project team must carefully consider the sequence of works and requirements in relation to any temporary shoring and battering requirements, and the excavation/remediation of fill. Remediation and validation of asbestos-contaminated fill must occur prior to any other construction-related excavation works on site.

The procedure for excavation of contaminated fill soil from the remediation areas is outlined in the table below:

Table 5-2: Remediation Details – Excavation and disposal of contaminated fill

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor	<u>Site management, geotechnical/stability and shoring:</u> The remediation contractor is to take steps to ensure the site management plan in this RAP (Section 8) is implemented. Geotechnical advice must be sought regarding the stability of the adjacent areas prior to commencing remediation (as required). Stability issues must be addressed to the satisfaction of a suitably qualified geotechnical engineer. The southern side of the remediation area extends along the site boundary, although we note that the cadastral boundary of the school is several metres further to the south. There is an existing slope with trees and associated tree protection zone between the southern site boundary (i.e. the southern boundary of remediation area) and the cadastral boundary along Allies Road. Due to the depth of fill along the southern portion of the remediation area, and the presence of the adjacent tree protection zones, we recommend that suitable shoring be constructed along the southern side of the remediation area (along the nominated site boundary) to facilitate the excavation works. The aim of the shoring is to avoid the need for battering back (southward) into the tree protection zone. Advice must be sought from the geotechnical and structural engineers in this regard, and the final solution must be implemented prior to excavation of contaminated soil from the remediation area. If shoring is not constructed along the southern side of the remediation area, then we anticipate that battering would be required to achieve the removal of fill in the southern section of the remediation area, and such battering will involve additional excavation of soils south of the nominated site area. This process will likely disturb additional asbestos in soil and may impact the tree protection zones, and hence this is not the preferred approach. Any encroachment into the tree protection zone should only occur subject to approval from the project arborist. All underground services are to be appropriately disconnected and/or rerouted to facilitate the works.
2.	Validation Consultant	<u>Waste classification letter:</u> A waste classification letter for fill/soil must be prepared to confirm the final expected waste quantity and the waste classification of the fill/soil to be excavated from the

Step	Primary Role/ Responsibility	Procedure
		remediation area and removed from the site. Any final waste classification documentation must consider the occurrence of asbestos and the existing data.
3.	Remediation contractor and validation consultant	<u>Excavation and disposal of fill from the remediation area, followed by validation:</u> Remediation will be undertaken as follows: • Notification of asbestos removal works must be made to SafeWork NSW by the Class B licensed asbestos removal contractor at least five days prior to commencement of works; • The remediation area is to be marked out using marking paint or star pickets; • Submit an application to dispose of the fill in the remediation area (in accordance with the assigned waste classification) to a facility that is appropriately licensed by the NSW EPA to receive the waste, and obtain authorisation to dispose; • The fill from the remediation area is to be excavated to the extent shown on Figure 5 in Appendix A (or any subsequent revision of this area, as documented in accordance with Section 5.3.2 of this RAP). The depth of excavation will vary depending on the depth of fill and should therefore be guided by the validation consultant and remediation contractor. Approximate fill depths from the previous investigation locations are shown on Figure 5 in Appendix A and the associated borehole/test pit logs are in Appendix C; • Experienced personnel must monitor the fill excavation process so that fill is not 'over excavated' into natural soil which could result in additional and unnecessary landfill fees for the client; • Load the fill directly into trucks and dispose of the soil to a facility licensed by the NSW EPA to receive the waste (the landfill will require a copy of the waste classification report referred to in Item 2 above). Waste tracking is to occur to meet the statutory requirements; and • All documents including landfill disposal dockets and tracking documentation must be retained by the remediation contractor and forwarded to the client and validation consultant (refer to Section 5.4 for details). This documentation forms a key part of the validation process and is to be included in the validation report.
4.	Validation consultant	<u>Validation of remedial excavations:</u> Following completion of the fill excavation/removal in the remediation areas, the validation consultant is to obtain validation samples and complete the asbestos clearance certificate in accordance with the validation plan in Section 6 of this RAP. Interim advice is to be provided regarding whether or not the validation has passed or failed prior to proceeding any further. Once validation of the remedial excavation is confirmed as being successful, excavation works for the remainder of the project can continue in accordance with the approved construction plans.
5.	Remediation contractor	<u>Reinstatement of remedial excavations:</u> Following successful validation of the remediation, we anticipate that the areas that fall outside the basement footprint may need to be reinstated with clean material to achieve the required levels. Preferably this reinstatement is to occur using the validated/natural soil and bedrock to be excavated from the basement footprint, provided it is considered appropriate for that purpose from a geotechnical and/or landscaping perspective. If an alternative material is to be imported for the reinstatement, this must be validated in accordance with Section 6. Reinstatement of a majority of the remedial excavation will not be required as the area will be excavated deeper to achieve the FFL for the basement.

The Contingency Plan in Section 7 of this RAP must be implemented as required.

5.4 Remediation Documentation

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

- Asbestos management documentation;
- Waste disposal dockets;
- Photographs of remediation works;
- Waste tracking documentation (see below and the example waste tracking form in Appendix D); and
- Imported materials documentation (see below and the example imported material tracking form in Appendix D).

Copies of these documents must be forwarded to the project manager and the validation consultant for assessment and inclusion in the validation report.

5.4.1 Waste Register

All waste removed from the site is to be appropriately classified, tracked and managed in accordance with the relevant guidelines and regulations. The remediation 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;
- 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 (i.e. weighbridge dockets for each load).

Any soil waste classification documentation is to be prepared in accordance with the reporting requirements specified by the NSW EPA as outlined in the Consultants Reporting Guidelines and the NSW EPA Waste Classification Guidelines (2014). The documentation must be reviewed by the validation consultant (if the documentation is prepared by others) prior to the waste leaving the site.

A review of the disposal facility's Environment Protection Licence (EPL) issued under the Protection of the Environment Operations (POEO) Act (1997)[10] is to be undertaken to assess whether the facility is appropriately licensed to receive the waste.

The above information is to be provided to the validation consultant for inclusion in the validation report. The register must be set up at the beginning of the project and provided to the validation consultant regularly (i.e. weekly) so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

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

5.4.2 Imported Materials Register

The remediation 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.

Examples of imported materials for this project may include but would not be limited to: site preparation materials (e.g. DGB etc); drainage and service trench backfill, and landscaping materials such as topsoil garden mixes, mulches etc.

The above information is to be provided to the validation consultant for inclusion in the validation report. The register be set up at the beginning of the project and provided to the validation consultant regularly (i.e. weekly) so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

6 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 6.1. This is the minimum requirement based on the remedial strategy proposed in this RAP. Additional validation sampling may be required based on the outcome of the pre-remediation investigation and/or observations made during remediation, however, that would be reflected in the RWP/revised RAP where necessary.

6.1 Validation Sampling and Documentation

The following subsections outline the validation requirements for the site:

6.1.1 Excavation/Fill Removal – Remediation Area

The following validation will occur:

- The validation consultant's LAA must undertake a visual inspection of the remedial excavation and document that the base and walls are visually free of visible asbestos (ACM/FCF). The inspection must confirm that there is no remnant fill at the base of the excavation and that natural soils or bedrock is exposed at the base. A surface clearance certificate for asbestos is to be provided for the remedial excavation, addressing the base and walls;
- A sample from each fill profile exposed along the excavation walls will be collected on a 5m spacing along the walls[11]. Wall validation samples must be collected at 5m intervals at a minimum rate of one sample per fill profile or one sample per vertical metre of fill (whichever is greater). Each fill sample must include a bulk (10L) sample screened in the field for ACM using the NEPM 2013 field screening methods. If shoring exists along the southern wall of the remedial excavation, sampling of the southern wall will not occur if there are no exposed soils along the wall;
- Bulk (10L) samples must also be collected and screened from the natural soils at the base of the excavation on a 5m by 5m square grid spacing. A base sample does not need to be collected in any areas if there is exposed bedrock at the surface; and
- Any FCF must be analysed to confirm whether the material contains asbestos.

The validation consultant is do document the excavation photographically and confirm that the fill was removed from the remediation area. A soil description of each sample is to be recorded and a sample location plan and cross sections are to be prepared for inclusion in the validation report.

6.1.2 Imported Materials

Prior to the importation of any soils/gravels to be used during construction, including but not limited to site preparation and construction materials (e.g. DGB, base course, service trench sands/gravels etc), backfill for remedial excavations (e.g. VENM), or landscaping materials (e.g. topsoil, turf underlay, mulch etc), the construction contractor must obtain a product specification from the supplier along with any other relevant documentation. Other relevant documentation may include (but is not necessarily limited to) compliance testing and assessment reports for VENM and other materials produced under Resource Recovery

[11] It is acknowledged that some of the excavation 'walls' may be battered back and may not be vertical

Orders/Exemptions. A hold point must occur to allow the validation consultant to assess the information and carry out the required sampling/analysis.

A minimum of three samples from each imported material type (from each source) must be collected and analysed for heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (TRHs), benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), pesticides (OCPs and OPPs), polychlorinated biphenyls (PCBs) and asbestos (500ml NEPM 2013 analysis). Additional analysis may be required depending on the material type and/or history of the material/source site, at the validation consultant's discretion.

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. A minimum of one inspection must occur for each imported material type from each different source.

6.2 Validation Assessment Criteria and Data Assessment

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

Table 6-1: VAC

Validation Aspect	VAC
Remediation area – following excavation and disposal of fill containing ACM	The quantitative VAC for soil validation are as follows: • Field screening results for asbestos must report no observed asbestos/ACM. The HSL-A criterion of 0.01%w/w for asbestos in ACM is not being adopted as that would not support the CSM relating to the localised extent of remediation and asbestos in fill. The qualitative VAC for soil validation are as follows: • Visual confirmation of complete fill removal from the remediation area so that no fill remains at the base of the remedial excavation; and • Visual confirmation of no visible asbestos at the base and walls of the remedial excavation by the LAA, via the asbestos clearance certificate (with due consideration to the commentary below relating to the southern remedial excavation wall). Asbestos data will be assessed as absent (pass) or present (fail). If shoring exists along the southern wall of the remediation area, it is acknowledged that sampling of the southern wall may not occur if there are no soils exposed along the wall. If soils are exposed along the southern wall of the remediation area and validation sampling occurs, the presence of asbestos in one of these wall validation samples will be acknowledged as a 'fail' however, no further remedial action will occur as this failure will be representative of 'off-site' conditions that extend beyond the nominated site area.
Imported materials	All results for imported materials are to be compared to the Health Investigation Level and Health Screening Level (HIL and HSL) A criteria in NEPM 2013 to check they do not pose a risk to human health in the proposed land use scenario. Landscaping materials must also be assessed against the urban residential and public open space Ecological Investigation Level and Ecological Screening Level (EIL/ESL) criteria to check they do not pose a risk to ecological receptors. Discretion can be used in assessing TRH data in landscaping materials as such materials often include high organic content which can interfere with the TRH analysis.

Validation Aspect	VAC
	Results for VENM and other imported materials will need to be consistent with expectations for those materials. VENM must meet the definition presented in the waste classification guidelines and the POEO Act 1997. Recycled materials are to meet the criteria of the relevant exemption/order under which they are produced. Aesthetics: imported materials are to be free of staining and odours. Landscaping materials are not to contain anthropogenic materials (e.g. plastic, building rubble, glass, etc).

6.3 Validation Sampling, Analysis and Quality Plan (SAQP)

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 are to 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.

6.3.1 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 1.1.

6.3.2 Step 2 - Identify the Decisions of the Study

The remediation goal, aims and objectives are defined in Section 1.2. 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?
- Was the remediation successful and is the site suitable for the proposed development from a contamination viewpoint?

6.3.3 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;
- Pre-remediation investigation sampling results and any associated reports;
- Site information, including site observations, inspections, asbestos clearance certificates, waste and imported materials registers;
- Validation sampling and analysis;
- Asbestos clearance certificate;
- Field and laboratory QA/QC data; and
- Records relating to unexpected finds (where applicable).

6.3.4 Step 4 - Define the Study Boundary

The remediation and validation will be confined to the land within the site boundaries.

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

6.3.5.1 VAC

The validation data will be assessed in accordance with the requirements outlined in Section 6.1 and 6.2. The data will be assessed as either above (fail) or below (pass) the VAC. Failures for imported materials will be further assessed using a multiple lines of evidence, risk-based approach in relation to complete source-pathway-receptor (SPR) linkages.

Statistical analysis is not considered to be appropriate for imported materials. Additionally, statistical analysis is not intended to be applied for in-situ validation of asbestos in soil.

Validation samples collected from the southern wall of the remediation area that adjoin areas of the wider school property that are technically representative of 'off-site' conditions are to be documented factually. VAC failures along the southern remedial excavation wall are consider likely to occur due to the close proximity of TP314 and TP315 where asbestos was found. This RAP includes a recommendation for the site owner to manage potential asbestos-related risks in these 'off-site' areas that are still within the wider school property.

6.3.5.2 Field and Laboratory QA/QC

Field QA/QC is to include analysis of inter-laboratory duplicates (5% frequency), intra-laboratory duplicates (5% frequency), trip blanks, trip spikes (one per daily sampling event) and rinsate samples (one per sampling event, only where re-usable equipment is utilised). Field QA/QC samples will be limited to validation activities associated with imported materials.

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, Trip Spikes and Rinsates

Acceptable targets for trip blank and rinsate 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.

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.

6.3.5.3 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.

6.3.6 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.

Decision errors can be controlled through the use of hypothesis testing. The test can be used to show either that the baseline condition is false or that there is insufficient evidence to indicate that the baseline condition is false. The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. For the application of statistical analysis to data sets, the null hypothesis (H_0) is that the 95% UCL for the contaminant of concern is greater than the VAC. The alternative hypothesis (H_A) is that the 95% UCL for the contaminant of concern is less than the VAC. Potential outcomes include Type I and Type II errors as follows:

- Type I error of determining that the soil is acceptable for the proposed land use when it is not (wrongly rejects true H_0), includes an alpha (α) risk of 0.05; and
- Type II error of determining that the soil is unacceptable for the proposed land use when it is (wrongly accepts false H_0), includes beta (β) risk of 0.2.

Notwithstanding the above, statistical analysis is not proposed for this project and results will be assessed as pass or fail as documented previously.

6.3.7 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.

6.3.8 Sampling Plan

The proposed sampling plan is described in Section 6.1.

6.4 Validation Report

As part of the site validation process, a site validation report will be prepared by the validation consultant. The report will present the results of the validation assessment and will be prepared in accordance with the Consultants Reporting Guidelines. The report must clearly state whether or not the site has been adequately remediated and validated, and whether or not the site is suitable for the proposed development from a contamination viewpoint.

Validation of imported materials must occur until the completion of the project.

7 CONTINGENCY PLAN

A review of the proposed remediation works has indicated that the greatest risks that may affect the success of the remediation include unexpected finds and validation failure. A contingency plan for the remediation is provided below:

7.1 Unexpected Finds Protocol

The following unexpected finds protocol must be implemented during remediation and construction activities until the point in time that the validation report is finalised.

Following completion and successful validation of the remedial excavation, earthworks will continue in accordance with the project construction and site management plan. This will involve staged excavation and management of excavated materials from across the remainder of the site. During this excavation work that involves excavation of fill, the validation consultant must inspect the site at a minimum frequency of once per day. The inspections must document the visual observations of soils exposed at the ground surface and at the surface of any stockpiles, and the inspection records must be documented in the site validation report. Any unexpected finds are to be addressed via the procedure below.

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 odorous or stained hydrocarbon impacted soils, underground infrastructure such as tanks or separator pits, asbestos or suspected asbestos outside the nominated asbestos remediation area etc. 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 must cease and the remediation contractor must contact the validation consultant and the client/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 site management and remediation. In the event that the remediation approach differs from that outlined in this RAP, a RWP or addendum RAP must be prepared in consultation with the project stakeholders and submitted to the consent authority; and
- Contamination must be remediated and validated in accordance with the advice provided, and the results should be included in the validation report.

7.2 Importation Failure for VENM or other Imported Materials

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

7.3 Validation Failure

In the event that a validation sample exceeds the VAC (other than on walls with adjoining ‘off-site’ areas as discussed previously), additional material must be ‘chased out’ and disposed off-site, then the area re-validated. Prior to the chase out of additional material, the remediation contractor/principal contractor must advise the project manager and client, and seek approval. In the event that any extension of the remedial

excavation impacts the Sydney Water easement, the work must not proceed until appropriate consultant occurs and approvals are obtained from the stakeholders (see also Section 7.4 below).

7.4 Unexpected Contamination Finds in Sydney Water Easement

In the event that unexpected contamination is identified in the Sydney Water easement that cannot be remediated under the scope of this RAP, it is acknowledged that there may be a need to implement an alternative remediation strategy of 'cap and contain' in-situ. Where this situation eventuates, the validation consultant must prepare a RWP (in consultation with the various stakeholders) outlining the proposed capping solution and associated validation requirements. The RWP must be submitted to council for approval prior to proceeding with such remediation.

Based on the Sutherland Development Control Plan (DCP) Chapter 40, implementation of a 'cap and contain' remedial approach as outlined in this contingency is deemed to be Category 1 remediation and requires development consent (see Clause 4.8 of SEPP Resilience and Hazards 2021 and Chapter 40 of the DCP). A hold point must be put in place until development consent is granted either via a new DA or modification to the development approval.

7.5 Remediation Strategy Changes

Any material change to the proposed remediation strategy will require revision of the RAP or preparation of an addendum RAP or RWP. This must not occur without appropriate consultation and approvals from the client, consent authority (council) and other relevant parties as necessary.

8 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.

8.1 Asbestos Management Plan (AMP)

A remediation-phase AMP must be prepared for the project by a suitably qualified consultant and implemented for the site remediation works. The AMP must include the minimum personal protective equipment (PPE), work health and safety (WHS) and other requirements outlined in the documents published by Safe Work Australia, WorkCover Authority of NSW, National Occupational Health and Safety Commission, and other relevant authorities as applicable. An asbestos removal control plan (ARCP) must be prepared by the remediation contractor/Class B licensed asbestos removalist and issued to SafeWork NSW, and notification of asbestos removal is to be provided to SafeWork NSW at least five days prior to commencement of works. Based on the current data, the asbestos is bonded/non-friable.

Although the asbestos found to date is bonded/non-friable ACM, we recommend that air monitoring be included in the AMP due to the close proximity of adjoining residential properties and adjoining parts of the wider school. 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)].

A 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.

8.2 Interim Site Management

The DSI recommended that an AMP be prepared and implemented for continued use of the school to manage potential asbestos-related risks associated with asbestos in soil.

8.3 Project Contacts and Signage

Emergency procedures and contact telephone numbers must be displayed in a prominent position at the site entrance gate and within the main site working areas. These details are to be confirmed when the various roles and responsibilities are assigned.

A sign displaying the contact details of the remediation contractor and site manager (if different from the remediation contractor) must be displayed on the site adjacent to the site access, including a contact

telephone number that is available 24 hours a day, 7 days a week. The sign must be clearly legible from the street and be displayed for the duration of the remediation works.

8.4 Security

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

8.5 Timing and Sequencing of Remediation Works

The anticipated sequence of remediation works is outlined in Section 5.3. The client must engage with the consent authority so that the remediation can occur as outlined in these steps.

8.6 Site Soil and Water Management Plan

The remediation contractor must prepare a detailed soil and water management plan prior to the commencement of site works and this must consider the requirements of the AMP. Silt fences must 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 are to 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.

No stockpiles of soil or other materials shall be placed on footpaths.

Vehicle access to the site shall be stabilised to prevent the tracking of sediment onto the roads and footpath. Soil, earth, mud or similar materials must be removed from the roadway by sweeping, shovelling, or a means other than washing, on a daily basis or as required. Soil washings from wheels shall be collected and disposed of in a manner that does not pollute waters.

Reference must also be made to the requirements of the AMP in this regard.

8.7 Noise and Vibration Control Plan

The guidelines for minimisation of noise on construction sites outlined in AS-2460 (2002)[12] should be adopted. Based on our experience on projects in Sutherland Local Government Area, council adopts a policy whereby the LAeq sound pressure level measured over a period of 15 minutes when the construction or demolition site is in operation, must not exceed the ambient background level (LA90 15min) by more than 10dB(A) when measured at the nearest affected premises.

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

All practicable measures are to 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 adjacent land users, notifications should be provided to the relevant authorities and the residents by the project manager, specifying the expected duration of the noisy works (or otherwise in accordance with the development consent requirements).

As the remedial excavations involve excavation of fill and not bedrock, vibrations are not expected to be of concern. Notwithstanding, reference is to be made to the JKG reports for further commentary regarding vibrations during excavation activities.

8.8 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;
- 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
- Geofabric/geotextile 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, where applicable.

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 relevant waste classification guidelines.

8.9 Dewatering

Temporary dewatering is not expected to be required in the context of the proposed remediation works. Groundwater has not been identified within the depth of fill during the JKE investigations.

Any construction-phase dewatering is to occur with regards to the conditions of consent and with due consideration to the relevant guidelines and legislation. Groundwater/seepage water must not be pumped to stormwater or sewer unless a prior application is made and this is approved by the relevant authorities.

8.10 Odour Control Plan

All activities undertaken at the site should 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.

8.11 WHS Plan

A site specific WHS plan must 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, where applicable for any work involving asbestos. Washroom and lunchroom facilities must also be provided to allow workers to remove potential contamination from their hands and clothing prior to eating or drinking.

8.12 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the remediation contractor must develop a waste management or recycling plan to minimise the amount of waste produced from the site. The plan must incorporate the requirements documented in Section 5.4.1 of this RAP.

8.13 Incident Management Contingency

The client/project manager and validation consultant must be contacted if any unexpected contamination-related 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 must be advised to assess potential impacts on contamination conditions and the remediation/validation timetable.

8.14 Hours of Operation

Based on our experience on projects in Sutherland Local Government Area, council adopts a policy whereby all building and demolition work must be carried out only between the hours of 7.00am and 6.00pm Monday to Friday inclusive, 8.00am and 3.00pm Saturdays. No work must be carried out on Sundays and Public Holidays. Reference must be made to the development consent conditions for the final details in regards to the hours of operation.

8.15 Community Consultation and Complaints

The remediation contractor must provide details for managing community consultation and complaints within their Construction Environmental Management Plan (CEMP), or equivalent document.

9 CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

The DSI identified bonded asbestos in soil at two locations in the southern area of the site. The proposed remediation strategy includes 'excavation and off-site disposal' of contaminated fill/soil to a suitably licensed landfill. This process aligns closely with the proposed development works which includes excavation for a proposed basement. The strategy is therefore easy to implement and is expected to be effective and successful to mitigate contamination risks.

We are of the opinion that the site can be made suitable for the proposed development via remediation and the implementation of this RAP. A site validation report is to be prepared on completion of remediation activities and submitted to the consent authority to demonstrate that the site is suitable for the proposed development following completion of remediation/validation.

As the site applicable to this RAP has been defined by the proposed development area, it is acknowledged that additional asbestos impacted soil may extended beyond the site boundaries. In particularly, we consider that it is likely that asbestos-impacted fill will remain between the southern site boundary and the cadastral property boundary for the wider school that extends along Allies Road (this area currently includes a treed embankment and associated tree protection zone). The client must engage a suitably qualified consultant to prepare an AMP to manage the potential occurrence of asbestos in this area until (or unless) it can be demonstrated that no additional asbestos in soils exists.

JKE is of the opinion that the RAP has met the objectives outlined in Section 1.2.

The regulatory requirements applicable for the site are outlined in Section 9.1.

9.1 Regulatory Requirements

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

Table 9-1: Regulatory Requirement

Guideline / Legislation / Policy	Applicability
SEPP Resilience and Hazards 2021	We have assessed that the proposed remediation comprising 'excavation and off-site disposal' of asbestos-contaminated soil falls within Category 2 with regards to Clause 4.11 of SEPP Resilience and Hazards 2021 and consideration of the Sutherland Development Control Plan (DCP) Chapter 40. This should be discussed with and confirmed by the client's expert planner and by council. Prior notice of commencement of Category 2 remediation work must be lodged with council at least 30 days prior to commencement of the work (see Clause 4.13). A notice of completion of remediation work is to be provided in accordance with Clauses 14.14 and 14.15 of SEPP Resilience and Hazards 2021.
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.

Guideline / Legislation / Policy	Applicability
	Activities must 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.
Work Health and Safety Regulation (2017) 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 licensed (Class B) asbestos removal works or handling. Reference is to be made to the construction-phase AMP for further details regarding the regulatory requirements for managing asbestos during remediation.

10 LIMITATIONS

The report limitations are outlined below:

- This report does not address structural or geotechnical matters and reference must be made to the reports prepared by the client's project engineers in relation to such matters;
- 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 will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the investigation. If the subject site is sold, ownership of the investigation report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the investigation was undertaken. No person should apply an investigation 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 investigation 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 investigations 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 investigation 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.

Investigation Limitations
Although information provided by a site investigation can reduce exposure to the risk of the presence of contamination, no environmental site investigation can eliminate the risk. Even a rigorous professional investigation 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 Investigations by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an investigation 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 Investigation 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 investigation. 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 investigation. 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 investigation 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 investigation 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 investigation, 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

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

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

Title: **SITE LOCATION PLAN**

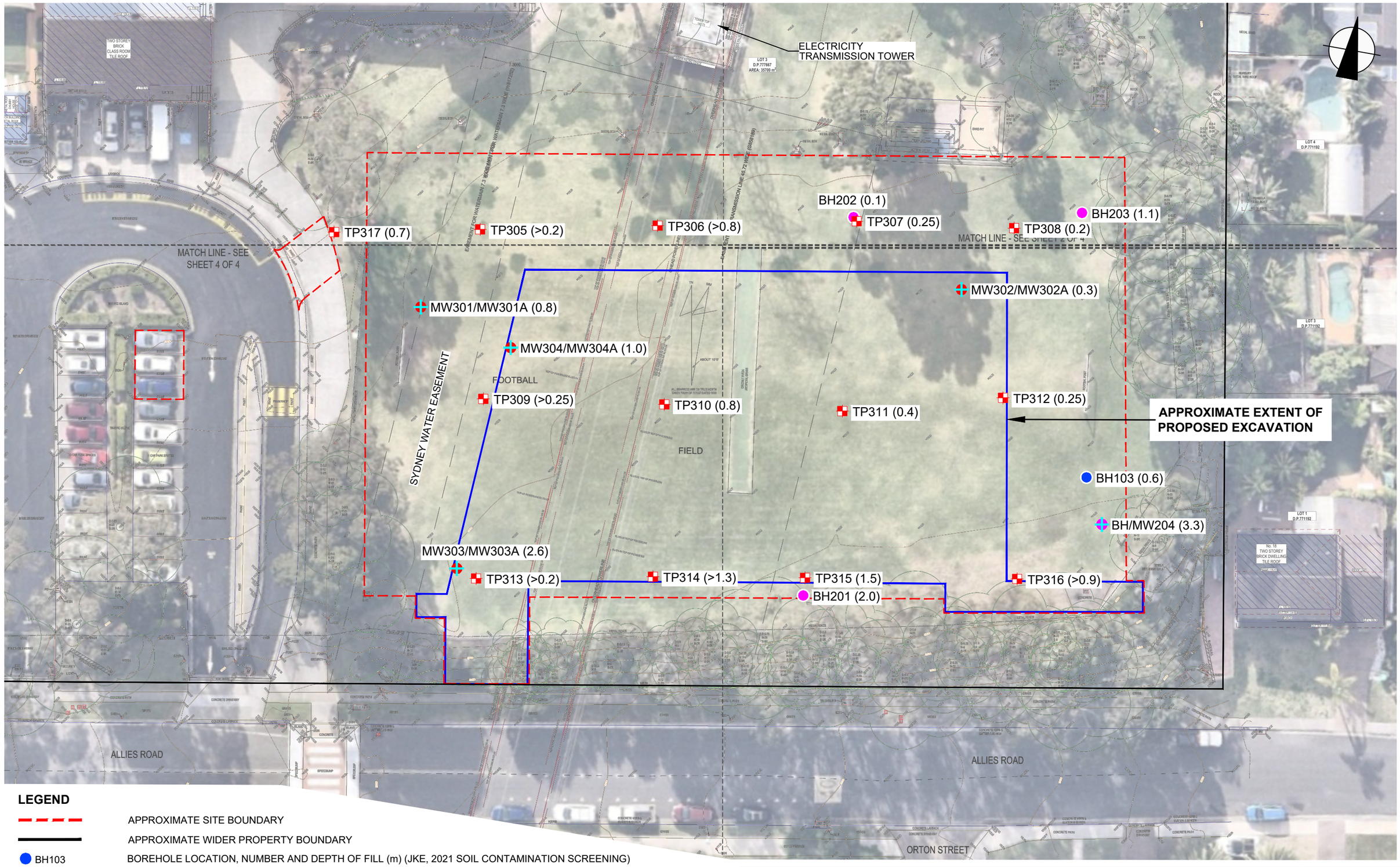
Location: SHIRE CHRISTIAN SCHOOL,16A ALLIES ROAD, BARDEN RIDGE, NSW

Project No: E34118PW

Figure No: 1

JKEnvironments

PLOT DATE: 10/08/2023 10:40:59 AM DWG FILE: K:\SC EIS JOBS\34000'S\E34118B2 BARDEN RIDGE\CAD\E34118PW.DWG



LEGEND

	APPROXIMATE SITE BOUNDARY
	APPROXIMATE WIDER PROPERTY BOUNDARY
BH103	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2021 SOIL CONTAMINATION SCREENING)
BH203	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2022 PSI)
BH/MW201	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (JKE, 2022 PSI)
TP301	TEST PIT LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2023 DSI)
304	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKG, 2023)
MW301	GROUNDWATER MONITORING WELL LOCATION AND NUMBER (JKE, 2023 DSI)

0 4 8 12 16 20

SCALE 1:400 @A3 METRES

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

Title: **SAMPLE LOCATION PLAN**

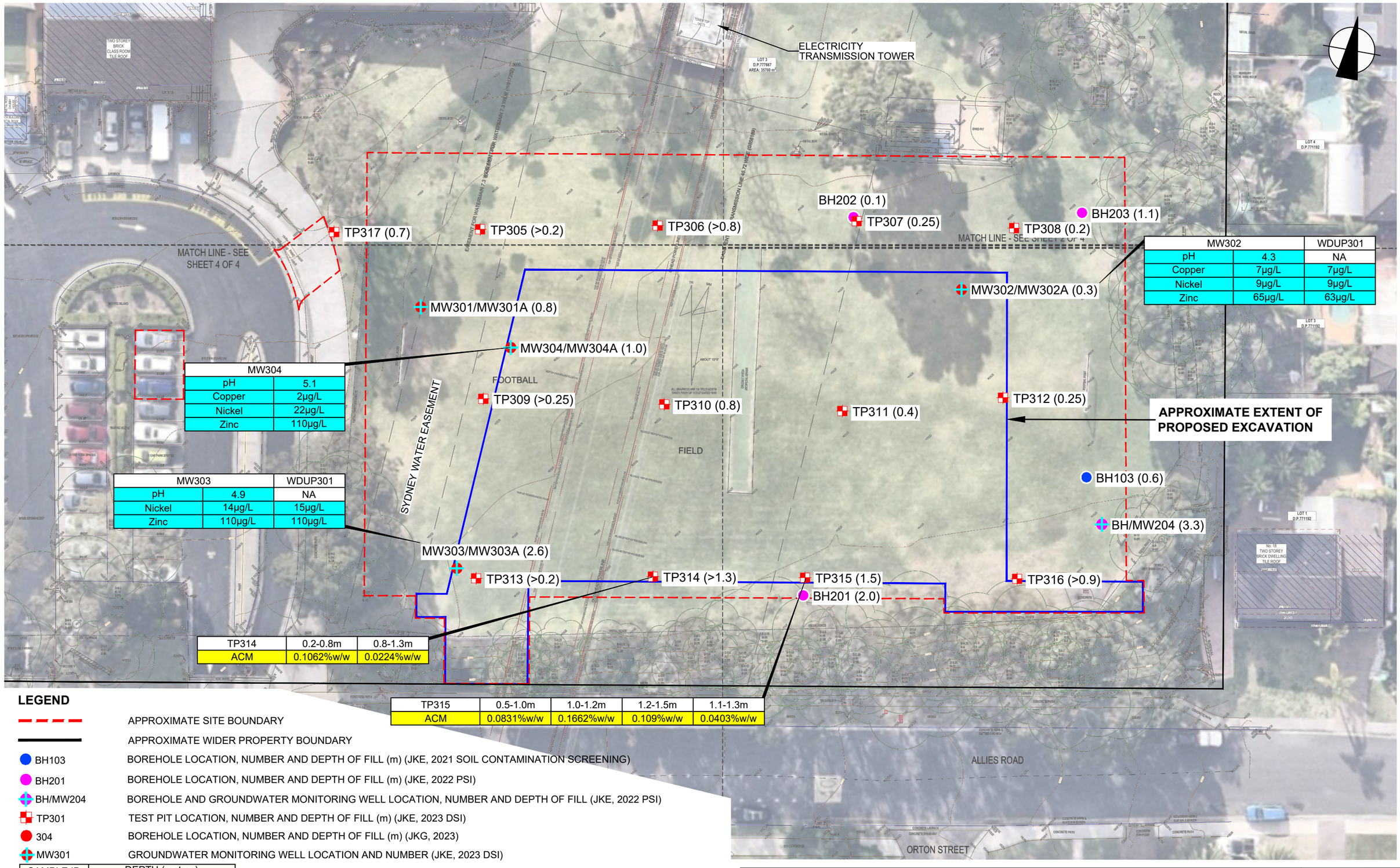
Location: SHIRE CHRISTIAN SCHOOL,16A ALLIES ROAD, BARDEN RIDGE, NSW

Project No: E34118PW

Figure No: 2

JKEnvironments

PLOT DATE: 16/08/2023 10:04:32 AM DWG FILE: K:\5C EIS JOBS\34000\SIE34118B2 BARDEN RIDGE\CAD\E34118PW.DWG



MW304	
pH	5.1
Copper	2µg/L
Nickel	22µg/L
Zinc	110µg/L

MW303		WDUP301
pH	4.9	NA
Nickel	14µg/L	15µg/L
Zinc	110µg/L	110µg/L

MW302		WDUP301
pH	4.3	NA
Copper	7µg/L	7µg/L
Nickel	9µg/L	9µg/L
Zinc	65µg/L	63µg/L

TP314	0.2-0.8m	0.8-1.3m
ACM	0.1062%w/w	0.0224%w/w

TP315	0.5-1.0m	1.0-1.2m	1.2-1.5m	1.1-1.3m
ACM	0.0831%w/w	0.1662%w/w	0.109%w/w	0.0403%w/w

LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- BH103 — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2021 SOIL CONTAMINATION SCREENING)
- BH201 — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2022 PSI)
- BH/MW204 — BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (JKE, 2022 PSI)
- TP301 — TEST PIT LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2023 DSI)
- 304 — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKG, 2023)
- MW301 — GROUNDWATER MONITORING WELL LOCATION AND NUMBER (JKE, 2023 DSI)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

SAMPLE ID	-
CHEMICAL	CONCENTRATION (µg/L)

GROUNDWATER SAMPLE EXCEEDANCE

SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK

GROUNDWATER CONTAMINATION ABOVE SAC

0 4 8 12 16 20

SCALE 1:400 @A3 METRES

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

Title: **SAC EXCEEDANCE PLAN**

Location: SHIRE CHRISTIAN SCHOOL,16A ALLIES ROAD, BARDEN RIDGE, NSW

Project No: E34118PW

Figure No: 3

JKEnvironments

PLOT DATE: 16/08/2023 2:19:16 PM DWG FILE: K:\5C EIS JOBS\34000\S\E34118B2 BARDEN RIDGE\CAD\E34118PW.DWG

ELECTRICITY TRANSMISSION TOWER

TP317 (0.7)

TP305 (>0.2)

TP306 (>0.8)

BH202 (0.1)

TP307 (0.25)

BH203 (1.1)

TP308 (0.2)

MATCH LINE - SEE SHEET 4 OF 4

MATCH LINE - SEE SHEET 2 OF 4

MW301/MW301A (0.8)

MW304/MW304A (1.0)

MW302/MW302A (0.3)

SYDNEY WATER EASEMENT

FOOTBALL

FIELD

TP309 (>0.25)

TP310 (0.8)

TP311 (0.4)

TP312 (0.25)

APPROXIMATE EXTENT OF PROPOSED EXCAVATION

BH103 (0.6)

BH/MW204 (3.3)

MW303/MW303A (2.6)

TP313 (>0.2)

TP314 (>1.3)

TP315 (1.5)

BH201 (2.0)

TP316 (>0.9)

ALLIES ROAD

ORTON STREET

LEGEND

	APPROXIMATE SITE BOUNDARY
	APPROXIMATE WIDER PROPERTY BOUNDARY
BH103	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2021 SOIL CONTAMINATION SCREENING)
BH203	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2022 PSI)
BH/MW201	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (JKE, 2022 PSI)
TP301	TEST PIT LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2023 DSI)
304	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKG, 2023)
MW301	GROUNDWATER MONITORING WELL LOCATION AND NUMBER (JKE, 2023 DSI)
110.5	GROUNDWATER CONTOUR INTERVALS (m)
	INFERRED GROUNDWATER FLOW DIRECTION

0 4 8 12 16 20

SCALE 1:400 @A3 METRES

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

Title: **GROUNDWATER CONTOUR PLOT**

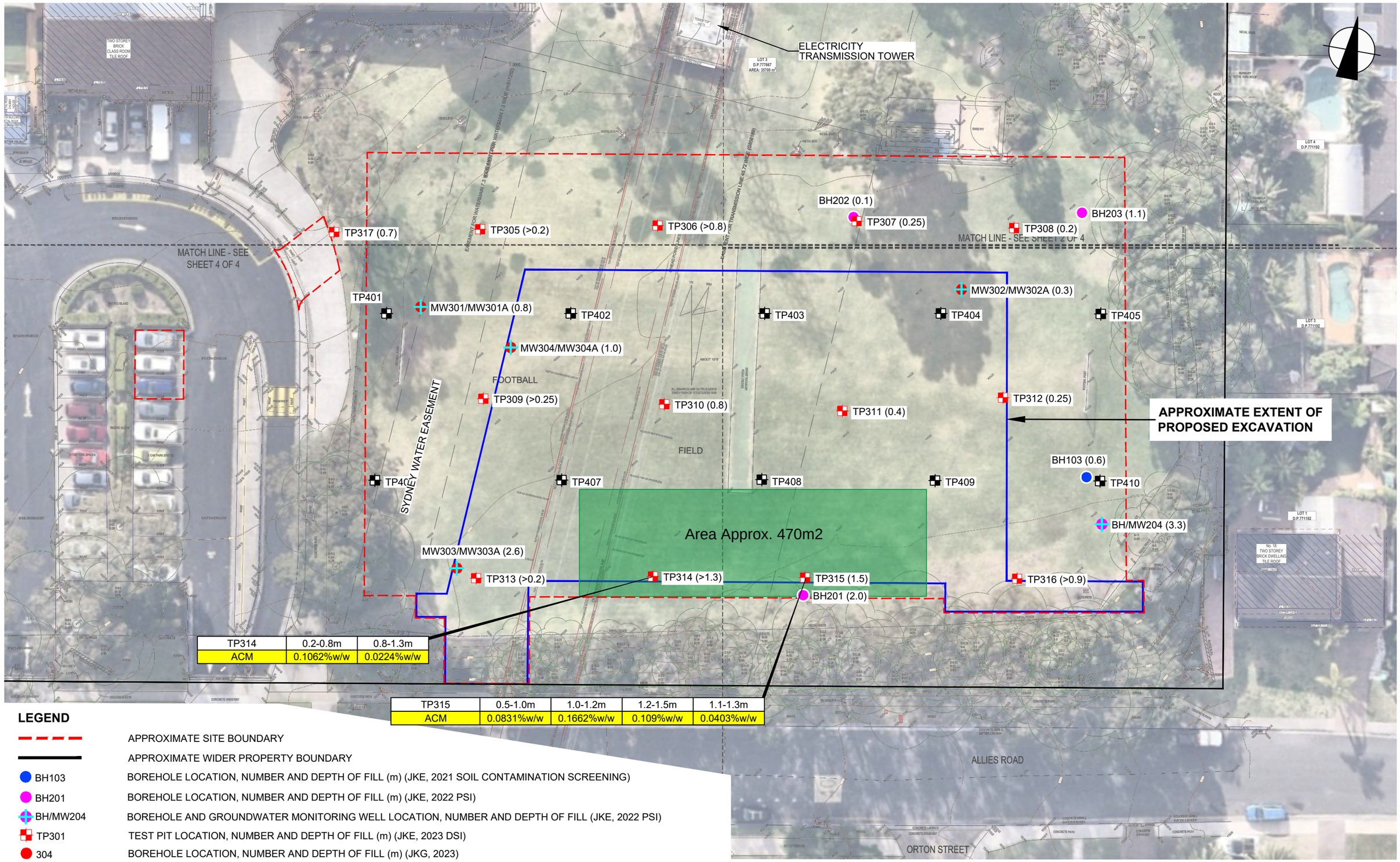
Location: SHIRE CHRISTIAN SCHOOL,16A ALLIES ROAD, BARDEN RIDGE, NSW

Project No: E34118PW

Figure No: 4

JKEnvironments

PLOT DATE: 16/08/2023 10:05:08 AM DWG FILE: K:\5C EIS JOBS\34000'S\E34118B2 BARDEN RIDGE\CAD\E34118PW.DWG



TP314	0.2-0.8m	0.8-1.3m
ACM	0.1062%w/w	0.0224%w/w

TP315	0.5-1.0m	1.0-1.2m	1.2-1.5m	1.1-1.3m
ACM	0.0831%w/w	0.1662%w/w	0.109%w/w	0.0403%w/w

LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- BH103 — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2021 SOIL CONTAMINATION SCREENING)
- BH201 — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2022 PSI)
- BH/MW204 — BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (JKE, 2022 PSI)
- TP301 — TEST PIT LOCATION, NUMBER AND DEPTH OF FILL (m) (JKE, 2023 DSI)
- 304 — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m) (JKG, 2023)
- MW301 — GROUNDWATER MONITORING WELL LOCATION AND NUMBER (JKE, 2023 DSI)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK
- INDICATIVE ASBESTOS REMEDIATION AREA, TO BE CONFIRMED VIA VALIDATION
- TP401 — PROPOSED PRE-REMEDIATION SAMPLING LOCATION

0 4 8 12 16 20
SCALE 1:400 @A3 METRES

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

Title: **REMEDIATION PLAN**

Location: SHIRE CHRISTIAN SCHOOL,16A ALLIES ROAD, BARDEN RIDGE, NSW

Project No: E34118PW

Figure No: 5

JKEnvironments

PLOT DATE: 30/08/2023 10:13:43 AM DWG FILE: K:\SC EIS .JOBS\34000\SIE34118B2 BARDEN RIDGE\CAD\E34118PW.DWG

Appendix B: Proposed Development Plans