REPORT TO

HEALTH INFRASTRUCTURE

ON

REMEDIATION ACTION PLAN (RAP)

FOR

COOMA HOSPITAL KEY WORKER ACCOMMODATION DEVELOPMENT - STAGE 2

AT

COOMA HOSPITAL, BENT STREET, COOMA, NSW

Date: 21 February 2023
Ref: E30596PTrpt4 DRAFT

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Executive Summary

Health Infrastructure ('the client') commissioned JK Geotechnics (JKG) to prepare a Remediation Action Plan (RAP) for the proposed Cooma Hospital Key Worker Accommodation Development – Stage 2 at Cooma Hospital, Bent Street, Cooma, NSW. The site location is shown on Figure 1 and the RAP is confined to the development area (referred to herein as 'the site') as shown on Figure 2 attached in Appendix A. The site is located in the central east section of the wider hospital property.

Environmental Investigation Services (EIS), the former environmental division of JKG, has previously undertaken several phases of investigation on the wider hospital property and JKG has undertaken a Detailed (Stage 2) Site Investigation (DSI)[1] of the site more recently in 2022. A summary of relevant information from the DSI has been included in Section 2.

The proposed development for this stage of works includes construction of a two storey, 12 unit block with indoor and outdoor shared space, which is proposed to be positioned in the central east of the existing hospital property (refer to Figure 2). The development is to be utilised for worker accommodation. Selected development plans are provided in Appendix B.

The DSI identified the occurrence of asbestos in the form of bonded/non-friable ACM on/in fill and at the ground surface. The proposed remediation strategies for the impacted fill include a combination of excavation and off-site disposal of contaminated fill/soil to a suitably licensed landfill, and in-situ capping and long-term management of the capped areas via an EMP.

The anticipated sequence of remediation works is outlined at the beginning of Section 5 of this RAP. Remediation will occur concurrently with the development works 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. Notably, remediation requires completion of construction as parts of the constructed development (e.g. the building floor slab etc) will form the cap.

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. An EMP will also be prepared to manage the asbestos impacted fill capped on site as part of the remediation. The EMP will provide a passive management approach and is not expected to impose onerous constraints on the day-to-day site use under the proposed development scenario.

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

[1] JKG, (2022). *Report to NSW Health Infrastructure on Detailed (Stage 2) Site Investigation of Proposed Cooma Hospital Key Worker Accommodation Development – Stage 2 at Cooma Hospital, Bent Street, Cooma, NSW* (Ref: E30596PT3, dated 21 December 2022) (referred to as DSI)

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Abbreviations

Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Below Ground Level	**BGL**
Benzo(a)pyrene Toxicity Equivalent Factor	**BaP TEQ**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Dial Before You Dig	**DBYD**
Data Quality Indicator	**DQI**
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Lab Control Spike	**LCS**
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National Association of Testing Authorities	**NATA**
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Organochlorine Pesticides	**OCP**
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Polycyclic Aromatic Hydrocarbons	**PAH**
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Photo-ionisation Detector	**PID**
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Practical Quantitation Limit	**PQL**
Quality Assurance	**QA**
Quality Control	**QC**
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Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
State Environmental Planning Policy	**SEPP**
Site Specific Assessment	**SSA**
Source, Pathway, Receptor	**SPR**
Specific Contamination Concentration	**SCC**
Standard Penetration Test	**SPT**
Trip Blank	**TB**
Total Recoverable Hydrocarbons	**TRH**
Trip Spike	**TS**
Upper Confidence Limit	**UCL**
Volatile Organic Compounds	**VOC**

World Health Organisation	**WHO**
Work Health and Safety	**WHS**

Units

Metres BGL	**mBGL**
Metres	**m**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Parts Per Million	**ppm**
Percentage	**%**
Percentage weight for weight	**%w/w**

1 INTRODUCTION

Health Infrastructure ('the client') commissioned JK Geotechnics (JKG) to prepare a Remediation Action Plan (RAP) for the proposed Cooma Hospital Key Worker Accommodation Development – Stage 2 at Cooma Hospital, Bent Street, Cooma, NSW. The site location is shown on Figure 1 and the RAP is confined to the development area (referred to herein as 'the site') as shown on Figure 2 attached in Appendix A. The site is located in the central east section of the wider hospital property.

Environmental Investigation Services (EIS), the former environmental division of JKG, has previously undertaken several phases of investigation on the wider hospital property and JKG has undertaken a Detailed (Stage 2) Site Investigation (DSI)[2] of the site more recently in 2022. A summary of relevant information from the DSI has been included in Section 2.

The DSI identified bonded/non-friable fibre cement fragments (FCF)/asbestos containing material (ACM) on/in fill soil. This RAP includes a methodology to remediate the identified FCF/ACM impacts and validate the site so it is suitable for the proposed development (from a contamination viewpoint). A detailed contingency plan to address unexpected finds is also included.

1.1 Proposed Development Details

The proposed development for this stage of works includes construction of a two storey, 12 unit block with indoor and outdoor shared space, which is proposed to be positioned in the central east of the existing hospital property (refer to Figure 2). The development is to be utilised for worker accommodation. Selected development plans are provided in Appendix B.

1.2 Remediation Goal, Aims and Objectives

The goal of the remediation is to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation at the site is to reduce the human health risks posed by site contamination so that risks to construction workers and future site occupants/users are appropriately managed and remain low and acceptable.

The objectives of the RAP are to:

- Provide a methodology to remediate and validate the site based on the risks identified during the previous phases of investigation;
- Outline site management procedures to be implemented during remediation work; and
- Provide a contingency plan for the remediation works, including an unexpected finds protocol and other relevant contingencies relating to remediation and validation.

1.3 Scope of Work

The RAP was prepared generally in accordance with a JKG proposal (Ref: EP58131PT) of 8 February 2022 and written acceptance from the client via email of 8 February 2023. The scope of work included a review of

[2] JKG, (2022). *Report to NSW Health Infrastructure on Detailed (Stage 2) Site Investigation of Proposed Cooma Hospital Key Worker Accommodation Development – Stage 2 at Cooma Hospital, Bent Street, Cooma, NSW* (Ref: E30596PT3, dated 21 December 2022) (referred to as DSI)

previous reports, review of the Conceptual Site Model (CSM), review of the proposed development details and preparation of the RAP.

The RAP was prepared with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[3], to State Environmental Planning Policy (Resilience and Hazards) 2021[4] (formerly known as SEPP55) and other guidelines made under or with regards to the Contaminated Land Management Act (1997)[5]. A list of reference documents/guidelines is included in the appendices.

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

[4] *State Environmental Planning Policy (Resilience and Hazards) 2021* (NSW) (referred to as SEPP Resilience and Hazards 2021)

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

2 SITE INFORMATION

2.1 Previous Investigations - DSI

Soil sampling for the DSI was undertaken from eight test pit locations across the site. Fill (i.e. historically imported soil) was encountered to depths of between approximately 0.4m below ground level (BGL) to 1.5mBGL and comprised silty clayey sand or silty sandy clay with inclusions of granite, igneous and quartz gravel, concrete, brick, and ceramic fragments, FCF, clay nodules, sand, ash and root fibres. FCF/ACM was encountered in fill in one of the eight locations during fieldwork and at the surface of the site.

Asbestos as ACM was encountered at a concentration that was above the health-based site assessment criteria (SAC) in fill soil in one test pit (TP205). ACM was also encountered in one FCF (FCF2) identified at the ground surface.

Based on the Tier 1 risk assessment, the level of contamination identified at the site was assessed to pose a potential risk in the current site configuration and in the context of the proposed development. A RAP was recommended to document the procedure for remediating the site. As a duty of care, and to meet the requirements under Clause 429 of the Work Health and Safety Regulation (2017), the DSI also stated that an Asbestos Management Plan (AMP) for asbestos in/on soil should be prepared and implemented.

The DSI report considered that the site could be made suitable for the proposed development provided that the following recommendations were implemented:

1. Prepare an AMP (for asbestos in/on soil) to manage the site;
2. Preparation and implementation of a RAP; and
3. Preparation of a validation report on completion of remediation.

A copy of the soil analysis summary tables and the test pit logs from the DSI is attached in Appendix C.

2.2 Site Identification

Table 2-1: Site Identification

Site Address:	Bent Street, Cooma, NSW
Lot & Deposited Plan:	Part of Lot 2 in DP1161366
Current Land Use:	Hospital grounds (landscaped/paved areas outside existing building footprints)
Proposed Land Use:	Continued use as part of the hospital grounds for key worker accommodation
Local Government Authority (LGA):	Snowy Monaro Regional Council
Current Zoning:	SP2: Infrastructure
Site Area (m^2) (approx.):	875
Geographical Location (decimal degrees) (approx. centre of site):	Latitude: -36.2413421 Longitude: 149.1306185

Site Plans:	Appendix A

2.3 Site Location, Topography and Regional Setting

The site is located within the central east section of the wider hospital property which is within a predominantly residential area of Cooma. The wider hospital property is bound by the Monaro Highway (Bombala Street) to the east and Victoria Street to the north. The site is located approximately 200m to the west of Cooma Creek.

The regional topography is characterised by undulating terrain that generally falls towards Cooma Creek to the north and north-east of the site and wider hospital property. The site slopes gently towards the east and parts of the site appear to have been levelled to account for the slope and accommodate the existing development.

2.4 Summary of Site Description

A walkover inspection of the site was undertaken by JK Environments (JKE) personnel on 18 November 2022 (JKE is the environmental division of JKG). In summary:

- The site comprised a section of grassed landscaped garden area in the central-eastern section of the wider hospital property. Additionally, in the west of the site, an area was slightly raised (0.2m to 0.4m) and a chain linked fence enclosed this area. This area was indicated to formerly be utilised for storage (gas bottles);
- Part of the western enclosed area of the site was concrete paved, otherwise the site was entirely unpaved and grass covered. Two large concrete plinths and metal framework was within the enclosed area (assumed to be former storage bays). To the west of the enclosed area was a section of asphaltic concrete paved carpark;
- The boundary of the site was entirely unfenced. No evidence of erosion was observed during the site inspection. Some fill soil was visible at the interface between the paved area and grass covered areas;
- Several stacked fibre cement panels (suspected asbestos containing material) were stored in the enclosed area;
- Fill soils (i.e. containing brick and tile fragments and igneous gravels) were observed in areas of exposed soils during the site inspection (generally along the southern area). The level of the enclosed former storage area in comparison to the adjacent paved carpark (which was to the west) also indicated that some filling may have occurred on site;
- Several FCF were encountered on the site surface during the inspection (refer to Figure 2). It appeared these were associated with the soils, rather than damage to the stored fibre cement panels. Two representative samples of FCF (FCF1 and FCF2) were analysed for the DSI, and one of these two samples was found to contain asbestos (sample FCF2 was ACM);
- Surface water at the site was expected to infiltrate the unpaved site surface, with the flow direction of excess surface water run off being towards to the east in keeping with the localised fall of the site;
- The site was predominantly grass covered, with medium-sized trees in a row along the east of the site and along the south. The vegetation appeared to be in good condition during the site inspection with no evidence of dieback or stress observed.

2.4.1 Surrounding Land Use

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

- North – grassed open space on the wider hospital property;
- South – asphaltic concrete paved driveway and grassed open space on the wider hospital property;
- East – grassed open space on the wider hospital property with the Monaro Highway and residential properties beyond; and
- West – asphaltic concrete paved carpark on the wider hospital property.

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

2.5 Summary of Geology, Soils and Hydrogeology

2.5.1 Regional Geology and Soil/Bedrock Conditions

Regional geological maps indicated that the site is underlain by Cooma Granodiorite, which typically consists of biotite granite, foliated granite, leucogranite, diorite and tonalitic gneiss.

The previous investigations encountered shallow granite bedrock across the site and wider hospital property from depths of approximately 0.4mBGL to 2mBGL.

The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation.

2.5.2 Hydrogeology and Groundwater

Hydrogeological information reviewed for the DSI indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes fractured or fissured, extensive aquifers of low to moderate productivity. There was a total of 48 registered bores within 2km of the site. The nearest registered bore was 130m cross-gradient to the north-east of the site and was registered for water supply purposes. All other bores were over 775m from the site and none were down-gradient.

There is a reticulated water supply in the area and consumption of groundwater is not expected to occur.

Considering the local topography, groundwater is anticipated to flow towards the north and north-east in sympathy with the topography and towards the nearest down gradient water body.

2.5.3 Receiving Water Bodies

The closest surface water body is Cooma Creek located approximately 200m to the east of the site at its closest point. This is down-gradient and is a potential receptor. However, groundwater contamination sources were not identified at the site and groundwater is not needing to be remediated or managed under the scope of this RAP.

3 REVIEW OF 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. An iteration of the CSM for the site is presented in the following table and is based on the site information (including the site inspection information) and the review of site history information including previous investigation findings.

3.1 Summary of Contamination (Site Characterisation)

The previous investigations encountered FCF/ACM on/in the fill (soil) at concentrations that exceeded the human health SAC as summarised below and presented on the Figure 3 attached in Appendix A:

- ACM was encountered on the site surface (FCF2); and
- The asbestos (in ACM) %w/w in the bulk screening samples from TP205 (0.1-0.6m) and TP205 (1.0-1.5m) of 0.0294%w/w and 0.0590%w/w respectively, exceeded the SAC.

A copy of the laboratory data summary tables and the test pits logs from the DSI are attached in Appendix C.

For the purpose of remediation, the contaminant of concern is asbestos which is present in the form of bonded/non-friable ACM (i.e. within fragments of fibre cement).

3.2 Review of CSM

Table 3-1: Review of CSM

Contaminant source(s) and contaminants of concern	The contamination source is the historically imported fill (soil) and/or historical demolition works. The contaminant of concern from a remediation standpoint is asbestos, which is present in bonded ACM.
Affected media	Soil/fill has been identified as the potentially affected medium. It is noted that asbestos fibres can mobilise to air.
Receptor identification	Human receptors include site occupants/users (including adult workers, and adult and children visitors), construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users.
Exposure pathways and mechanisms	The exposure pathway (for the contaminant of concern) relevant to the human receptors includes inhalation of airborne asbestos fibres and dust during soil disturbance.

3.3 Remediation Extent

For the purpose of the RAP, remediation extends across the entire area defined as the site, and applies to all fill. Fill was found to extend to depths of between 0.4mBGL to 1.5mBGL during the DSI. Please refer to Figure 2 in Appendix A which presents the fill depths at the previous sample locations. A holistic approach to remediation will occur whereby all fill will be deemed to be contaminated with asbestos/ACM for remedial purposes.

4 REMEDIATION OPTIONS

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 Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2021)[6] require consideration of the following in assessing remediation options:

1. Minimisation of public risk;
2. Minimisation of contaminated soil disturbance; and
3. Minimisation of contaminated material/soil moved to landfill, including minimisation of risks associated with transportation.

The NSW EPA Contaminated Land Management Guidelines for the NSW Site Auditor Scheme (3rd Edition) (2017)[7] 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.

[6] Western Australian (WA) Department of Health (DoH), (2021). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia. (referred to as WA DoH 2021)

[7] 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 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, thermal desorption and physical removal of bonded ACM fragments. 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. The NSW EPA released a position statement[8] relating to the WA DoH 2021 guidelines and indicated that treatment of soils via physical removal of ACM (otherwise known as 'emu picking') is not permitted, unless the impact is surficial (i.e. in the top 10cm only). As the ACM is present in fill at this site, all fill cannot be treated in this manner.
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 and is not supported by the NSW EPA 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 borrow pit/cell, or capping contaminated soils in-situ beneath appropriate clean capping materials (such as pavement and/or clean soil) to reduce the potential for future exposure. The capping and/or containment must be appropriate for the specific contaminants of concern. A long-term Environmental Management Plan (EMP) would be required and an EMP would need to be publicly notified and made to be legally enforceable (e.g. via listings in the Section 10.7 planning certificate and on the land title).	This option is applicable for the fill and is well suited to ACM as capping the asbestos mitigates the risk of disturbance and exposure in the context of the proposed land use.

[8] https://www.epa.nsw.gov.au/your-environment/contaminated-land/other-contamination-issues/managing-asbestos-in-and-on-land/position-statement-wa-managment-of-asbestos-sites

Option	Discussion	Assessment/Applicability
<u>Option 4</u> Removal of contaminated material to an appropriate facility and reinstatement with clean material	Contaminated soils would be classified in accordance with NSW EPA guidelines for waste disposal, excavated and disposed of off-site to a licensed landfill. The material would have to meet the requirements for landfill disposal. Landfill gate fees (which may be significant) would apply in addition to transport costs.	This option is applicable as a stand-alone strategy which could be used to remove all fill/asbestos from the site. Or alternatively, it can be used in conjunction with Option 3 if some material needs to be removed from more sensitive areas (such as proposed landscaped zones) or to achieve the required site levels to facilitate capping.
<u>Option 5</u> Implementation of management strategy	Contaminated soils would be managed in such a way to reduce risks to the receptors and monitor the conditions over time so that there is an on-going minimisation of risk. This may occur via the implementation of monitoring programs, potentially also involving capping systems.	Applicable for the long-term management of contamination, if capping occurs in accordance with Option 3. A passive management system is anticipated for the development.

4.3 Rationale for the Preferred Option for Remediation

The preferred option for remediation is a combination of Option 3 and Option 4 which includes excavation of impacted fill soils to enable installation of appropriate cap and containment across the site, and Option 5 managing the site via a long-term EMP.

The preferred option for remediation is considered to be appropriate on the basis that:

- The asbestos contamination is considered to be widespread in fill;
- Minimising disturbance of asbestos impacted soils aligns with the asbestos remediation hierarchy and reduces the potential for exposure to asbestos;
- Excavating and disposing of surplus asbestos-impacted soil, only to the extent required to facilitate the installation of the capping system, reduces unnecessary disturbance and disposal of material to landfill;
- Capping the site will result in an incomplete exposure pathway to asbestos during future day-to-day use of the site, hence mitigating the risks from exposure to asbestos; and
- The strategy is sustainable, economically viable, commensurate with the level of risk posed by the contaminant and technically achievable to implement concurrently with the proposed development works.

5 REMEDIATION DETAILS

The following general sequence of works is anticipated:

- Pre-commencement meeting;
- Preparation of a Construction-Phase Asbestos Management Plan (AMP) for the proposed development;
- Excavation and off-site disposal of contaminated fill from landscaped areas and as required to achieve site levels in paved areas;
- General earthworks and site preparations, followed by remediation/capping of the site concurrently with the proposed development works;
- Validation of capping areas; and
- Validation of imported soil materials. This includes materials imported to reinstate the remedial excavations, together with engineering material such as sub-base and drainage materials (e.g. recovered aggregate etc), landscaping materials or any other materials imported for service trenches etc, to the point in time that the validation report is issued.

Validation of the works would occur progressively throughout the remediation program.

Details in relation to the above are outlined in the following subsections:

5.1 Roles and Responsibilities

Table 5-1: Roles and Responsibilities

Role	Responsibility
Client/Owner	Health Infrastructure Contact: To be confirmed (TBC) The client 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, consent authority and any other relevant parties involved in the project.
Project Manager	Central West Project Management (CWPM) Contact: Jessica Cooper 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 appointed 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.

Role	Responsibility
	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 appointed. The remediation contractor is required to review all relevant documents prepared for the project, apply for any relevant removal licences or permits and implement the remediation requirements outlined in this RAP. The remediation contractor should be or must subcontract a Class B licensed asbestos removalist to manage and undertake any works associated with the disturbance of asbestos. The Class B contractor will need to submit the required notification to SafeWork NSW for asbestos removal works. 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.
Validation Consultant	To be appointed (by the principal contractor). The validation consultant[9] provides consulting advice and validation services in relation to the remediation, and prepares the validation report and EMP, as required. The validation consultant is required to review any deviation of this RAP or any unexpected finds if and when encountered during the site work. The validation consultant should have a Licensed Asbestos Assessor (LAA) on staff. 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 investigations, validation sampling and inspections. The client and project manager will have full access to the validation consultant at all times during the remediation work.

5.2 Remediation and Associated Tasks

5.2.1 Pre-commencement

The project team is to have a pre-commencement meeting to discuss the sequence of remediation, and the remediation and validation tasks. The site management plan for remediation works (see Section 8) must be reviewed by project manager and remediation contractor, and appropriate steps are to be taken to ensure the adequate implementation of the plan.

5.2.2 Asbestos Management Plan (AMP)

A construction-phase AMP should be prepared for the site by a licensed asbestos assessor and implemented for the site remediation and development works. The AMP should 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,

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

and other relevant authorities as applicable. An asbestos removal control plan (ARCP) should be prepared by the remediation contractor and issued to SafeWork where required, and notification of asbestos removal is to be provided to SafeWork at least five days prior to commencement of works.

5.2.3 Site Establishment

The remediation contractor is to establish on site as required to facilitate the remediation and validation works. Consideration must be given to the work sequence and extent of remediation/excavation so that the site establishment (e.g. site sheds, fencing, access points etc) does not inhibit the required works. Any soil/gravel-type materials imported during the site establishment (e.g. DGB, 40/70 etc) must be validated in accordance with Section 6 of this report.

As part of the site establishment, it is anticipated that the stored fibre cement sheets will need to be removed. This material should be tested to confirm whether it contains asbestos, then disposed of appropriately. It is anticipated that there is >10m^2 of material, hence the relevant SafeWork NSW notification for removal and waste tracking will apply assuming the material is confirmed to contain asbestos.

5.2.4 Remediation Details - Excavation and Off-site Disposal of Contaminated Fill

The excavation and off-site disposal remediation procedure is to be applied to all parts of the site that will be landscaped (i.e. all areas within the site that are not covered by the building/hardstand area). Reference should be made to Section 5.2.5 for the cap and contain/manage option which will apply to the remaining building/hardstand area.

For the purpose of the procedure provided below, the fill within the site is classified as and is to be excavated and disposed of as **General Solid Waste (non-putrescible) containing Special Waste (asbestos)** as per the data from the DSI. We note that the receiving landfill is likely to require a standalone waste classification letter confirming this and the quantity of waste being disposed. This waste classification documentation should be arranged at least 3-4 weeks prior to commencement of any excavation works.

The procedure for excavation of fill soil is outlined below:

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

Step	Primary Role/ Responsibility	Procedure
1	Validation Consultant	Waste Classification Letter A waste classification addendum letter for fill must be prepared to confirm the final expected waste quantities and the waste classification as per the DSI.
2	Remediation contractor	Address Stability Issues and Underground Services: Geotechnical advice must be sought regarding the stability of adjacent structures and/or adjacent areas prior to commencing remediation (as required). Stability issues are to be addressed to the satisfaction of a suitably qualified geotechnical engineer. This may require the installation of temporary shoring, if specified by the engineer. All underground services are to be appropriately disconnected or rerouted to facilitate the works.

Step	Primary Role/ Responsibility	Procedure
3.	Remediation contractor	<u>Establish Asbestos Related Controls and Arrange Licenses and Tracking Requirements</u> Prior to the commencement of any excavation, asbestos related controls, licences and tracking requirements should be implemented as outlined in the AMP (refer to Section 5.2.2).
4.	Remediation contractor	<u>PPE and WHS:</u> Confirm PPE and WHS requirements prior to commencement of remediation works. All personnel involved in the remediation works must wear appropriate PPE as specified in the AMP.
5.	Remediation contractor (or their nominated Class B licensed sub-contractor) and validation consultant	<u>Excavation and disposal of fill, followed by validation:</u> Following pavement removal, remediation will be undertaken as follows: • Submit an application to dispose of the fill (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 excavation and removal of asbestos contaminated soil should be completed in accordance with the construction-phase AMP; • The area(s) where fill is to be removed must be marked out using an appropriate method; • The fill within the nominated area(s) is to be excavated and completely removed, down to the top of the underlying natural soil. This is expected to result in excavations extended to depths in the order of approximately 0.4mBGL to 1.5mBGL, depending on the location of the excavation (based on the fill depths encountered during the DSI); • It is recommended that experienced personnel monitor the fill excavation process so that fill is not 'over excavated' into natural soil which could result in additional and unnecessary landfill fees. The details of the excavation works will need to be agreed with the remediation contractor. The works should be done in the most efficient manner that minimises cross contamination; • 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 refer to Item 1 above); and • All documents including landfill disposal dockets should be retained by the remediation contractor/asbestos removal contractor and forwarded to the client and validation consultant. This documentation forms a key part of the validation process and is to be included in the validation report.
6.	Validation consultant	<u>Validation of Excavations:</u> Once all fill is removed to required levels, the base and walls of the excavation are to be validated in accordance with the validation plan outlined in Section 6, which includes completion of a surface clearance by a LAA.
7.	Remediation contractor	<u>Survey of Excavations:</u> Once the excavations are successfully validated, the remediation contractor is to undertake a survey of the horizontal extent of the excavations. This information must clearly document the extent of the areas where all fill is successfully removed as these areas will not be subject to future management controls under the EMP.
8.	Remediation contractor and validation consultant	<u>Backfilling/Reinstatement of Excavations:</u> Where required, remedial excavations are to be reinstated with clean (validated) materials, to meet the geotechnical and landscape requirements of the project. Imported materials must be validated in accordance with the validation plan outlined in Section 6, with sampling/analysis preferably occurring prior to importation.

Part 7 of the Protection of the Environment (POEO) Waste Regulation sets out 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 10m^2 of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use WasteLocate.

Clause 78 of the POEO Waste Regulation requires that a person who transports asbestos waste must ensure that:

- Any part of any vehicle in which the person transports the waste is covered, and leak-proof, during the transportation; and
- If the waste consists of bonded asbestos material—it is securely packaged during the transportation; and
- If the waste consists of friable asbestos material—it is kept in a sealed container during transportation; and
- If the waste consists of asbestos-contaminated soils—it is wetted down.

Asbestos waste cannot be re-used or recycled.

5.2.5 Capping of Impacted Fill

The remedial actions in this section of the RAP are for in-situ cap and containment which will occur for all parts of the site where all fill is not removed in accordance with Section 5.2.4 of this RAP.

The capping specification is provided in the following table. JK had not been provided with detailed landscape plans for for-construction drawings at the time of preparing this RAP, hence some assumptions have been made in designing the capping specification. Consequently, these requirements must be reviewed and discussed by the project team well in advance of construction commencing. In the event that the capping specification needs to be altered, an addendum to the RAP must be prepared by JK or by the validation consultant, and approved by the client and consent authority, prior to commencement.

Table 5-3: Remediation Details – In-situ Capping Specification

Area	Capping Specification^
Continuous hardstand (e.g. pavement/concrete, or beneath permanent fixed features such as steps, retaining walls etc)	Installation of: • Geotextile marker[10] layer over the impacted fill; • Clean imported (validated) basecourse, only as required based on the engineering specification; and • Pavement material (i.e. concrete) as per engineering specification, or construction of the above ground feature.
Areas with non-continuous hardstand or raised decks (e.g. brick pavers etc.)	Installation of: • Geotextile marker over the impacted fill; • At least 200mm clean imported (validated) capping material; and • Surface finish to required development design

[10] The purpose of the geotextile marker is to provide visual demarcation to the underlying contaminated fill, should the overlying capping layers be disturbed. The client/project manager, remediation contractor and validation consultant are to agree on appropriate materials based on the project requirements.

Area	Capping Specification^
Service trenches	New services installed within impacted fill must be lined with the geotextile (or geogrid) marker at the base and walls and backfilled with clean (validated) material. The marker layer must be overlapped or appropriately fixed to the marker material in the areas adjoining the trench.

^ The capping specification relates to the remediation only and has not considered engineering requirements for the site. Engineering design requirements must be assessed by others in the context of the RAP requirements and the validation consultant must be advised if any aspects of the capping are not achievable or require alternative solutions.

The proposed remediation and validation steps associated with in-situ capping of impacted fill are outlined in the following table.

Table 5-4: Remediation Details – In-situ Capping

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor/principal contractor	Service Trenching, Piling/Footing Excavations and Establishment of Pre-Capping Site Levels: The principal contractor and remediation contractor are to undertake the relevant site preparation works, piling/footing excavations and any excavations required to facilitate the capping procedures. Any surplus excavated materials must be managed and disposed off-site appropriately in accordance with the relevant requirements in Section 5.2.4.
2.	Remediation contractor	Installation of Marker Layers and Survey of site levels: After the bulk excavation levels are achieved to facilitate the minimum capping requirements, the geotextile (or geogrid) marker is to be installed over the impacted fill and secured appropriately using 'U' nails, pegs or other means. A pre-capping levels survey is to be completed by the remediation contractor prior to the placement of any overlying clean capping layers or construction of pavements etc. The purpose of the survey is to provide factual information of the site levels, and the horizontal extent of the geotextile marker, prior to installation of the clean capping layers. Survey points must be taken at appropriate frequencies (say every 5m lineal for narrow areas, a 5m grid for broader areas, at the corners/edges of the geotextile, and more frequently for significant change in surface elevation such as service trenches and tree pits etc). The pre-capping levels survey is to be provided to the client/project manager and the validation consultant prior to any further capping works commencing.
3.	Validation consultant and remediation contractor	Importation of Capping Materials: Imported materials are to be validated in accordance with Section 6. Validated materials can then be used to achieve the minimum capping requirements for the project.
4.	Remediation contractor	Post-Capping Survey of site levels: After completion of capping, a post-capping levels survey is to be completed by the remediation contractor. The purpose of the survey is to provide factual information regarding the capping thickness and confirm that the minimum capping requirements have been achieved.

Step	Primary Role/ Responsibility	Procedure
		Survey points must be taken at appropriate frequencies as noted for the pre-capping survey. The post-capping levels survey is to be provided to the client/project manager and the validation consultant.

5.3 Remediation Documentation

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

- Asbestos management documentation, including all relevant notifications and monitoring reports, and clearance certificates (additional details in this regard are to be outlined in the AMP);
- Photographs of remediation works;
- Waste disposal dockets and waste tracking documentation (see below and the example waste tracking form in Appendix D);
- 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.

5.3.1 Waste

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 (and/or their nominated Class B licensed asbestos removalist) 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). This includes consignment details via the WasteLocate system; 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 documented previously in Section 5.2.4.

A review of the disposal facility's Environment Protection Licence (EPL) issued under the Protection of the Environment Operations (POEO) Act (1997)[11] is to be undertaken to assess whether the facility is appropriately licensed to receive the waste.

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

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 so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

5.3.2 Imported Materials Register

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

Examples of imported materials for this project may include but would not be limited to: site preparation materials (e.g. DGB, 40/70, material to create the pavement base or piling platforms etc); clean capping or backfill material such as virgin excavated natural material (VENM); 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 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 strategies provided. Additional validation sampling may be required based on observations made during remediation.

6.1 Validation Sampling and Documentation

The validation requirements for the site are outlined below:

6.1.1 Validation Requirements – Excavation and offsite Disposal

Table 6-1: Validation Requirements – Excavation and Off-site Disposal of ACM in Fill

Aspect	Sampling	Analysis	Observations and Documentation
Validation of Excavation and Removal of Fill (Section 5.2.4)			
Validation sampling following removal of fill	One sample per 25m^2 of the base of the excavation (i.e. on a 5m by 5m grid, or no more than 5m apart for irregular-shaped excavations where a 5m by 5m grid is not achievable). Any exposed soil at the excavation walls must be sampled every 5m lineal, from each distinct fill profile, or at least one fill sample per vertical metre on the wall (whichever is the greater). Sampling is to included bulk sampling (10L field screening) for asbestos in accordance with the NEPM (2013) procedures.	Any FCF identified during the field screening is to be analysed for asbestos.	Observations to be recorded by the **validation consultant** to document fill/soil lithology on the base and walls of the excavations. A sample location plan is to be prepared by the **validation consultant**. Photographs are to be taken by the **validation consultant**. **LAA** to provide asbestos surface clearance for the base of the remedial excavations. Air monitoring results to be reviewed (where air monitoring is specified under the AMP). Disposal dockets to be retained by the **remediation contractor** and forwarded to validation consultant for inclusion in the validation report. Validated area/remedial excavations to be surveyed by the **remediation contractor** or their chosen sub-contractor.

6.1.2 Validation Requirements – Capping

Table 6-2: Validation Requirements – Capping of Impacted Fill

Aspect	Sampling	Analysis	Observations and Documentation
Capping of Impacted Fill (Section 5.2.5)			
Capping	Not required	Not required	**Validation consultant** to carry out inspections to document the installation of the cap. Key hold points for inspections include: - Geotextile installation; - During importation of materials used to construct the cap; and - Finished surface levels. A photographic record is to be maintained by the **remediation contractor and validation consultant**. Pre- and post-capping surveys are to be undertaken by the **remediation contractor** or their chosen sub-contractor. As-built details for the development are to be documented on as-built drawings by the remediation contractor/principal contractor and provided to the validation consultant. As a minimum these must include: - Pre- and post-capping levels surveys, including surveys of the landscaped areas where all fill is removed, and surveys of the horizontal extent of geofabric; - The location and depth of any underground services; - Finished surface details (e.g. pavements, tiled areas, decks, concrete building floor slab thicknesses etc)

6.1.3 Imported Materials

The table below outlines the validation requirements for material imported onto the site:

Table 6-3: Validation Requirements

Aspect	Sampling	Analysis	Observations and Documentation
Imported Materials – validation of imported materials is required for any materials imported onto the site during the site establishment, remediation and to the point in time that the site validation report is prepared (e.g. general fill to raise the site levels, imported materials to create piling platform, gravels for site preparation, material used for capping layers or to reinstate remedial excavations etc).			
Imported VENM backfill (if required)	Minimum of three samples per source	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml). Additional analysis may be required depending on the site history of the source property.	**Remediation contractor** to supply existing VENM documentation/report (report to be prepared in accordance with the NSW EPA waste classification reporting requirements). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Material is to be inspected upon importation by the **validation consultant** to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Photographic documentation and an inspection log are to be maintained. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing VENM documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the Validation Assessment Criteria (VAC).
Imported engineering materials such as recycled aggregate, road base etc Excavated Natural Material (ENM)	Minimum of three samples per source/material type. ENM testing must meet the specification within the ENM Order. If the analysis is not compliant, the validation consultant	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml quantification). As required in the ENM Order.	**Remediation contractor** to provide product specification and documentation to confirm the material has been classified with reference to a relevant Resource Recovery Order/Exemption. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the facility's EPL, where applicable. Material is to be inspected by the **validation consultant** upon importation to

Aspect	Sampling	Analysis	Observations and Documentation
	must carry out an ENM assessment and prepare a report in accordance with the ENM Order/Exemption prior to material being imported.		confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Imported engineering materials comprising only natural quarried products.	At the validation consultant's discretion based on robustness of supplier documentation.	At the validation consultant's discretion based on robustness of supplier documentation.	**Remediation contractor** to provide documentation from the supplier confirming the material is a product comprising only natural quarried material. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the quarry's EPL. Material is to be inspected by the **validation consultant** upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Imported garden mix/turf underlay/topsoil	Minimum of three samples per source.	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml). Analysis of mulch can be limited to asbestos (500ml) and visual	**Remediation contractor** to provide documentation from the supplier confirming the product specification. This must include a description of the Australian Standard or other relevant product specification under which the material is produced, and the components. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps.

Aspect	Sampling	Analysis	Observations and Documentation
		observations to confirm there are no anthropogenic materials.	Material is to be inspected by the **validation consultant** upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. The validation consultant is to review any existing/available analysis results for the materials. A minimum of one batch for each imported material type (from each individual supplier) must be inspected by the validation consultant. This inspection must be repeated for each material type from each supplier, a minimum of once per month thereafter. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Mulch	Minimum of three samples per source.	Asbestos (500ml).	As above.

6.2 Validation Assessment Criteria and Data Assessment

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

Table 6-4: Validation Assessment Criteria (VAC)

Validation Aspect	VAC
Validation of excavations following fill removal	Quantitative – asbestos must be absent in bulk samples obtained from the base of excavations. Asbestos concentrations in wall samples are to be recorded for factual information to be considered in preparation of the EMP. Qualitative/visual – base of excavation must comprise only natural soil or rock (i.e. not fill) and must be free of visible FCF/suspected asbestos material.
Validation of capping	Validation of capping will occur via a review of survey information, as-built drawings and via the inspection process. The validation report/EMP is to include cross-sections documenting the completed capping details for the various areas of the site.
Imported materials	The validation of imported materials is two-fold: the validation is to demonstrate that the imported material will not pose a risk in the context of the proposed land use; and also, that the imported material meets the requirements where applicable under a relevant resource recovery exemption/order under which they are produced ENM and recycled materials are to meet the criteria of the relevant exemption/order under which they are produced. Analytical results for VENM and other imported materials will need to be consistent with expectations for those materials. For VENM, it is expected that: - Heavy metal concentrations are to be less than the most conservative Added Contaminant Limit (ACL) concentrations for an 'urban residential and public open space' (URPOS) exposure setting presented in Schedule B1 of the NEPM 2013, except for lead which should be less than 104mg/kg; and - Organic compounds are to be less than the laboratory PQLs and asbestos to be absent. The lower lead VAC nominated above is based on the fact that the lead ACL is quite high and is not consistent with expectations for natural material in the area. The concentration of 104mg/kg was sought from the Ambient Background Concentration (ABC) for 'old suburb, low traffic' presented in the document titled Trace Element Concentrations in Soils from Rural and Urban Areas of Australia (1995)[12]. All materials imported onto the site must also be adequately assessed as being appropriate for the final use of the site. A risk-based assessment approach is to be adopted with regards to the tier 1 screening criteria presented in Schedule B1 of NEPM 2013, consistent with the approach taken for the DSI. Aesthetics: all imported materials are to be free of staining and odours.

Laboratory data are to be assessed as above or below the VAC. Statistical analysis is not proposed.

[12] Olszowy, H., Torr, P., and Imray, P., (1995), *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4*. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission

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 should be reflected in the validation report.

DQOs have been broadly established for the validation with regards to the seven-step process outlined NEPM (2013). The seven steps include the following which are detailed further in the following subsections:

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

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

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:

- Were the relevant reports prepared prior to commencement of the remediation (e.g. waste classification, AMP, etc)?
- 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 and what is the implication of this in relation to the remediation/validation and future site management?
- 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;
- Site information, including site observations, inspections, asbestos clearance certificates, waste and imported materials registers;
- Validation sampling and laboratory analysis results for remedial excavations and imported materials;
- Laboratory analysis (as required); and

- Field and laboratory QA/QC data.

6.3.4 Step 4 - Define the Study Boundary

The remediation and validation will be confined to the site boundaries as shown in Figure 2 in Appendix A and will be limited vertically to the depth of fill in the defined remediation areas.

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.

6.3.5.2 Field and Laboratory QA/QC

Field QA/QC is required for imported materials validation. This is to include:

- Analysis of inter-laboratory duplicates (5% frequency) and intra-laboratory duplicates (5% frequency), analysed for the same analytical suite as the primary samples;
- Trip blank samples (one per batch), analysed for the same analytical suite as the primary samples excluding asbestos;
- Trip spike samples (one per batch), analysed for BTEX, only where samples within that batch have been scheduled for analysis of TRH or BTEX; and
- Rinsate samples (one per batch), analysed for the same analytical suite as the primary samples excluding asbestos, only where re-usable sampling equipment is utilised.

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

Field Duplicates

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

Trip Blanks

Acceptable targets for trip blank samples will be less than the PQL.

Trip Spikes

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

Laboratory QA/QC

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

A summary of the typical limits is provided below:

RPDs

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

Laboratory Control Samples (LCS) and Matrix Spikes

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

Surrogate Spikes

- 60-140% recovery acceptable for general organics.

Method Blanks

- All results less than PQL.

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

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. Data will be assessed as above or below the VAC. Statistical analysis is not proposed, therefore there have been no limits on decision errors set for validation purposes.

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. Data collection will be via various methods including inspections and sampling.

The proposed sampling plan for the validation is described in Section 6.1.

6.4 Validation Report and Long-term EMP

As part of the site validation process, a 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 on Contaminated Land (2020)[13] guidelines .

It should also be noted that any material changes to the remediation or validation strategy will require an addendum or revision of the RAP, which in turn must be approved by the client and the consent authority.

A long-term EMP will be required to manage the contamination that is to be capped at the site and the long-term EMP will be documented as part of the overall validation process. Public notification and enforcement mechanisms for the long-term EMP are to be arranged and Snowy Monaro Regional Council is to be provided with a draft copy of the long-term EMP for consultation prior to finalisation of the document.

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

The long-term EMP will include requirements for passive management of the capping system that will focus on maintaining the capping layers to minimise the potential of exposure to the underlying fill. The long-term EMP will also include contingencies for managing intrusive works in the event that the capping system is breached.

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

7 CONTINGENCY PLAN

The contingency plan for contamination-related aspects of the project and site remediation is provided in the following sub-sections:

7.1 Complete Fill Removal from Landscaped Areas Impracticable/Unachievable

In the event that all fill cannot be completely removed from landscaped areas, the fill in these areas must be capped with a robust capping layer and consequently the areas will be managed under the EMP. The minimum capping requirements in such a circumstance are as follows:

- Installation of a geotextile marker layer over the fill;
- Installation of a minimum of 500mm of clean (validated) materials; and
- No new tree plantings can occur in these areas. Plantings must be limited to shallow plantings of small shrubs above the marker layer, or alternatively, the areas could be mulched or turfed at the surface.

The remediation and validation requirements outlined in Table 5-4 and Section 6 respectively must be applied in this scenario.

7.2 Validation Failure for Excavation and Off-site Disposal Remediation

Considering the contaminant of concern (i.e. asbestos) and the simplicity of the proposed remediation strategy, the potential for the remediation strategy to fail is considered to be low. In the event of validation failure in the asbestos remedial excavations, additional material can either be 'chased out' and disposed off-site, then the area re-validated. Or alternatively, the area can be considered contaminated with asbestos capped appropriately in accordance with Section 7.1 above, then managed under the EMP.

7.3 Unexpected Finds

Residual hazards that may exist at the site would generally be expected to be detectable through visual or olfactory means. At this site, these types of hazards may include odorous or stained hydrocarbon impacted soils, underground tanks, suspected friable types of asbestos 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 should cease and the remediation contractor should 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 to inspect the find;
- The validation consultant is to adequately characterise the contamination and provide advice in relation to site management and remediation. In the event that remediation differs from that outlined in this RAP, an addendum RAP must be prepared in consultation with the project stakeholders and submitted to the consent authority; and
- Contamination should be remediated and validated in accordance with the advice provided, and the results are to be included in the validation report.

7.4 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.

7.5 Remediation Strategy Changes

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

8 SITE MANAGEMENT PLAN FOR REMEDIATION WORKS

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

8.1 Asbestos Management Plan

Prior to the commencement of any soil disturbance at the site, a construction-phase AMP is to be prepared as noted previously. The AMP is to be implemented by the remediation contractor (and their nominated subcontractors where relevant) throughout the remediation.

8.1 Interim Site Management

All observed, surficial fragments of ACM were removed from the site by JKE during the previous investigation, however it is noted that fibre cement sheets (suspected of containing asbestos) were being stored on the site. The site is operational and interim management of the site for the potential occurrence of asbestos is required. An interim AMP for ongoing and normal use of the site as part of the wider hospital grounds should be prepared and implemented prior to the commencement of construction to fulfill the hospital's requirement to have an AMP in place under the WHS Regulation (2017).

8.2 Project Contacts

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

Table 8-1: Project Contacts

Role	Company	Contact Details
Client	Health Infrastructure	TBC
Project Manager	Central West Project Management	Contact: Jessica Cooper Phone: 0400 683 842 Email: Jessica.Cooper@cwpm.com.au
Principal Contractor	To be appointed	-
Remediation Contractor	To be appointed	-
Validation Consultant	To be appointed	-
Certifier	To be appointed	-
NSW EPA	Pollution Line	131 555

Role	Company	Contact Details
Emergency Services	Ambulance, Police, Fire	000

8.3 Security

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

8.4 Timing and Sequencing of Remediation Works

The anticipated sequence of remediation works is outlined at the beginning of Section 5 of this RAP. Remediation will occur concurrently with the development works to facilitate the implementation of the requirements under this RAP.

The client must engage with the consent authority so that the conditions in the development approval/consent align with the sequence of works and requirements of the RAP. Notably, remediation requires completion of construction as parts of the constructed development (e.g. the building floor slab etc) will form the cap.

8.5 Site Soil and Water Management Plan, and On-Site Material Tracking Plan

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

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

8.6 Noise and Vibration Control Plan

The guidelines for minimisation of noise on construction sites outlined in AS-2460 (2002)[14] should be adopted. Other measures specified in the consent conditions should also be complied with. Noise producing machinery and equipment should only be operated between the hours approved by the consent authority (refer to consent documents).

All practicable measures should be taken to reduce the generation of noise and vibration to within acceptable limits. In the event that short-term noisy operations are necessary, and where these are likely to affect

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

residences, notifications should be provided to the relevant authorities and the residents by the project manager, specifying the expected duration of the noisy works.

8.7 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 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.

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.

Reference is also to be made to the AMP in this regard.

8.8 Dewatering

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

8.9 Air Monitoring

Air monitoring details must be outlined as part of the AMP to be prepared for the site. 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.

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

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

8.12 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the remediation contractor should develop a waste management plan to minimise the amount of waste produced from the site and promote recycling of building materials such as concrete pavement to the extent practicable, but with due consideration to the asbestos impacts in fill.

8.13 Incident Management Contingency

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

8.14 Hours of Operation

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

8.15 Community Consultation and Complaints

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

9 CONCLUSION

Investigations at the site have identified the occurrence of asbestos in the form of bonded/non-friable ACM on/in fill and at the ground surface. The proposed remediation strategies for the impacted fill include a combination of excavation and off-site disposal of contaminated fill/soil to a suitably licensed landfill, and in-situ capping and long-term management of the capped areas via an EMP.

The anticipated sequence of remediation works is outlined at the beginning of Section 5 of this RAP. Remediation will occur concurrently with the development works 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. Notably, remediation requires completion of construction as parts of the constructed development (e.g. the building floor slab etc) will form the cap.

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. An EMP will also be prepared to manage the asbestos impacted fill capped on site as part of the remediation. The EMP will provide a passive management approach and is not expected to impose onerous constraints on the day-to-day site use under the proposed development scenario.

The RAP has met the objectives outlined in Section 1.2.

9.1 Remediation Category

The remediation category should be confirmed by the client's expert planner. Based on our initial assessment, we consider the remediation falls under Category 2 with regards to Clause 4.11 of SEPP Resilience and Hazards 2021.

9.2 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	On the basis that the remediation is Category 2, at least 30 days prior notice must be provided to Snowy Monaro Regional Council prior to the commencement of remediation, with regards to Clause 4.13 of SEPP Resilience and Hazards 2021. A notice of completion of remediation work is to be given to Snowy Monaro Regional Council within 30 days of completion of the work, in accordance with Clauses 4.14 and 4.15 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.

Guideline / Legislation / Policy	Applicability
	Appropriate waste tracking is required for all waste that is disposed off-site. Activities should be carried out in a manner which does not result in the pollution of waters.
POEO (Waste) Regulation 2014	Part 7 of the POEO Waste Regulation 2014 set outs the requirements for the transportation and management of asbestos waste and Clause 79 of the POEO Waste Regulation requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10 square meters of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use WasteLocate.
Work Health and Safety Regulation (2017)	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.
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 asbestos removal works or handling (e.g. Class B).
NSW EPA Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997	The requirement to notify the EPA should be assessed as part of the site validation process. The need to notify will be largely dependent on the asbestos air monitoring results during the remediation.

10 LIMITATIONS

The report limitations are outlined below:

- JKG 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 JKG proposal; and terms of contract between JKG 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, JKG has not undertaken any verification process, except where specifically stated in the report;
- JKG 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;
- JKG 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;
- JKG 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. JKG 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 JKG 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 JKG 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.

JKG 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 JKG 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

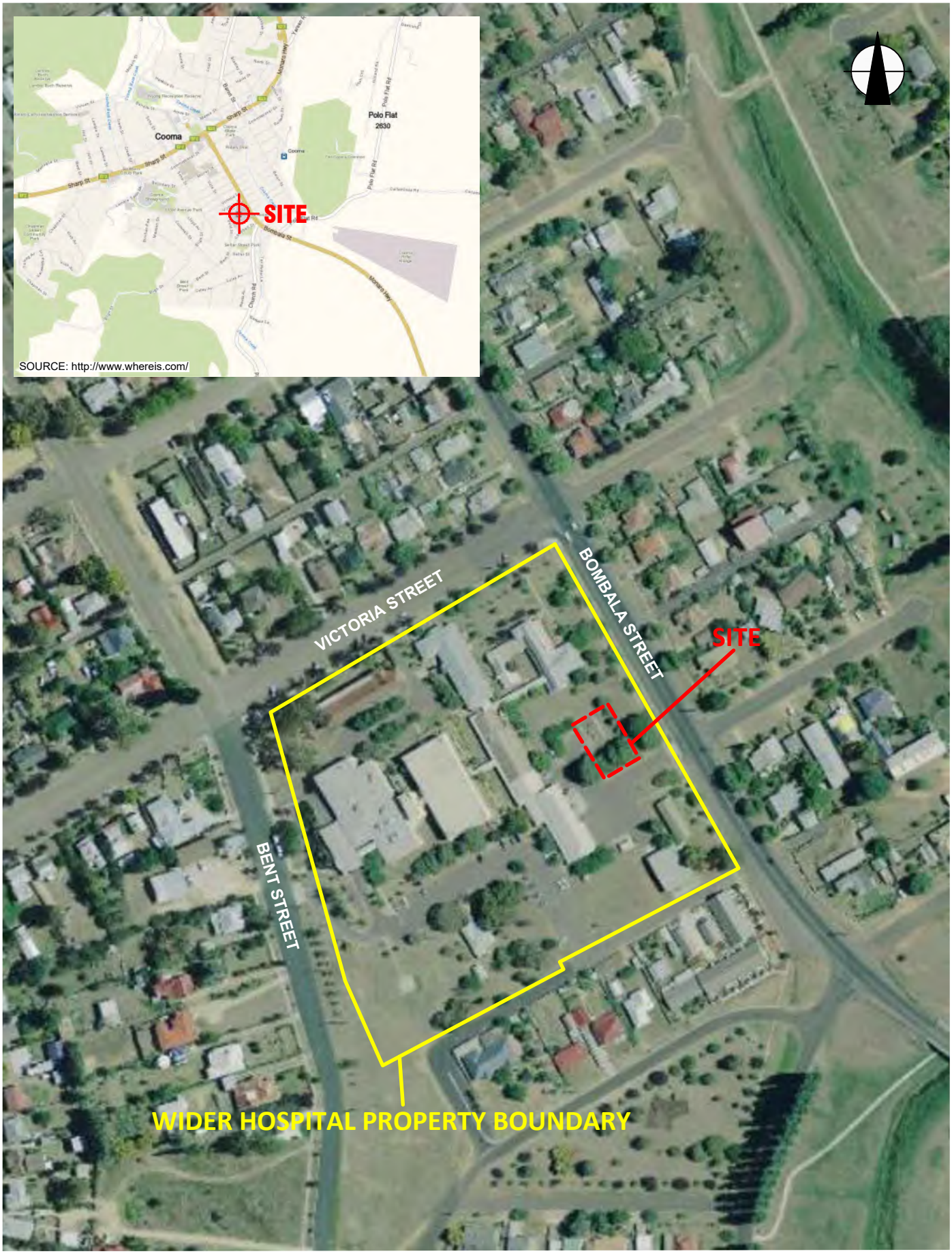
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other 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.SIX.NSW.GOV.AU

This plan should be read in conjunction with the JK Geotechnics report.

Title: **SITE LOCATION PLAN**

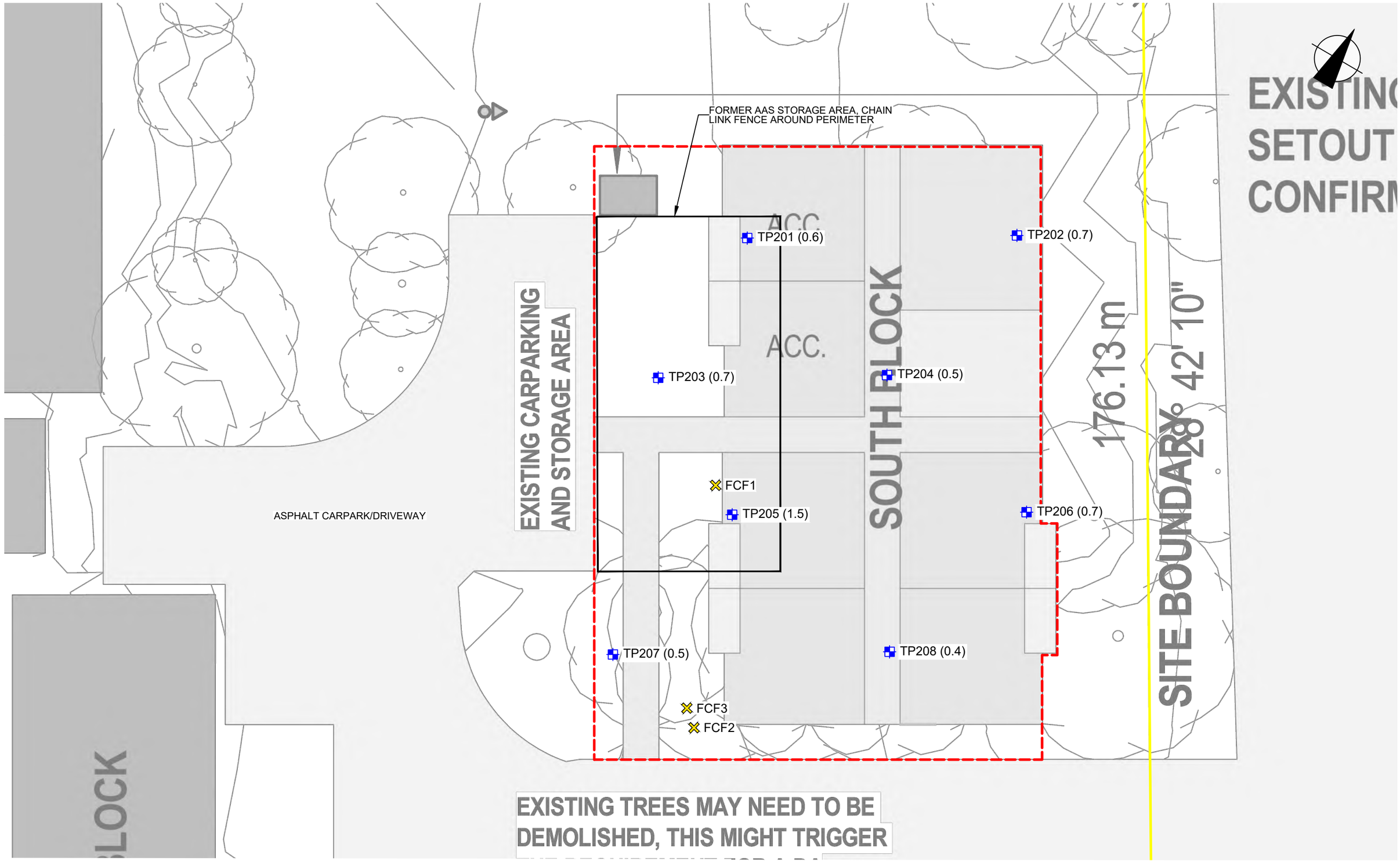
Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Report No: E30596PT

Figure No: 1

JKGeotechnics

PLOT DATE: 15/11/2022 11:10:57 AM DWG FILE: K:\5C EIS JOBS\30000'S\E30596K COOMA HOSPITAL\CAD\E30596PTE30596PT.DWG



LEGEND

APPROXIMATE SITE BOUNDARY	
APPROXIMATE WIDER PROPERTY BOUNDARY	
TP201 (Fill Depth)	TEST PIT LOCATION, NUMBER AND DEPTH OF FILL (m)
FCF(Surface)	FIBRE CEMENT FRAGMENT LOCATION, NUMBER AND DEPTH (Surface/m)

0 2 4 6 8 10

SCALE 1:200 @A3 METRES

This plan should be read in conjunction with the JK Geotechnics report.

Title: **SAMPLE LOCATION PLAN**

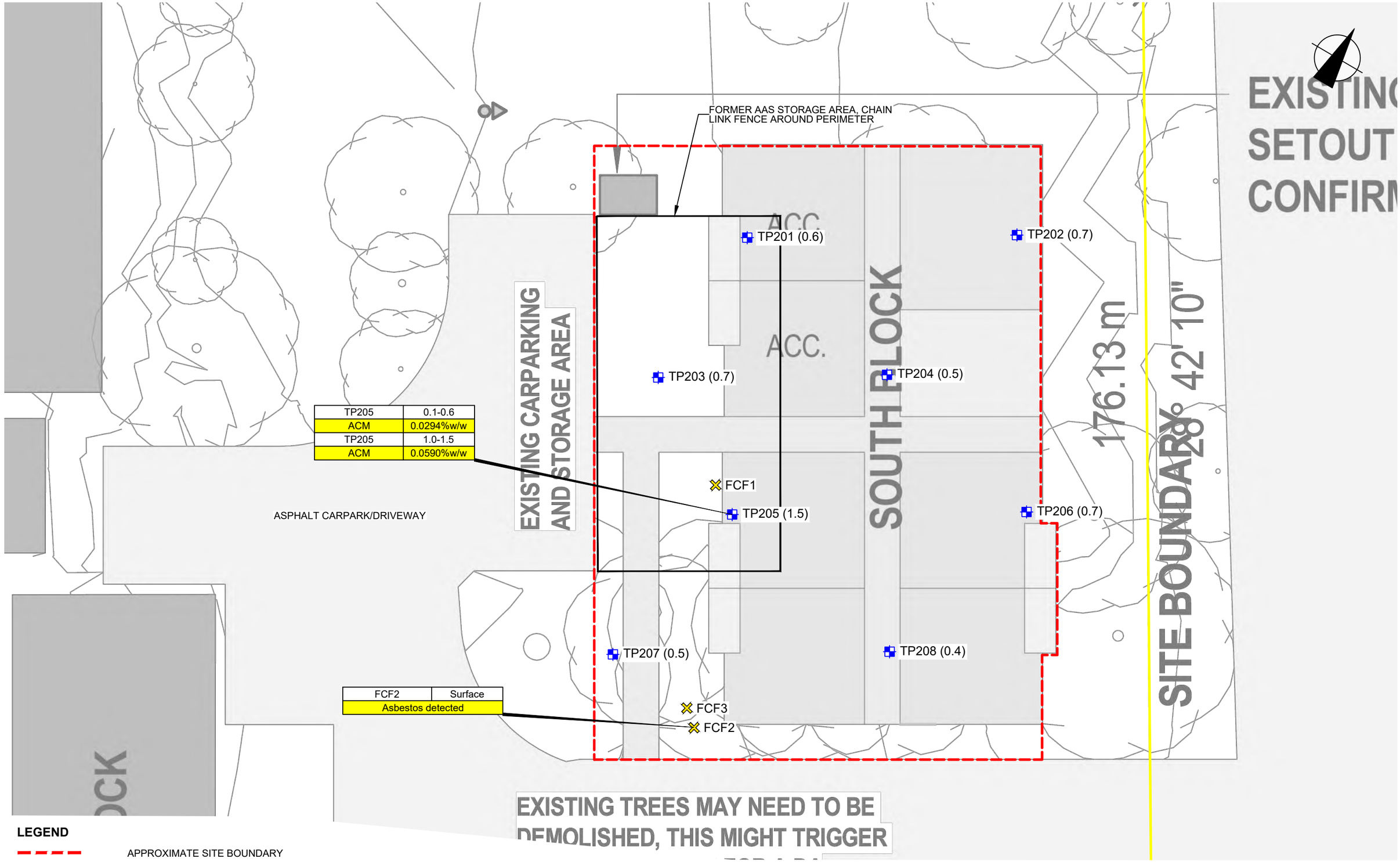
Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Report No: E30596PT

Figure No: 2

JKGeotechnics

PLOT DATE: 13/12/2022 3:46:38 PM DWG FILE: K:\5C EIS JOBS\30000\SIE30596K COOMA HOSPITAL\CAD\E30596PT\E30596PT.DWG



LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- TP201 (Fill Depth) — TEST PIT LOCATION, NUMBER AND DEPTH OF FILL (m)
- FCF(Surface) — FIBRE CEMENT FRAGMENT LOCATION, NUMBER AND DEPTH (Surface/m)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK

0 2 4 6 8 10

SCALE 1:200 @A3 METRES

This plan should be read in conjunction with the JK Geotechnics report.

Title: **SAC EXCEEDANCE PLAN**

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Report No: E30596PT

Figure No: 3

JKGeotechnics

PLOT DATE: 13/12/2022 3:47:05 PM DWG FILE: K:\SC EIS JOBS\30000\SIE30596K COOMA HOSPITAL\CAD\E30596PT\E30596PT.DWG

Appendix B: Proposed Development Plan

Proposed
Cooma Stage 2

SOUTH BLOCK - GROUND

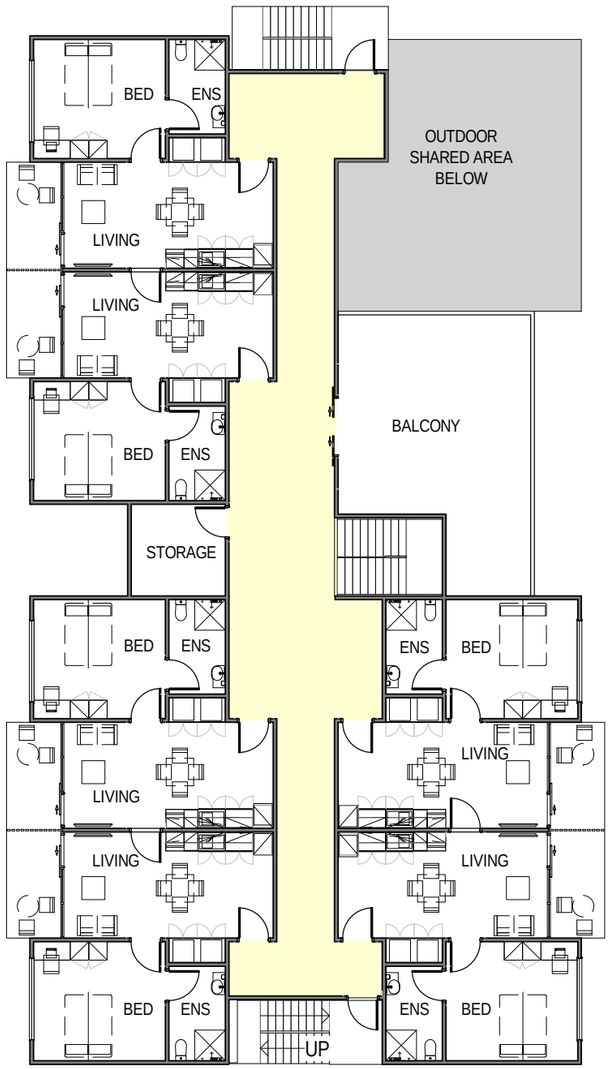
Project Number **10599**

COOMA KWA

Scale **1 : 200@A3** Date **26/07/22** Drawing Number **A20-002**

DATE: 26/07/2022 5:35:19 PM

SILVER THOMAS HANLEY



Proposed
Cooma Stage 2

SOUTH BLOCK - LEVEL 01

Project Number **10599**

COOMA KWA

Scale **1 : 200@A3** Date **26/07/22** Drawing Number **A20-003**

SILVER THOMAS HANLEY

DATE: 26/07/2022 5:35:13 PM

Appendix C: JK DSI Data Summary

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ABC:	Ambient Background Concentration
ACM:	Asbestos Containing Material
ADWG:	AustralianDrinking Water Guidelines
AF:	Asbestos Fines
ANZG	Australian and New Zealand Guidelines
B(a)P:	Benzo(a)pyrene
CEC:	Cation Exchange Capacity
CRC:	Cooperative Research Centre
CT:	Contaminant Threshold
EILs:	Ecological Investigation Levels
ESLs:	Ecological Screening Levels
FA:	Fibrous Asbestos
GIL:	Groundwater Investigation Levels
GSW:	General Solid Waste
HILs:	Health Investigation Levels
HSLs:	Health Screening Levels
HSL-SSA:	Health Screening Level-SiteSpecific Assessment
kg/L	kilograms per litre
NA:	Not Analysed
NC:	Not Calculated
NEPM:	National Environmental Protection Measure
NHMRC:	National Health and Medical Research Council
NL:	Not Limiting
NSL:	No Set Limit
OCP:	Organochlorine Pesticides
OPP:	Organophosphorus Pesticides
PAHs:	Polycyclic Aromatic Hydrocarbons
%w/w:	weight per weight
ppm:	Parts per million
PCBs:	Polychlorinated Biphenyls
PCE:	Perchloroethylene (Tetrachloroethylene or Teterachloroethene)
pH_{KCL} :	pH of filtered 1:20, 1M KCL extract, shaken overnight
pH_{ox} :	pH of filtered 1:20 1M KCl after peroxide digestion
PQL:	Practical Quantitation Limit
RS:	Rinsate Sample
RSL:	Regional Screening Levels
RSW:	Restricted Solid Waste
SAC:	Site Assessment Criteria
SCC:	Specific Contaminant Concentration
S_{Cr}:	Chromium reducible sulfur
S_{POS}:	Peroxide oxidisable Sulfur
SSA:	Site Specific Assessment
SSHSLs:	Site Specific Health Screening Levels
TAA:	Total Actual Acidity in 1M KCL extract titrated to pH6.5
TB:	Trip Blank
TCA:	1,1,1 Trichloroethane (methyl chloroform)
TCE:	Trichloroethylene (Trichloroethene)
TCLP:	Toxicity Characteristics Leaching Procedure
TPA:	Total Potential Acidity, 1M KCL peroxide digest
TS:	Trip Spike
TRH:	Total Recoverable Hydrocarbons
TSA:	Total Sulfide Acidity (TPA-TAA)
UCL:	Upper Level Confidence Limit on Mean Value
USEPA	United States Environmental Protection Agency
VOCC:	Volatile Organic Chlorinated Compounds
WHO:	World Health Organisation

Table Specific Explanations:

HIL Tables:

- The chromium results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
- Carcinogenic PAHs is a toxicity weighted sum of analyte concentrations for a specific list of PAH compounds relative to B(a)P. It is also refered to as the B(a)P Toxic Equivalence Quotient (TEQ).
- Statistical calculations are undertaken using ProUCL (USEPA). Statistical calculation is usually undertaken using data from fill samples.

EIL/ESL Table:

- ABC Values for selected metals have been adopted from the published background concentrations presented in Olszowy et. al., (1995), Trace Element Concentrations in Soils from Rural and Urban New South Wales (the 25th percentile values for old suburbs with low traffic have been quoted).

Waste Classification and TCLP Table:

- Data assessed using the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014).
- The assessment of Total Moderately Harmful pesticides includes: Dichlorovos, Dimethoate, Fenitrothion, Ethion, Malathion and Parathion.
- Assessment of Total Scheduled pesticides include: HBC, alpha-BHC, gamma-BHC, beta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, gamma-Chlordane, alpha-chlordane, pp-DDE, Dieldrin, Endrin, pp-DDD, pp-DDT, Endrin Aldehyde.

QA/QC Table:

- Field blank, Inter and Intra laboratory duplicate results are reported in mg/kg.
- Trip spike results are reported as percentage recovery.
- Field rinsate results are reported in µg/L.

TABLE S1
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013.
HIL-A: 'Residential with garden/accessible soils; children's day care centers; preschools; and primary schools'

All data in mg/kg unless stated otherwise			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)	TOTAL PCBs	ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	Carcinogenic PAHs	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos		
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC)			100	20	100	6000	300	40	400	7400	300	3	10	270	300	6	50	240	6	160	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
TP201	0-0.1	F: Silty Clay	<4	<0.4	**43**	**30**	**41**	**0.1**	**50**	**70**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP201 - [LAB_DUP]	0-0.1	F: Silty Clay	<4	<0.4	**45**	**34**	**50**	**0.1**	**58**	**81**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
TP201	1.0-1.2	XW Granite	<4	<0.4	**42**	**22**	**14**	**0.4**	**18**	**55**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP202	0-0.1	F: Silty Clay	<4	<0.4	**47**	**43**	**38**	**0.3**	**23**	**92**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP203	0-0.1	F: Silty Sandy Gravel	<4	<0.4	**29**	**17**	**51**	<0.1	**28**	**53**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP203	0.4-0.6	F: Silty Clay	<4	<0.4	**35**	**59**	**24**	**0.3**	**16**	**77**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP203	1.0-1.2	Silty clay	<4	<0.4	**65**	**33**	**13**	**0.1**	**31**	**52**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP204	0-0.1	F: Silty Clay	<4	<0.4	**38**	**19**	**23**	**0.1**	**17**	**86**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP205	0-0.1	F: Silty Clay	<4	<0.4	**42**	**19**	**23**	<0.1	**20**	**55**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP205	1.0-1.2	F: Silty Clay	<4	<0.4	**39**	**17**	**17**	**0.2**	**18**	**52**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP206	0-0.1	F: Silty Clay	<4	<0.4	**47**	**25**	**25**	**0.2**	**34**	**97**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP207	0-0.1	F: Silty Clay	<4	<0.4	**38**	**17**	**10**	<0.1	**17**	**37**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP207	0.8-1.0	Silty clay	<4	<0.4	**38**	**18**	**8**	<0.1	**17**	**28**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP208	0-0.1	F: Silty Clay	<4	<0.4	**36**	**15**	**10**	<0.1	**16**	**40**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
TP208	0.6-0.8	Silty clay	<4	<0.4	**51**	**24**	**10**	<0.1	**23**	**39**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP1	-	TP205 0-0.1	<4	<0.4	**43**	**19**	**16**	<0.1	**20**	**54**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
SDUP1 - [LAB_DUP]	-	TP205 0-0.1	<4	<0.4	**41**	**18**	**18**	<0.1	**19**	**53**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
SDUP2	-	TP201 0-0.1	<4	<0.4	**53**	**37**	**60**	**0.1**	**59**	**86**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
SDUP2 - [LAB_DUP]	-	TP201 0-0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	NA	NA
FCF1	Surface	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
FCF2	Surface	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
TP205-FCF1	0.1-0.6	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
TP205-FCF2	1.0-1.5	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
TP205-FCF3	1.0-1.5	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
Total Number of Samples			18	18	18	18	18	18	18	18	18	18	13	13	13	13	13	13	13	12	12	13
Maximum Value			<PQL	<PQL	65	59	60	0.4	59	97	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	Detected

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S2
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	$>C_{10}$-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Field PID Measurement
PQL - Envirolab Services					25	50	0.2	0.5	1	1	1	ppm
NEPM 2013 HSL Land Use Category					**HSL-A/B: LOW/HIGH DENSITY RESIDENTIAL**							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
TP201	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.9
TP201 - [LAB_DUP]	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.9
TP201	1.0-1.2	XW Granite	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.5
TP202	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.5
TP203	0-0.1	F: Silty Sandy Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.7
TP203	0.4-0.6	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	1
TP203	1.0-1.2	Silty clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.8
TP204	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.8
TP205	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.3
TP205	1.0-1.2	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.9
TP206	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.4
TP207	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	0.6
TP207	0.8-1.0	Silty clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	2.3
TP208	0-0.1	F: Silty Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	1
TP208	0.6-0.8	Silty clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	3.4
SDUP1	-	TP205 0-0.1	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	-
SDUP1 - [LAB_DUP]	-	TP205 0-0.1	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	-
SDUP2	-	TP201 0-0.1	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	-
SDUP2 - [LAB_DUP]	-	TP201 0-0.1	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<1	<1	-
Total Number of Samples					19	19	19	19	19	19	19	15
Maximum Value					<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	3.4

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the concentration above the SAC is highlighted in grey in the Site Assessment Criteria Table below

HSL SOIL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	$>C_{10}$-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
TP201	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP201 - [LAB_DUP]	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP201	1.0-1.2	XW Granite	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP202	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP203	0-0.1	F: Silty Sandy Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP203	0.4-0.6	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP203	1.0-1.2	Silty clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP204	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP205	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP205	1.0-1.2	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP206	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP207	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP207	0.8-1.0	Silty clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP208	0-0.1	F: Silty Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
TP208	0.6-0.8	Silty clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP1	-	TP205 0-0.1	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP1 - [LAB_DUP]	-	TP205 0-0.1	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP2	-	TP201 0-0.1	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP2 - [LAB_DUP]	-	TP201 0-0.1	0m to <1m	Sand	45	110	0.5	160	55	40	3

TABLE S3
SOIL LABORATORY RESULTS COMPARED TO MANAGEMENT LIMITS
All data in mg/kg unless stated otherwise

			C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
PQL - Envirolab Services			25	50	100	100
NEPM 2013 Land Use Category			**RESIDENTIAL, PARKLAND & PUBLIC OPEN SPACE**			
Sample Reference	**Sample Depth**	**Soil Texture**				
TP201	0-0.1	Fine	<25	<50	**190**	<100
TP201 - [LAB_DUP]	0-0.1	Fine	<25	<50	**210**	<100
TP201	1.0-1.2	Fine	<25	<50	<100	<100
TP202	0-0.1	Fine	<25	<50	<100	<100
TP203	0-0.1	Fine	<25	<50	<100	<100
TP203	0.4-0.6	Fine	<25	<50	<100	<100
TP203	1.0-1.2	Fine	<25	<50	<100	<100
TP204	0-0.1	Fine	<25	<50	<100	<100
TP205	0-0.1	Fine	<25	<50	**190**	<100
TP205	1.0-1.2	Fine	<25	<50	<100	<100
TP206	0-0.1	Fine	<25	<50	**110**	<100
TP207	0-0.1	Fine	<25	<50	<100	<100
TP207	0.8-1.0	Fine	<25	<50	<100	<100
TP208	0-0.1	Fine	<25	<50	<100	<100
TP208	0.6-0.8	Fine	<25	<50	<100	<100
SDUP1	-	Fine	<25	<50	**100**	<100
SDUP1 - [LAB_DUP]	-	Fine	<25	<50	**120**	<100
SDUP2	-	Fine	<25	<50	**200**	**150**
SDUP2 - [LAB_DUP]	-	Fine	<25	<50	**210**	**170**
Total Number of Samples			19	19	19	19
Maximum Value			<PQL	<PQL	210	170

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

MANAGEMENT LIMIT ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Soil Texture**	C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
TP201	0-0.1	Fine	800	1000	3500	10000
TP201 - [LAB_DUP]	0-0.1	Fine	800	1000	3500	10000
TP201	1.0-1.2	Fine	800	1000	3500	10000
TP202	0-0.1	Fine	800	1000	3500	10000
TP203	0-0.1	Fine	800	1000	3500	10000
TP203	0.4-0.6	Fine	800	1000	3500	10000
TP203	1.0-1.2	Fine	800	1000	3500	10000
TP204	0-0.1	Fine	800	1000	3500	10000
TP205	0-0.1	Fine	800	1000	3500	10000
TP205	1.0-1.2	Fine	800	1000	3500	10000
TP206	0-0.1	Fine	800	1000	3500	10000
TP207	0-0.1	Fine	800	1000	3500	10000
TP207	0.8-1.0	Fine	800	1000	3500	10000
TP208	0-0.1	Fine	800	1000	3500	10000
TP208	0.6-0.8	Fine	800	1000	3500	10000
SDUP1	-	Fine	800	1000	3500	10000
SDUP1 - [LAB_DUP]	-	Fine	800	1000	3500	10000
SDUP2	-	Fine	800	1000	3500	10000
SDUP2 - [LAB_DUP]	-	Fine	800	1000	3500	10000

TABLE S4
SOIL LABORATORY RESULTS COMPARED T0 DIRECT CONTACT CRITERIA
All data in mg/kg unless stated otherwise

Analyte		C_6-C_{10}	>C_{10}-C_{16}	>C_{16}-C_{34}	>C_{34}-C_{40}	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services		25	50	100	100	0.2	0.5	1	1	1	
CRC 2011 -Direct contact Criteria		4,400	3,300	4,500	6,300	100	14,000	4,500	12,000	1,400	
Site Use		**RESIDENTIAL WITH ACCESSIBLE SOIL- DIRECT SOIL CONTACT**									
Sample Reference	**Sample Depth**										
TP201	0-0.1	<25	<50	**190**	<100	<0.2	<0.5	<1	<1	<1	**0.9**
TP201 - [LAB_DUP]	0-0.1	<25	<50	**210**	<100	<0.2	<0.5	<1	<1	<1	**0.9**
TP201	1.0-1.2	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.5**
TP202	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.5**
TP203	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.7**
TP203	0.4-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**1**
TP203	1.0-1.2	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.8**
TP204	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.8**
TP205	0-0.1	<25	<50	**190**	<100	<0.2	<0.5	<1	<1	<1	**0.3**
TP205	1.0-1.2	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.9**
TP206	0-0.1	<25	<50	**110**	<100	<0.2	<0.5	<1	<1	<1	**0.4**
TP207	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**0.6**
TP207	0.8-1.0	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**2.3**
TP208	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**1**
TP208	0.6-0.8	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<1	**3.4**
SDUP1	-	<25	<50	**100**	<100	<0.2	<0.5	<1	<1	<1	
SDUP1 - [LAB_DUP]	-	<25	<50	**120**	<100	<0.2	<0.5	<1	<1	<1	
SDUP2	-	<25	<50	**200**	**150**	<0.2	<0.5	<1	<1	<1	NA
SDUP2 - [LAB_DUP]	-	<25	<50	**210**	**170**	<0.2	<0.5	<1	<1	<1	
Total Number of Samples		19	19	19	19	19	19	19	19	19	15
Maximum Value		<PQL	<PQL	210	170	<PQL	<PQL	<PQL	<PQL	<PQL	3.4

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S5
ASBESTOS QUANTIFICATION - FIELD OBSERVATIONS AND LABORATORY RESULTS
HSL-A: Residential with garden/accessible soils; children's day care centers; preschools; and primary schools

FIELD DATA															LABORATORY DATA											
Date Sampled	Sample reference	Sample Depth	Visible ACM in top 100mm	Approx. Volume of Soil (L)	Soil Mass (g)	Mass ACM (g)	Mass Asbestos in ACM (g)	[Asbestos from ACM in soil] (%w/w)	Mass ACM <7mm (g)	Mass Asbestos in ACM <7mm (g)	[Asbestos from ACM <7mm in soil] (%w/w)	Mass FA (g)	Mass Asbestos in FA (g)	[Asbestos from FA in soil] (%w/w)	Lab Report Number	Sample refeference	Sample Depth	Sample Mass (g)	Asbestos ID in soil (AS4964) >0.1g/kg	Trace Analysis	Total Asbestos (g/kg)	Asbestos ID in soil <0.1g/kg	ACM >7mm Estimation (g)	FA and AF Estimation (g)	ACM >7mm Estimation %(w/w)	FA and AF Estimation %(w/w)
SAC			**No**					**0.01**			**0.001**			**0.001**											**0.01**	**0.001**
17/11/2022	TP201	0.0-0.1	No	10	10,390	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP201	0-0.1	704.19	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP201	0.1-0.6	NA	10	10,560	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP202	0.0-0.1	No	10	10,250	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP202	0-0.1	669.01	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP202	0.1-0.6	NA	10	10,720	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP203	0.0-0.1	No	10	10,910	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP203	0-0.1	778.54	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP203	0.1-0.7	NA	10	11,200	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP204	0.0-0.1	No	10	11,490	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP204	0-0.1	640.06	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP204	0.1-0.5	NA	10	10,720	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP205	0.0-0.1	No	10	12,560	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP205	0-0.1	653.3	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP205	0.1-0.6	NA	10	10,290	20.2	3.027	0.0294	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP205	0.6-1.0	NA	10	10,530	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP205	1.0-1.5	NA	10	11,350	44.6	6.696	0.0590	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP206	0.0-0.1	No	10	10,190	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP206	0-0.1	545.92	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP206	0.1-0.7	NA	10	10,850	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP207	0.0-0.2	No	10	13,210	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP207	0-0.1	809.06	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP207	0.2-0.5	NA	10	10,070	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17/11/2022	TP208	0.0-0.2	No	10	13,230	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	311057	TP208	0-0.1	801.37	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
17/11/2022	TP208	0.2-0.4	NA	10	10,440	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Concentration above the SAC **VALUE**

TABLE S6
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013 EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																		
							AGED HEAVY METALS-EILs						EILs		ESLs							
				pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	1	0.1	25	50	100	100	0.2	0.5	1	1	0.05
Ambient Background Concentration (ABC)				-	-	-	NSL	8	18	104	5	77	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																			
TP201	0-0.1	F: Silty Clay	Fine	**7.5**	**42**	NA	<4	**43**	**30**	**41**	**50**	**70**	<1	<0.1	<25	<50	**190**	<100	<0.2	<0.5	<1	<1	<0.05
TP201 - [LAB_DUP]	0-0.1	F: Silty Clay	Fine	**7.5**	**42**	NA	<4	**45**	**34**	**50**	**58**	**81**	<1	<0.1	<25	<50	**210**	<100	<0.2	<0.5	<1	<1	<0.05
TP201	1.0-1.2	XW Granite	Fine	NA	NA	NA	<4	**42**	**22**	**14**	**18**	**55**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP202	0-0.1	F: Silty Clay	Fine	NA	NA	NA	<4	**47**	**43**	**38**	**23**	**92**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP203	0-0.1	F: Silty Sandy Gravel	Fine	NA	NA	NA	<4	**29**	**17**	**51**	**28**	**53**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP203	0.4-0.6	F: Silty Clay	Fine	NA	NA	NA	<4	**35**	**59**	**24**	**16**	**77**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP203	1.0-1.2	Silty clay	Fine	NA	NA	NA	<4	**65**	**33**	**13**	**31**	**52**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP204	0-0.1	F: Silty Clay	Fine	NA	NA	NA	<4	**38**	**19**	**23**	**17**	**86**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP205	0-0.1	F: Silty Clay	Fine	NA	NA	NA	<4	**42**	**19**	**23**	**20**	**55**	<1	<0.1	<25	<50	**190**	<100	<0.2	<0.5	<1	<1	<0.05
TP205	1.0-1.2	F: Silty Clay	Fine	NA	NA	NA	<4	**39**	**17**	**17**	**18**	**52**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP206	0-0.1	F: Silty Clay	Fine	NA	NA	NA	<4	**47**	**25**	**25**	**34**	**97**	<1	<0.1	<25	<50	**110**	<100	<0.2	<0.5	<1	<1	<0.05
TP207	0-0.1	F: Silty Clay	Fine	NA	NA	NA	<4	**38**	**17**	**10**	**17**	**37**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP207	0.8-1.0	Silty clay	Fine	NA	NA	NA	<4	**38**	**18**	**8**	**17**	**28**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP208	0-0.1	F: Silty Clay	Fine	NA	NA	NA	<4	**36**	**15**	**10**	**16**	**40**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
TP208	0.6-0.8	Silty clay	Fine	NA	NA	NA	<4	**51**	**24**	**10**	**23**	**39**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.05
SDUP1	-	TP205 0-0.1	Fine	NA	NA	NA	<4	**43**	**19**	**16**	**20**	**54**	<1	<0.1	<25	<50	**100**	<100	<0.2	<0.5	<1	<1	<0.05
SDUP1 - [LAB_DUP]	-	TP205 0-0.1	Fine	NA	NA	NA	<4	**41**	**18**	**18**	**19**	**53**	<1	<0.1	<25	<50	**120**	<100	<0.2	<0.5	<1	<1	<0.05
SDUP2	-	TP201 0-0.1	Fine	**7.5**	**42**	NA	<4	**53**	**37**	**60**	**59**	**86**	<1	<0.1	<25	<50	**200**	**150**	<0.2	<0.5	<1	<1	<0.05
SDUP2 - [LAB_DUP]	-	TP201 0-0.1	Fine	**7.5**	**42**	NA	NA	NA	NA	NA	NA	NA	<1	<0.1	<25	<50	**210**	**170**	<0.2	<0.5	<1	<1	NA
Total Number of Samples				4	4	0	18	18	18	18	18	18	19	13	19	19	19	19	19	19	19	19	18
Maximum Value				7.5	42	NA	<PQL	65	59	60	59	97	<PQL	<PQL	<PQL	<PQL	210	170	<PQL	<PQL	<PQL	<PQL	<PQL

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

EIL AND ESL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**	pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
TP201	0-0.1	F: Silty Clay	Fine	7.5	42	NA	100	200	250	1200	560	1400	170	180	180	120	1300	5600	65	105	125	45	20
TP201 - [LAB_DUP]	0-0.1	F: Silty Clay	Fine	7.5	42	NA	100	200	250	1200	560	1400	170	180	180	120	1300	5600	65	105	125	45	20
TP201	1.0-1.2	XW Granite	Fine	NA	NA	NA	100	200	80	1200	35	150	170	--	180	120	1300	5600	65	105	125	45	20
TP202	0-0.1	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
TP203	0-0.1	F: Silty Sandy Gravel	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
TP203	0.4-0.6	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	--	180	120	1300	5600	65	105	125	45	20
TP203	1.0-1.2	Silty clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	--	180	120	1300	5600	65	105	125	45	20
TP204	0-0.1	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
TP205	0-0.1	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
TP205	1.0-1.2	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	--	180	120	1300	5600	65	105	125	45	20
TP206	0-0.1	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
TP207	0-0.1	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
TP207	0.8-1.0	Silty clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	--	180	120	1300	5600	65	105	125	45	20
TP208	0-0.1	F: Silty Clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
TP208	0.6-0.8	Silty clay	Fine	NA	NA	NA	100	200	80	1200	35	150	170	--	180	120	1300	5600	65	105	125	45	20
SDUP1	-	TP205 0-0.1	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
SDUP1 - [LAB_DUP]	-	TP205 0-0.1	Fine	NA	NA	NA	100	200	80	1200	35	150	170	180	180	120	1300	5600	65	105	125	45	20
SDUP2	-	TP201 0-0.1	Fine	7.5	42	NA	100	200	250	1200	560	1400	170	180	180	120	1300	5600	65	105	125	45	20
SDUP2 - [LAB_DUP]	-	TP201 0-0.1	Fine	7.5	42	NA	--	--	--	--	--	--	170	180	180	120	1300	5600	65	105	125	45	--

TABLE S7
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful	Total Scheduled	PCBs	C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	50	0.2	0.5	1	1	100
General Solid Waste CT1			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	50	50	650		NSL		10,000	10	288	600	1,000	-
General Solid Waste SCC1			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	50	50	650		NSL		10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	50	50	2600		NSL		40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	50	50	2600		NSL		40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
TP201	0-0.1	F: Silty Clay	<4	<0.4	**43**	**30**	**41**	**0.1**	**50**	**70**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**150**	**150**	<0.2	<0.5	<1	<1	Not Detected
TP201 - [LAB_DUP]	0-0.1	F: Silty Clay	<4	<0.4	**45**	**34**	**50**	**0.1**	**58**	**81**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**180**	**180**	<0.2	<0.5	<1	<1	NA
TP201	1.0-1.2	XW Granite	<4	<0.4	**42**	**22**	**14**	**0.4**	**18**	**55**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
TP202	0-0.1	F: Silty Clay	<4	<0.4	**47**	**43**	**38**	**0.3**	**23**	**92**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
TP203	0-0.1	F: Silty Sandy Gravel	<4	<0.4	**29**	**17**	**51**	<0.1	**28**	**53**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
TP203	0.4-0.6	F: Silty Clay	<4	<0.4	**35**	**59**	**24**	**0.3**	**16**	**77**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
TP203	1.0-1.2	Silty clay	<4	<0.4	**65**	**33**	**13**	**0.1**	**31**	**52**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
TP204	0-0.1	F: Silty Clay	<4	<0.4	**38**	**19**	**23**	**0.1**	**17**	**86**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
TP205	0-0.1	F: Silty Clay	<4	<0.4	**42**	**19**	**23**	<0.1	**20**	**55**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**120**	**120**	<0.2	<0.5	<1	<1	Not Detected
TP205	1.0-1.2	F: Silty Clay	<4	<0.4	**39**	**17**	**17**	**0.2**	**18**	**52**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
TP206	0-0.1	F: Silty Clay	<4	<0.4	**47**	**25**	**25**	**0.2**	**34**	**97**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
TP207	0-0.1	F: Silty Clay	<4	<0.4	**38**	**17**	**10**	<0.1	**17**	**37**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
TP207	0.8-1.0	Silty clay	<4	<0.4	**38**	**18**	**8**	<0.1	**17**	**28**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
TP208	0-0.1	F: Silty Clay	<4	<0.4	**36**	**15**	**10**	<0.1	**16**	**40**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	Not Detected
TP208	0.6-0.8	Silty clay	<4	<0.4	**51**	**24**	**10**	<0.1	**23**	**39**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
SDUP1	-	TP205 0-0.1	<4	<0.4	**43**	**19**	**16**	<0.1	**20**	**54**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
SDUP1 - [LAB_DUP]	-	TP205 0-0.1	<4	<0.4	**41**	**18**	**18**	<0.1	**19**	**53**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<1	NA
SDUP2	-	TP201 0-0.1	<4	<0.4	**53**	**37**	**60**	**0.1**	**59**	**86**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**210**	**210**	<0.2	<0.5	<1	<1	NA
SDUP2 - [LAB_DUP]	-	TP201 0-0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NA	NA	NA	<25	<50	<100	**240**	**240**	<0.2	<0.5	<1	<1	NA
FCF1	Surface	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
FCF2	Surface	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
TP205-FCF1	0.1-0.6	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
TP205-FCF2	1.0-1.5	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
TP205-FCF3	1.0-1.5	Fill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
Total Number of Samples			18	18	18	18	18	18	18	18	18	18	13	12	12	12	12	19	19	19	19	19	19	19	19	19	13
Maximum Value			<PQL	<PQL	65	59	60	0.4	59	97	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	240	240	<PQL	<PQL	<PQL	<PQL	Detected

Concentration above the CT1 — **VALUE**
Concentration above SCC1 — **VALUE**
Concentration above the SCC2 — **VALUE**
Concentration above PQL — **Bold**

TABLE S8

SOIL LABORATORY TCLP RESULTS

All data in mg/L unless stated otherwise

			Arsenic	Cadmium	Chromium	Lead	Mercury	Nickel	B(a)P
PQL - Envirolab Services			0.05	0.01	0.01	0.03	0.0005	0.02	0.001
TCLP1 - General Solid Waste			5	1	5	5	0.2	2	0.04
TCLP2 - Restricted Solid Waste			20	4	20	20	0.8	8	0.16
TCLP3 - Hazardous Waste			>20	>4	>20	>20	>0.8	>8	>0.16
Sample Reference	**Sample Depth**	**Sample Description**							
TP201	0-0.1	F: Silty Clay	NA	NA	NA	NA	NA	<0.02	NA
Total Number of samples			0	0	0	0	0	1	0
Maximum Value			NA	NA	NA	NA	NA	<PQL	NA

General Solid Waste	**VALUE**
Restricted Solid Waste	**VALUE**
Hazardous Waste	**VALUE**
Concentration above PQL	**Bold**

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TABLE Q1
SOIL QA/QC SUMMARY

			TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene
	PQL Envirolab SYD		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1*	*2*	*1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.05*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1.0*	*2.0*	*1.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	TP205	0-0.1	<25	<50	190	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
laboratory	SDUP1	-	<25	<50	100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	145	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	62%	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Inter	TP201	0-0.1	<25	<50	190	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
laboratory	SDUP2	-	<25	<50	200	150	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	195	100	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	5%	100%	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field	TB-S2	-	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
Blank	18/11/22																									
Field	FR2-SHOVEL	µg/L	130	<50	<100	<100	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1
Rinsate	18/11/22																									
Trip	TS-S2		-	-	-	-	97%	96%	97%	98%	98%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	18/11/22																									

			HCB	alpha- BHC	gamma- BHC	beta- BHC	Heptachlor	delta- BHC	Aldrin	Heptachlor Epoxide	Gamma- Chlordane	alpha- chlordane	Endosulfan I	pp- DDE	Dieldrin	Endrin	pp- DDD	Endosulfan II	pp- DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	TP205	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Inter	TP201	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field	TB-S2	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	18/11/22																					
Field	FR2-SHOVEL	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rinsate	18/11/22																					
Trip	TS-S2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	18/11/22																					

			Azinphos-methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Ronnel	Total PCBS	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4*	*0.4*	*1*	*1*	*1*	*0.1*	*1*	*1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4.0*	*0.4*	*1.0*	*1.0*	*1.0*	*0.1*	*1.0*	*1.0*
Intra	TP205	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	42	19	23	<0.1	20	55
laboratory	SDUP1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	43	19	16	<0.1	20	54
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	42.5	19	19.5	nc	20	54.5
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	2%	0%	36%	nc	0%	2%
Inter	TP201	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	43	30	41	0.1	50	70
laboratory	SDUP2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	53	37	60	0.1	59	86
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	48	33.5	50.5	0.1	54.5	78
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	21%	21%	38%	0%	17%	21%
Field	TB-S2	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4	<0.4	3	<1	2	<0.1	<1	2
Blank	18/11/22																						
Field	FR2-SHOVEL	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	<0.01	<0.01	0.8	<0.03	<0.0005	<0.02	<0.02
Rinsate	18/11/22																						
Trip	TS-S2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	18/11/22																						

Result outside of QA/QC acceptance criteria (yellow highlight)

JKEnvironments

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. TP201 1/1

SDUP2: 0-0.1m

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty clay, medium plasticity, trace of sand, granite and igneous gravel, ceramic fragments and root fibres.	w≈PL			GRASS COVER SCREEN: 10.39kg 0-0.1m NO FCF SCREEN: 10.56kg 0.1-0.6m NO FCF
							0.5		-	Extremely Weathered granite: gravelly SAND, fine to coarse grained, dark brown and dark grey, fine to coarse grained granite gravel, trace of silt.	XW			
							1			END OF TEST PIT AT 1.3m				
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Log No. TP202 1/1

Environmental logs are not to be used for geotechnical purposes

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty clay, low to medium plasticity, brown, trace of granite gravel, ash and root fibres.	w≈PL			GRASS COVER SCREEN: 10.25kg 0-0.1m NO FCF SCREEN: 10.72kg 0.1-0.7m NO FCF
							0.5							
							1		-	Extremely Weathered granite: gravelly SAND, fine to coarse grained, dark brown and dark grey, fine to coarse grained granite gravel, trace of silt.	XW			
										END OF TEST PIT AT 1.1m				
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. TP203 1/1

SDUP3: 0-0.1m

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Silty sandy gravel, fine to coarse grained igneous, grey, fine to medium grained sand, trace of quartz gravel, clay nodules and root fibres.	D			SCREEN: 10.91kg 0-0.1m NO FCF
											w≈PL			SCREEN: 11.20kg 0.1-0.7m NO FCF
							0.5			FILL: Silty clay, medium plasticity, brown, trace of sand, ceramic fragments and root fibres.				
	■		■						CI	Silty CLAY: medium plasticity, orange brown and yellow brown, trace of granite gravel.	w≈PL			RESIDUAL
							1							
										END OF TEST PIT AT 1.3m				
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Log No. **TP204** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty clay, low to medium plasticity, brown, trace of granite and quartz gravel and root fibres.	w≈PL			GRASS COVER SCREEN: 11.49kg 0-0.1m NO FCF SCREEN: 10.72kg 0.1-0.5m NO FCF
							0.5		-	Extremely Weathered granite: gravelly SAND, fine to coarse grained, dark brown and dark grey, fine to coarse grained granite gravel, trace of silt.	XW			
										END OF TEST PIT AT 0.8m				REFUSAL ON GRANITE BEDROCK
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. TP205 1/1

SDUP1: 0-0.1m

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty clay, low to medium plasticity, brown, trace of sand, quartz and granite gravel, concrete, brick and fibre cement fragments and root fibres.	w≈PL			GRASS COVER SCREEN: 12.56kg 0-0.1m NO FCF SCREEN: 10.29kg 0.1-0.6m TP205-FCF1 SCREEN: 10.53kg 0.6-1.0m NO FCF
							0.5							
							1			FILL: Silty clay, medium plasticity, red brown, trace of sand, brick and fibre cement fragments, ash and root fibres.	w≈PL			SCREEN: 11.35kg 1.0-1.5m TP205-FCF2 TP205-FCF3
							1.5		-	Extremely Weathered granite: gravelly SAND, fine to coarse grained, dark brown and dark grey, fine to coarse grained granite gravel, trace of silt.	XW			
										END OF TEST PIT AT 1.6m				REFUSAL ON GRANITE BEDROCK
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Log No. **TP206** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty clay, low to medium plasticity, brown, trace of granite, quartz and igneous gravel, brick fragments, root fibres and ash.	w≈PL			GRASS COVER SCREEN: 10.19kg 0-0.1m NO FCF SCREEN: 10.85kg 0.1-0.7m NO FCF
							0.5		-	Extremely Weathered granite: gravelly SAND, fine to coarse grained, dark brown and dark grey, fine to coarse grained granite gravel, trace of silt.	XW			
							1			END OF TEST PIT AT 0.95m				REFUSAL ON GRANITE BEDROCK
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. TP207 1/1

SDUP4: 0-0.1m

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION							0			FILL: Silty clay, low to medium plasticity, red brown, trace of igneous and granite gravel, ceramic fragments and root fibres.	w≈PL			SCREEN: 13.21kg 0-0.2m NO FCF
										as above, but with igneous gravel, fine to coarse grained, grey.	w≈PL			SCREEN: 10.07kg 0.2-0.5m NO FCF
							0.5		CI	Silty CLAY: medium plasticity, red brown, trace of granite gravel and root fibres.	w≈PL			RESIDUAL
							1			END OF TEST PIT AT 1.0m				
							1.5							
							2							
							2.5							
							3							
							3.5							

JKEnvironments

ENVIRONMENTAL LOG

Log No. TP208 **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: HEALTH INFRASTRUCTURE C/- CWPM

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: COOMA HOSPITAL, BENT STREET, COOMA, NSW

Job No.: E30596PT **Method:** TEST PIT **R.L. Surface:** N/A

Date: 17/11/22 **Datum:** -

Plant Type: 2T EXCAVATOR **Logged/Checked by:** A.D./M.D.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLE-TION	■		■		■		0			FILL: Silty clay, low to medium plasticity, red brown, trace of igneous and granite gravel and root fibres.	w≈PL			SCREEN: 13.23kg 0-0.2m NO FCF
	■		■		■					as above, but with igneous gravel and sand.	w<PL			SCREEN: 10.44kg 0.2-0.4m NO FCF
							0.5		CI	Silty CLAY: medium plasticity, red brown, trace of granite gravel.	w≈PL			RESIDUAL
							1			END OF TEST PIT AT 0.85m				REFUSAL ON GRANITE BEDROCK
							1.5							
							2							
							2.5							
							3							
							3.5							

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the

structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

The borehole or test pit logs presented herein are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
ine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad and \qquad C_C = \frac{(D_{30})^2}{D_{10}\, D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

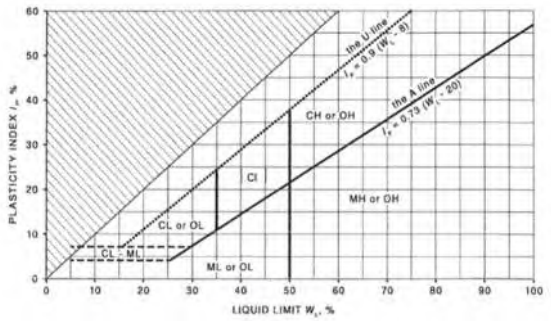
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

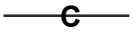
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
	PFAS	Soil sample taken over depth indicated, for analysis of Per- and Polyfluoroalkyl Substances.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of undrained shear strength.
	PID = 100	Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL	Moisture content estimated to be greater than plastic limit.
	$w \approx$ PL	Moisture content estimated to be approximately equal to plastic limit.
	w < PL	Moisture content estimated to be less than plastic limit.
	$w \approx$ LL	Moisture content estimated to be near liquid limit.
	w > LL	Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	D	DRY – runs freely through fingers.
	M	MOIST – does not run freely but no free water visible on soil surface.
	W	WET – free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – unconfined compressive strength ≤ 25kPa.
	S	SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa.
	F	FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa.
	St	STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa.
	VSt	VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa.
	Hd	HARD – unconfined compressive strength > 400kPa.
	Fr	FRIABLE – strength not attainable, soil crumbles.
	( )	Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE: ≤ 15 / 0 – 4 LOOSE: > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE: > 35 and ≤ 65 / 10 – 30 DENSE: > 65 and ≤ 85 / 30 – 50 VERY DENSE: > 85 / > 50
	VL	
	L	
	MD	
	D	
	VD	
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other assessment.

Log Column	Symbol	Definition
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Appendix D: Example of Imported Materials and Waste Tracking Registers

Imported Materials Register

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

Exported (Waste) Materials Register

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

Appendix E: Guidelines and Reference Documents

Contaminated Land Management Act 1997 (NSW)

Conveyancing Act (1919) (NSW).

Environmental Planning and Assessment Act 1979 (NSW)

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

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

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

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

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

Protection of the Environment Operations Act 1997 (NSW)

SafeWork NSW, (2019). Code of Practice: How to manage and control asbestos in the workplace

State Environmental Planning Policy (Resilience and Hazards) 2021 (NSW)

Work Health and Safety Regulation 2017 (NSW)

Western Australian Department of Health, (2021). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia