ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

HEALTH INFRASTRUCTURE

ON

PRELIMINARY STAGE 2 ENVIRONMENTAL SITE ASSESSMENT

FOR

NEPEAN HOSPITAL & INTEGRATED AMBULATORY SERVICES REDEVELOPMENT – SSDA

AT

NEPEAN HOSPITAL, DERBY STREET, KINGSWOOD, NSW

6 APRIL 2018 **REF: E29845KDrpt2.3rev4**

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Document Distribution Record

Report Reference	Distribution	Report Date
E29845KDrpt2.3	Client C/ - CBRE	30 October 2017
E29845KDrpt2.3rev	Client C/ - CBRE	12 December 2017
E29845KDrpt2.3rev2	Client C/ - CBRE	18 December 2017
E29845KDrpt2.3rev3	Client C/ - CBRE	23 March 2018
E29845KDrpt2.3rev4	Client C/ - CBRE	6 April 2018

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EXECUTIVE SUMMARY

Health Infrastructure commissioned Environmental Investigation Services to undertake a Preliminary Stage 2 Environmental Site Assessment (ESA) for the proposed Nepean Hospital and Integrated Ambulatory Services Redevelopment –SSDA at Nepean Hospital, Derby Street, Kingswood, NSW ('the site'). The site location is shown on Figure 1 and the assessment was confined to the site boundaries at the time of the investigation as shown on Figure 2.

This report has been prepared to support a State Significant Development (SSD) Application for the proposed Nepean Hospital and Integrated Ambulatory Services Redevelopment at Nepean Hospital.

The primary aims of the assessment were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination and make a preliminary assessment of the soil and groundwater contamination conditions.

The scope of work for the assessment included the following: review of site information, including background and site history information from previous investigation reports by others; assess the potential for acid sulfate soil (ASS) via desktop review; a walkover site inspection; design and implementation of a sampling, analysis and quality plan (SAQP); interpretation of the analytical results against the adopted site assessment criteria (SAC); assessment of data quality and preparation of an ESA report presenting the results of the assessment, including a CSM and Tier 1 risk assessment.

Soil samples for the previous EIS PESA 2017 (see Section 2.1.1) were obtained from seven sampling locations (BH10 to BH16) within the proposed development area. Samples for the preliminary Stage 2 ESA were obtained from an additional seventeen sampling locations. Therefore, sampling was undertaken from a total of twenty-four sampling locations within the proposed development area at the time of the investigation. All sampling locations are shown on the attached Figure 2. The total sampling density is approximately 80% of the minimum sampling density recommended by the EPA (i.e. (30/24) x 100).

A groundwater monitoring well was installed in the north-east section of the site by JK Geotechnics in borehole BH12 as part of the 2017 geotechnical investigation. Three additional groundwater monitoring wells were installed for the Preliminary Stage 2 ESA in boreholes BH132, BH140 and BH143 as shown on Figure 2.

The soil and groundwater results were generally below the human health associated SAC. However, asbestos fibres were detected in the following samples/materials:

- Fibre cement fragment sample MDF2 obtained from the surface in the central/west section of the site;
- Fibre cement fragment sample BH134-S obtained from the surface in the central/west section of the site adjacent to borehole BH134; and
- Fibre cement fragment sample BH135 (0-0.3m) obtained from the fill material at borehole sampling location BH135.

The assessment identified the following data gaps:

- The area beneath the existing building in the central and north-west sections of the site were not accessible at the time of the investigation;
- The vertical and horizontal extent of fill material at the site has not been fully assessed; and
- The proposed development area has been moved to the east, increased in area to the south-east and therefore requires further assessment.

EIS consider that the site can be made suitable for the proposed development provided that the following recommendations are implemented to address the data gaps and to minimise risks:

- Prepare a Remediation Action Plan (RAP) to outline remedial measures for the site. The RAP should address the data gaps; and
- Prepare a Validation Assessment (VA) report on completion of remediation.

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

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ABBREVIATIONS

Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Australian Drinking Water Guidelines	**ADWG**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Asbestos Health Screening Levels	**ASL**
Acid Sulfate Soil	**ASS**
Above-Ground Storage Tank	**AST**
Below Ground Level	**BGL**
Bureau of Meteorology	**BOM**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene	**BTEXN**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Construction Management Plan	**CMP**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Detailed Site Investigation	**DSI**
Ecological Assessment Criteria	**EAC**
Ecological Investigation Levels	**EILs**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
Excavated Natural Material	**ENM**
Environmental Protection Agency	**EPA**
Environmental Site Assessment	**ESA**
Ecological Screening Level	**ESL**
Fibre Cement Fragments	**FCF**
General Approvals of Immobilisation	**GAI**
General Solid Waste	**GSW**
Health Investigation Level	**HILs**
Hardness Modified Trigger Values	**HMTV**
Health Screening Level	**HSLs**
Lab Control Spike	**LCS**
Light Non-Aqueous Phase Liquid	**LNAPL**
Local Government Authority	**LGA**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Polycyclic Aromatic Hydrocarbons	**PAH**
Photo-ionisation Detector	**PID**

ABBREVIATIONS

Practical Quantitation Limit	**PQL**
Preliminary Site Investigation	**PSI**
Quality Assurance	**QA**
Quality Control	**QC**
Remediation Action Plan	**RAP**
Relative Percentage Difference	**RPD**
Restricted Solid Waste	**RSW**
Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
Site Audit Statement	**SAS**
Site Audit Report	**SAR**
Specific Contamination Concentration	**SCC**
Standard Penetration Test	**SPT**
Semi-Volatile Organic Compounds	**sVOC**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Standard Sampling Procedure	**SSP**
Trip Blank	**TB**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Trip Spike	**TS**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
Work Health and Safety	**WHS**

1 INTRODUCTION

Health Infrastructure ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake a Preliminary Stage 2 Environmental Site Assessment (ESA) for the proposed Nepean Hospital and Integrated Ambulatory Services Redevelopment –SSDA at Nepean Hospital, Derby Street, Kingswood, NSW ('the site'). The site location is shown on Figure 1 and the assessment was confined to the site boundaries at the time of the investigation as shown on Figure 2.

EIS issued a Preliminary Stage 2 ESA on 30th October 2017 for the site (EIS Report Ref: E29845KDrpt2.3). Since the issue of the report EIS have been informed that the proposed building and development area has been extended by approximately 35m to the east of the former EIS investigation area. EIS were requested by Health Infrastructure care of CBRE to undertake further field work by drilling of boreholes BH201 and BH202 within the additional site area and revise the Preliminary Stage 2 ESA accordingly. The additional investigation was undertaken in conjunction with JK Geotechnics. This report includes the results of the additional assessment.

This report has been prepared to support a State Significant Development (SSD) Application for the proposed Nepean Hospital and Integrated Ambulatory Services Redevelopment at Nepean Hospital.

The proposed development area at the time of the investigation is shown in the attached Figures and referred to as 'the site' in this report. EIS note that the proposed development area has moved to the east and increased in area to the south-east since the original Preliminary Stage 2 ESA (EIS Report Ref: E29845KDrpt2.3, dated 30 October 2017). EIS have provided suitable commentary in this revised report relating to the implications of the revised development area. This is further discussed in the Remediation Action Plan (RAP) prepared for the proposed development (EIS Report Ref: E29845KDrpt2.3, dated 30 October 2017).

1.1 Proposed Development Details

EIS understand that significant redevelopment works are proposed at Nepean Hospital. The proposed Nepean Hospital and Integrated Ambulatory Services Redevelopment includes the demolition of the existing single storey building in the central section of the site and construction of a new fourteen storey main tower building. New hardstand areas are proposed including internal roads and pavements. Landscaped gardens and courtyards are also proposed within the development area.

EIS have been provided cut and fill plans for the proposed development. Cut excavations are proposed to a maximum of approximately 8.0m below the existing ground levels, with filling proposed to approximately 2m above the existing ground levels. The plans indicate that approximately 40,000m^3 of excess material will remain as a result of the cut and fill excavation works.

[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)

1.2 Aim and Objectives

The primary aims of the assessment were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination, and make a preliminary assessment of the soil and groundwater contamination conditions. The assessment objectives were to:

- Provide an appraisal of the past site use(s) based on a review of previous investigation reports prepared by others;
- Assess the potential for Acid Sulfate Soil (ASS) via desktop review of available information;
- Assess the current site conditions and use via a site walkover inspection;
- Identify potential contamination sources/areas of environmental concern (AEC) and contaminants of potential concern (CoPC);
- Assess the soil and groundwater contamination conditions via implementation of a preliminary sampling and analysis program;
- Prepare a conceptual site model (CSM);
- Assess the potential risks posed by contamination to the receptors identified in the CSM (Tier 1 assessment);
- Provide a preliminary waste classification for off-site disposal of soil;
- Assess whether further intrusive investigation and/or remediation is required; and
- Assess whether the site is suitable or can be made suitable for the proposed development (from a contamination viewpoint).

1.3 Scope of Work

The assessment was undertaken generally in accordance with the following EIS proposals:

- EIS proposal ref: EP45451KP of 14 June 2017 and written acceptance from the client of via a Health Infrastructure Consultancy Agreement (Contract No. HI16465) of 5 July 2017;
- EIS proposal ref: EP45451KDrev of 4 August 2017 and written acceptance from CBRE on behalf of the client of 10 August 2017; and
- EIS proposal ref: EP46156KD of 15 November 2017 and written acceptance from CBRE on behalf of the client of 20 November 2017.

The scope of work for the assessment included the following:

- Review of site information, including background and site history information from previous investigation reports by others;
- A walkover site inspection;
- Design and implementation of a sampling, analysis and quality plan (SAQP);
- Interpretation of the analytical results against the adopted site assessment criteria (SAC);
- Assessment of data quality; and
- Preparation of an ESA report presenting the results of the assessment, including a CSM and Tier 1 risk assessment.

The report was prepared with reference to regulations/guidelines outlined in the table below. Individual guidelines are also referenced within the text of the report.

Table 1-1: Guidelines

Guidelines/Regulations/Documents
Contaminated Land Management Act (1997)[2]
State Environmental Planning Policy No.55 – Remediation of Land (1998)[3]
Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)[4]
Guidelines for Consultants Reporting on Contaminated Sites (2011)[5]
Guidelines for the NSW Site Auditor Scheme, 3rd Edition (2017)[6]
National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)[7]

[2] NSW Government Legislation, (1997). *Contaminated Land Management Act 1997.* (referred to as CLM Act 1997)

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

[4] Department of Urban Affairs and Planning, and Environment Protection Authority, (1998). *Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land*. (SEPP55 Planning Guidelines)

[5] NSW Office of Environment and Heritage (OEH), (2011). *Guidelines for Consultants Reporting on Contaminated Sites.* (referred to as Reporting Guidelines 2011)

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

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

2 SITE INFORMATION

2.1 Background

2.1.1 Preliminary Environmental Site Assessment (February, 2017[8])

Health Infrastructure commissioned EIS to undertake a preliminary ESA for the proposed upgrade works at Nepean Hospital, Derby Street, Kingswood, NSW. At the time of the PESA, detailed proposed development details had not been provided to EIS. However, it was understood that the proposed upgrade included a new multi-deck car park in the north-western corner of the site and a main works area described as the '24 hour zone' in the central eastern part of the site. The PESA included an assessment of the wider site area/hospital including the above proposed works areas.

A geotechnical investigation was undertaken in conjunction with the PESA by JK Geotechnics[9]. The results of the investigation are presented in two separate reports (JK Geotechnics Project Ref: 29845L[10]).

The primary aims of the EIS PESA were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination, and make a preliminary assessment of the soil contamination conditions. The assessment included an appraisal of the past site use(s) based on a review of previous investigation reports prepared by Golder Associates.

Potential sources of contamination/AEC outlined in the CSM included fill material, above-ground bulk fuel and chemical storage, former/abandoned Underground Storage Tanks (USTs), historical agricultural use and hazardous building materials. Based on the findings of the ESA, the potential for significant, widespread soil contamination associated with each source/AEC is considered to be low (fill) or low to moderate (remaining AEC).

The field work for the PESA included soil sampling from sixteen boreholes spread across the hospital grounds. This included soil sampling from seven boreholes (BH10 to BH16) within the subject site area. The assessment of groundwater conditions at the site was outside of the scope of the PESA.

The soil results analysed for the PESA indicated the following:

- All soil results analysed for PESA were below the human health-based Site Assessment Criteria (SAC) (HIL-D and HSL-D);
- Asbestos was identified in a fibre cement fragment (asbestos containing material (ACM)) in sample HLF1 which was collected from the ground surface in the north-east section of the site. EIS note that the sample HLF1 was located approximately 100m to the north of the subject site; and

[8] EIS, (2017), *Report to Health Infrastructure on Preliminary Environmental Site Assessment for Hospital Upgrade at Nepean Hospital, Derby Street, Kingswood, NSW.* (Report Ref: E29845KPrpt, dated 24 February 2017) (referred to as EIS PESA 2017)

[9] Geotechnical consulting division of J&K

[10] Collectively referred to as' JK report'

- Marginally elevated concentrations of nickel (BH4 and BH15) and benzo(a)pyrene (BH10) were identified above the respective EIL/ESL commercial/industrial SAC. These elevations were identified in fill (road base material) beneath asphalt pavement. EIS note that BH4 is located outside of the subject site area.

Based on the scope of work undertaken, EIS were of the opinion that the site could be made suitable for the proposed developments via the completion of additional investigation, and if required, remediation undertaken. EIS indicated that the requirement for remediation would be evaluated as part of the additional investigation process.

EIS recommended the following:

- A Stage 2 investigation should be undertaken to characterise the soil and groundwater conditions, with particular focus on the development areas and identifying the source and extent of the groundwater impacts identified by Golder Associates;
- An unexpected finds protocol and asbestos management plan should be prepared for the proposed development. This was considered to be suitable to address the potential for isolated occurrences of ACM; and
- A waste classification assessment should be undertaken prior to disposing of any surplus excavated materials off-site.

2.2 Site Identification

Table 2-1: Site Identification

Site Address:	35-65 Derby Street, Kingswood, NSW (also known as 256A Great Western Highway)
Lot & Deposited Plan:	Part of Lot 1 DP1114090
Current Land Use:	Hospital
Proposed Land Use:	Unchanged
Local Government Authority (LGA):	Penrith
Current Zoning:	SP2 (Health Services Facilities) (Penrith Local Environmental Plan 2010)
Proposed Development Area Investigated by this Preliminary Stage 2 ESA (m^2):	19,250

Total Revised Proposed Development Area (m^2):	25,300
RL (AHD in m) (approx.):	50-53
Geographical Location (decimal degrees) (approx.):	Latitude: -33.759171 Longitude: 150.714559

2.3 Site Location and Regional Setting

The site is located to the west of Somerset Street and approximately 100m to the south of the intersection with Great Western Highway. Barber Avenue is located immediately to the north-west of the site. The site is located within the central/east section of Nepean Hospital.

The regional setting is characterised by commercial and low to medium density residential land uses with some commercial/industrial uses to the northern side of the great Western Highway.

2.4 Topography

The regional and site topography is gently undulating. The site appears to be located on the side of a minor hill slope that appeared to fall to the south-west.

2.5 Site Inspection

A walkover inspection of the site was undertaken by EIS on 16 August 2017. The inspection was limited to accessible areas of the site and immediate surrounds. An internal inspection of the existing building was not undertaken. A summary of relevant inspection observations are outlined in the following subsections:

2.5.1 Buildings, Structures and Roads

At the time of the site inspection a number of single to two storey hospital associated buildings were located in the central and north-west section of the site. The buildings in the north-west section of the site generally appeared to be occupied for hospital maintenance and associated use. The buildings in the east section of the central section of the site appeared to be occupied for hospital related services, including potential short-term patient accommodation.

An on grade asphaltic concrete car park was located in the central/east section of the site. A number of concrete pedestrian pathways transverse the site linking to the car park and hospital buildings.

2.5.2 Visible or Olfactory Indicators of Contamination

Two fragment of fibre cement were identified at the ground surface in the central section of the site (see samples identified as “MDF2” and “BH134-S” on Figure 2). The fragments were in reasonable condition and could not be crushed, broken or compressed using hand pressure.

There were no other visible or olfactory indicators of contamination observed during the site walkover.

2.5.3 Drainage

Surface metal grate drains were located across the site and primarily in the asphaltic concrete car park area located in the central/east section of the site. The surface water at the site is expected to flow to the north-east of the site, before discharging to the stormwater system to the east at Somerset Street.

2.5.4 Presence of Drums/Chemicals, Waste and Fill Material

There were no obvious indicators of chemical storage or underground storage tanks (USTs) at the site. However, it was noted that machinery (including a ride on lawn mower, small tractor etc.) were located in the hospital maintenance area in the north-west section of the site, therefore it is reasonable to expect that fuel (e.g. petrol/diesel) is likely to be stored in this section of the site.

Above ground storage cylinders and associated pipework were observed adjacent to the maintenance building in the north-west section of the site. Signage suggested that the cylinders were used for storage of nitrogen and oxygen.

As identified in EIS PESA 2017 a potential UST was identified within the hospital grounds. The potential UST was located approximately 50m to the south-west of the north-west section of the site and is shown in Figure 2. A yellow identification tag located on the ground adjacent to the UST fill point indicated that the UST was used for diesel fuel storage. EIS are of the opinion (due to signage in the area) that the diesel storage may be associated with a backup electrical generator which may be located within a locked room to the north.

The site levels appeared to have been altered to accommodate the existing buildings and site features including the car park in the central/east section of the site.

2.5.5 Sensitive Environments

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

2.5.6 Landscaped Areas and Visible Signs of Plant Stress

Grassed and landscaped areas containing various native and non-native trees and shrubs were observed throughout the site. There were no obvious indicators of widespread plant stress or tree dieback observed during the inspection.

2.6 Surrounding Land Use

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

- North – Nepean Private Hospital, an on-grade hardstand car park associated with the hospital. The cancer care hospital building/facility was located further to the north of the car park;

- South – Nepean Hospital, including a multistorey car park. Residential and commercial landuse were evident to the south of the hospital beyond Derby Street;
- East – A child care centre was located to the east of the site. Residential landuse was evident to the east of Somerset Street; and
- West – Nepean Hospital, including the main hospital building, a multistorey car park.

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

2.7 Underground Services

The 'Dial Before You Dig' (DBYD) plans were reviewed for the assessment in order to establish whether any major underground services exist at the site or in the immediate vicinity that could act as a preferential pathway for contamination migration. No major services were identified that would be expected to act as preferential pathway for contamination migration.

2.8 Interview with Site Personnel

EIS identified a potential UST during the site inspection (see Section 2.5.4). We note that a brief interview was undertaken with a hospital representative (responsible for maintenance related hospital activities) on the 17 January 2017 as part of the EIS PESA 2017. EIS were informed that there were no operational USTs at the site and the current maintenance staff were not aware of any former USTs.

3 GEOLOGY AND HYDROGEOLOGY

3.1 Regional Geology

A review of the regional geological map of Penrith (1991[11]) indicates that the site is underlain by Bringelly Shale of the Wianamatta Group, which typically consists of shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff.

3.2 Hydrogeology

The EIS PESA 2017 indicated that information contained within the Golder Associates reports suggested there were no registered groundwater users in the immediate vicinity of the site. Based on information from registered bores located over 2km from the site, groundwater was expected to be saline to brackish and to occur in discrete horizons, typically within deeper unconsolidated clays and fractured bedrock. Golder Associates reported that groundwater at the site was expected to occur in discrete water bearing zones within the shale bedrock at depths greater than 5m below the ground surface. Standing water levels recorded in the monitoring wells ranged from approximately 3m to >5m below ground level (mBGL).

The information reviewed for this assessment suggests that the subsurface conditions at the site are likely to consist of residual soils overlying relatively shallow bedrock. The potential for viable groundwater abstraction and use of groundwater under these conditions is considered to be low. Groundwater is unlikely to be encountered during the proposed development works where only relatively minor/shallow excavations are required, however groundwater may be encountered in the event deeper excavations are required (e.g. for the construction of a basement). Use of groundwater is not proposed as part of the development.

Based on the local topography, shallow groundwater at the site would be expected to flow towards the north-east.

3.3 Receiving Water Bodies

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Werrington Lakes (approximately 2km to the east/north-east of the site). The Nepean River is located approximately 3.5km to the west of the site. Claremont Creek is located approximately 3.4km to the south-east and due to the site and regional topography is considered to be the most likely receiving water body.

[11] Department of Mineral Resources, (1991). *1:100,000 Geological Map of Penrith (Series 9030)*

4 CONCEPTUAL SITE MODEL

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the site information (including the site inspection information) and the review of site history information. Reference should also be made to the figures attached in the appendices.

4.1 Potential Contamination Sources/AEC and CoPC

The potential contamination sources/AEC and CoPC are presented in the following table:

Table 4-1: Potential Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
Fill material – Previous investigations identified fill to variable depths in parts of the site. The fill may have been imported from various sources. Previous investigations by Golder Associates and the EIS PESA 2017 did not identify significant, widespread impacts in fill, however ACM has been identified. We note that not all areas of the hospital site were investigated.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, BTEX, PAHs, OCPs, PCBs and asbestos.
Potential UST – What appeared to be a UST used for storage of diesel was located approximately 50m south-west of the north-west section of the site (see Figure 2). Although details regarding the potential diesel use were unclear, signage in the area suggested that the diesel may be a source of fuel for a back-up electrical generator. Potential leakage or accidental spills of diesel are considered to pose a potential onsite migration risk. The Golder Associates investigations (in 2010) indicated that: • Potentially two USTs have been decommissioned at the site, one of which was in 1995. One of the USTs appeared to have been located approximately 100m to the south-west of the site. EIS note that the details surrounding the USTs use and decommissioning were unclear; and • Elevated concentrations of TRHs and BTEX (notably ethylbenzene and xylene) were identified in groundwater in the north section of the site (within the current maintenance yard). The source of the elevated concentrations detected in the groundwater was unknown. As part of the EIS PESA the concentrations were reviewed in relation to the updated assessment criteria presented in the NEPM (2013).	Lead, TRH, BTEX and PAHs
Historical agricultural use – Historically the site may have been used for agricultural activities in the early to mid-1900s. This could	Heavy metals, TRH, PAHs, OCPs and asbestos

Source / AEC	CoPC
have resulted in contamination across the site via use of machinery, application of pesticides and building/demolition of various structures.	
Hazardous Building Material – Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site.	Asbestos, lead and PCBs

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

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

Table 4-2: CSM

Potential mechanism for contamination	Potential mechanisms for contamination include: • Fill material – importation of impacted material, 'top-down' impacts (e.g. leaching from surficial material), or sub-surface release (e.g. impacts from buried material); • Diesel UST located approximately 50m south-west of the north-west section of the site and other potential current/former fuel storage – 'top-down', spills (e.g. during filling of the tanks and/or dispensing activities), or sub-surface release (e.g. from leaking tank or pipework); • Historical agricultural use – 'top-down' and spills (e.g. application of pesticides, refuelling or repairing machinery, and other activities at the ground surface level); and • Hazardous building materials – 'top-down' (e.g. demolition resulting in surficial impacts in unpaved areas).
Affected media	Soil/soil vapour and groundwater have been identified as potentially affected media.
Receptor identification	Human receptors include site users, construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users. Ecological receptors include terrestrial organisms and plants within unpaved areas.
Potential Exposure pathways	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with the construction and excavation works, and

	use of unpaved areas (i.e. the gardens) and basement (i.e. vapour inhalation or incidental contact with groundwater seepage). Potential exposure pathways for ecological receptors include primary contact and ingestion.
Presence of preferential pathways for contaminant movement	There is considered to be a potential for the underground service trenches to act as preferential pathways for contaminant migration. However, the potential for migration would be highly dependent on the nature and type of contamination present, the laydown and transport mechanisms for the contaminants, and the contaminant properties.

5 SAMPLING, ANALYSIS AND QUALITY PLAN

5.1 Data Quality Objectives (DQO)

The NEPM 2013 defines the DQO process as a seven step iterative planning tool used to define the type, quantity and quality of data needed to inform decisions relating to the environmental condition of the site. The DQO process is detailed in the Site Auditor Guidelines 2006 and the USEPA documents Data Quality Objectives Processes for Hazardous Waste Site Investigations (2000) and Guidance on Systematic Planning Using the Data Quality Objectives Process (2006). These seven steps are applicable to this assessment as summarised in the table below:

Table 5-1: DQOs – Seven Steps

Step	Input
State the Problem	The CSM has identified AEC at the site which may pose a risk to the site receptors. An intrusive investigation is required to assess the risk and comment on the suitability of the site for the proposed development or intended landuse. The assessment also aims to meet the requirements of SEPP55 in order to address the SSD assessment process.
Identify the Decisions/ Goal of the Study	The data collection is project specific and has been designed based on the following information: • Review of site information including the EIS PESA 2017; • AEC, CoPC, receptors, pathways and medium identified in the CSM; • Development of SAC for each media; and • The use of decision statements outlined below: 1. Are any of the results above the SAC? 2. Do any of the contaminants pose a risk to the site receptors? 3. Is remediation required to render the site suitable for the proposed development? Statistical analysis will be used to assess the laboratory data against the SAC. The following criteria will be adopted: ➢ The 95% Upper Confidence Limit (UCL) value of the arithmetic mean concentration of each contaminant should be less than the SAC; ➢ The standard deviation (SD) of the results must be less than 50% of the SAC; and ➢ No single value exceeds 250% of the relevant SAC. Statistical calculations will not be undertaken if all results are below the SAC; and Statistical calculations will not be undertaken on the following: ➢ Health Screening Levels (HSLs) – elevated point source contamination associated with petroleum hydrocarbons can pose a vapour risk to receptors; and ➢ Groundwater Investigation Levels (GILs) – elevated GILs can indicate a wider groundwater contamination risk.

Step	Input
Identify Information Inputs	The following information will be collected: • Soil samples based on subsurface conditions; • Groundwater samples from monitoring wells; • Fibre Cement Fragments (FCF) in the vicinity of the sampling points; • The SAC will be designed based on the criteria outlined in NEPM 2013. Other criteria will be used as required and detailed in this report; • The samples will be analysed in accordance with the analytical methods outlined in NEPM 2013; • Field screening information (i.e. PID data, presence of hydrocarbons etc.) will be taken into consideration in selecting the analytical schedule; and • Any additional information that may arise during the field work will also be used as data inputs.
Define the Study Boundary	The sampling will be confined to the proposed development area of the site as shown in Figure 2. Fill has been identified as an AEC. The source of fill has not been established. Fill is considered to be heterogeneous material with CoPC occurring in random pockets or layers. The presence of CoPC in between sampling points cannot be measured. The areas excluded from the investigation are outlined in the data gaps.
Develop the analytical approach (or decision rule)	The following acceptable limits will be adopted for the data quality assessment: • The following acceptance criteria will be used to assess the RPD results: ➢ results > 10 times the practical quantitation limit (PQL), RPDs < 50% are acceptable; ➢ results between 5 and 10 times PQL, RPDs < 75% are acceptable; ➢ results < 5 times PQL, RPDs < 100% are acceptable; and ➢ An explanation is provided if RPD results are outside the acceptance criteria. • Acceptable concentrations in Trip Spike (TS), Trip Blanks (TB) and Field Rinsate (FR) samples. Non-compliance to be documented in the report; • The following acceptance criteria will be used to assess the primary laboratory QA/QC results. Non-compliance to be documented: ➢ RPDs: - Results that are < 5 times the PQL, any RPD is acceptable; and - Results > 5 times the PQL, RPDs between 0-50% are acceptable; ➢ LCS recovery and matrix spikes: - 70-130% recovery acceptable for metals and inorganics; - 60-140% recovery acceptable for organics; and - 10-140% recovery acceptable for VOCs; ➢ Surrogate spike recovery: - 60-140% recovery acceptable for general organics; and - 10-140% recovery acceptable for VOCs; ➢ Blanks: All less than PQL.

Step	Input
Specify the performance or acceptance criteria	NEPM 2013 defines decision errors as '*incorrect decisions caused by using data which is not representative of site conditions*'. This can arise from errors during sampling or analytical testing. A combination of these errors is referred to as '*total study error*'. The study error can be managed through the correct choice of sample design and measurement. Decision errors can be controlled through the use of hypothesis testing. The test can be used to show either that the baseline condition is false or that there is insufficient evidence to indicate that the baseline condition is false. The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. In this case, for example, the CoPC identified in the CSM is considered to pose a risk to receptors unless proven not to. The null hypothesis has been adopted for this assessment.
Optimise the design for obtaining data	The most resource-effective design will be used in an optimum manner to achieve the assessment objectives.

5.2 Soil Sampling Plan and Methodology

The soil sampling plan and methodology adopted for this assessment is outlined in the table below:

Table 5-2: Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	The NSW EPA Contaminated Sites Sampling Design Guidelines (1995[12]) recommend a sampling density for an environmental assessment based on the size of the investigation area. The guideline provides a minimum number of sampling points required for the investigation on a systematic sampling pattern. The guidelines recommend sampling from a minimum of thirty evenly spaced sampling points for this site with an area of approximately 19,250m^2. Samples for the EIS PESA 2017 were obtained from seven sampling locations (BH10 to BH16) within the proposed development area. Samples for this preliminary Stage 2 ESA were obtained from an additional seventeen sampling locations. Therefore, sampling was undertaken from a total of twenty-four sampling locations within the proposed development area at the time of the investigation. All sampling locations are shown on the attached Figure 2. The total sampling density is approximately 80% of the minimum sampling density recommended by the EPA (i.e. (30/24) x 100).

[12] NSW EPA, (1995), *Contaminated Sites Sampling Design Guidelines.* (referred to as EPA Sampling Design Guidelines 1995)

Aspect	Input
Sampling Plan	The sampling locations were generally placed on a systematic plan with a grid spacing of approximately 20-30m between sampling locations. A systematic plan was considered suitable to address potential contaminants associated with the fill material. The systematic sampling plan was amended where necessary due to site features (e.g. buildings, underground services, internal roads etc.).
Exclusion Areas (Data Gaps)	Sampling was not undertaken in inaccessible areas of the site such as beneath existing buildings. EIS estimate that approximately 20% of the site area was covered with existing buildings at the time of the investigation.
Sampling Equipment	Soil samples for this investigation were obtained on 16th and18th August 2017. Additional soil samples for the investigation were obtained on 29th and 30th November 2017. All samples were obtained in accordance with the standard sampling procedure (SSP) attached in the appendices. Sampling locations were set out using a hand held GPS unit (with an accuracy of ±2m). The groundwater monitoring well locations and relative heights were measured by a surveyor. In-situ sampling locations were cleared for underground services by an external contractor prior to sampling as outlined in the SSP. The sample locations were drilled using the following equipment as shown on the borehole logs attached in the appendices: • Hydraulically operated drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler; and • Hand equipment in areas not accessible to machinery.
Sampling Collection and Field QA/QC	Soil samples were collected from the fill and natural profiles based on field observations. The sampling depths are shown on the logs attached in the appendices. Additional samples were obtained when relatively deep fill (>0.5m) was encountered. Samples were also obtained when there was a distinct change in lithology or based on the observations made during the investigation. Where groundwater monitoring wells were installed additional natural soil samples were obtained to assess the potential for onsite migration of hydrocarbon contamination associated with potential existing/former USTs. During sampling, soil at selected depths was split into primary and duplicate samples for field QA/QC analysis. Samples were placed in glass jars with plastic caps and teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags.

Aspect	Input
	Sampling personnel used disposable nitrile gloves during sampling activities. The samples were labelled with the job number, sampling location, sampling depth and date in accordance with the SSP.
Field PID Screening for VOCs	A portable Photoionisation Detector (PID) was used to screen the samples for the presence of VOCs and to assist with selection of samples for hydrocarbon analysis. The sensitivity of the PID is dependent on the organic compound and varies for different mixtures of hydrocarbons. Some compounds give relatively high readings and some can be undetectable even though present in identical concentrations. The portable PID is best used semi-quantitatively to compare samples contaminated by the same hydrocarbon source. The PID is calibrated before use by measurement of an isobutylene standard gas. All the PID measurements are quoted as parts per million (ppm) isobutylene equivalents. PID field check records are maintained in the job file. PID screening for VOCs was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases.
Decontamination and Sample Preservation	The decontamination procedure adopted during sampling is outlined in the SSP. Where applicable, the sampling equipment was decontaminated using a scrubbing brush and potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water. Rinsate samples were obtained during the decontamination process as part of the field QA/QC. Soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with the SSP. On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.

5.3 Groundwater Sampling Plan and Methodology

The groundwater sampling plan and methodology is outlined in the table below:

Table 5-3: Groundwater Sampling Plan and Methodology

Aspect	Input
Sampling Plan	A groundwater monitoring well was installed in the north-east section of the site by JK Geotechnics in borehole BH12 as part of the 2017 geotechnical investigation. The

Aspect	Input
	monitoring well installation was considered adequate to allow for groundwater sampling purposes for the EIS preliminary Stage 2 ESA. Three additional groundwater monitoring wells were installed for the Preliminary Stage 2 ESA in boreholes BH132, BH140 and BH143 as shown on Figure 2. The monitoring well locations were chosen to target the AEC and CoPC encountered at the site.
Exclusion Areas (Data Gaps)	Sampling was not undertaken in inaccessible areas of the site such as beneath existing buildings. EIS estimate that approximately 20% of the site area was covered with existing buildings at the time of the investigation.
Monitoring Well Installation Procedure	The monitoring well construction details are documented on the appropriate borehole logs attached in the appendices. The monitoring wells were installed to depths of approximately 6.0m below ground level (bgl) in BH132, BH140 and BH143. The monitoring well in BH12 was installed to a depth of approximately 12.13mbgl. The installation depth was designed to make an assessment of shallow perched groundwater conditions. The wells were constructed as follows: • 50mm diameter Class 18 PVC casing and machine slotted screen; • A 2mm sand filter pack was used around the screen section for groundwater infiltration; • A bentonite seal/plug was used on top of the slotted section to seal the wells; • A gatic cover was installed at the surface with a concrete plug to limit the inflow of surface water. The surface Relative Levels (RLs) for the monitoring wells were provided by Geomat Engineering Pty Ltd at the request of EIS. The groundwater monitoring well survey plan is attached in the appendices.
Monitoring Well Development	Monitoring wells MW132, MW140 and MW143 were development on 18 August 2017. Monitoring well MW4 was developed on 24 August 2017. The monitoring wells were developed using a submersible electrical pump. A minimum of 3 well volumes was removed or the wells were pumped dry in slow recharging conditions. The following parameters were monitored using calibrated field instruments (see SSP): • Standing water level (SWL) using an electronic dip meter; and • pH, temperature, electrical conductivity (EC), dissolved oxygen (DO) and redox potential (Eh) using a YSI Multi-probe water quality meter. The field monitoring records and calibration data are attached in the appendices.
Groundwater Sampling	The monitoring wells were allowed to recharge for approximately 6 to 11 days after development. Groundwater samples were obtained on 30 August 2017.

<table>
<tr><th>Aspect</th><th>Input</th></tr>
<tr><td></td><td>Prior to sampling, the monitoring wells were checked for the presence of Light Non-Aqueous Phase Liquids (LNAPLs) using an inter-phase probe electronic dip meter. The monitoring well head space was checked for VOCs using a calibrated PID unit.

The samples were obtained using a peristaltic pump. During sampling, the following parameters were monitored using calibrated field instruments (see SSP):
• Standing water level (SWL) using an electronic dip meter; and
• pH, temperature, electrical conductivity (EC), dissolved oxygen (DO) and redox potential (Eh) using a YSI Multi-probe water quality meter.

Steady state conditions were considered to have been achieved when the difference in the pH measurements was less than 0.2 units and the difference in conductivity was less than 10%.

Groundwater samples were obtained directly from the single use PVC tubing and placed in the sample containers.

The use of low-flow sampling techniques (such as a micro-purge or peristaltic pump) generally provides for an increased confidence of accuracy, and in particular, improves the likelihood that the sample is representative of general aquifer conditions due to much lower aquifer disturbance during sampling.

Duplicate samples were obtained by alternate filling of sample containers. This technique was adopted to minimise disturbance of the samples and loss of volatile contaminants associated with mixing of liquids in secondary containers, etc.

Groundwater removed from the wells during development and sampling was transported to EIS in jerry cans and stored in holding drums prior to collection by a licensed waste water contractor for off-site disposal.

The field monitoring record and calibration data are attached in the appendices.</td></tr>
<tr><td>Decontaminant and Sample Preservation</td><td>All tubing used for groundwater development and sampling is single use and was discarded after each sampling event therefore no decontamination procedures were necessary.

The samples were preserved in accordance with water sampling requirements detailed in NEPM 2013 and placed in an insulated container with ice in accordance with the SSP.

On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.</td></tr>
</table>

5.4 Analytical Schedule

The analytical schedule is outlined in the following table:

Table 5-4: Analytical Schedule

CoPC	Fill Samples	Natural Soil Samples	Groundwater Samples
Heavy Metals	19	13	4
TRH/BTEXN	19	13	4
PAHs	19	13	4
OCPs/OPPs	19	2	Na
PCBs	19	2	Na
Asbestos	19	Na	Na
pH	Na	Na	4
Asbestos in Fibre Cement Fragments (FCF)	3 (material/potential ACM)	Na	Na

5.4.1 Laboratory Analysis

The samples were analysed by the NATA Accredited laboratory/s using the analytical methods detailed in Schedule B(3) of NEPM 2013. Reference should be made to the laboratory reports attached in the appendices for further details.

Table 5-5: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including (intra-laboratory duplicates, trip blanks, trip spikes and field rinsate samples)	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	173795, 173795-A, 174543, 181201 and 181201-A
Inter-laboratory duplicates	Envirolab Services Pty Ltd VIC, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	11589 and 11673

6 SITE ASSESSMENT CRITERIA (SAC)

The SAC adopted for the assessment is outlined in the table below. The SAC has been derived from the NEPM 2013 and other guidelines as applicable. The guideline values for individual contaminants are presented in the attached report tables.

Table 6-1: SAC Adopted for this Investigation

Guideline	Applicability
Health Investigation Levels (HILs) (NEPM 2013)	The HIL-C criteria for 'public open space, secondary schools, foot paths (includes hospitals)' land use were adopted for this assessment. The above criteria were considered appropriate for the proposed car park.
Health Screening Levels (HSLs) (NEPM 2013)	The HSL-B criteria for 'high density residential' land use were adopted for this assessment. The HSL-C criteria for public open space are non-limiting therefore the HSL-B criteria were considered most appropriate for the proposed Hospital redevelopment.
Ecological Assessment Criteria (EAC) (NEPM 2013)	A preliminary screening of ecological risk has been undertaken based on the limited information available at this stage. The Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) for 'commercial/industrial' land use were adopted for this assessment. The EILs for selected metals were derived as follows: • The ambient background concentrations (ABC) values for high traffic (25th percentiles) areas for old suburbs of NSW published in Olszowy et al. (1995[13]) were adopted; and • The Added Contaminant Limit (ACL) values were adopted based on a 'worst case' scenario for the proposed land use setting, considering the values presented in Schedule B1 of NEPM (2013).
Management Limits for TRH and Direct Contact Limits for TRH (NEPM 2013)	These guidelines have only been used after considering the relevant HSLs and ESLs for adverse effects of TRH contamination where necessary.
Asbestos in Soil	The 'presence/absence' of asbestos in soil has been adopted as the assessment criteria.

[13] 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.

Guideline	Applicability
Waste Classification (WC) Criteria	The criteria outlined in the NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014[14]) has been adopted to classify the material for off-site disposal.
Groundwater Investigation Levels (GILs)	The NSW Department of Environment and Conservation (now EPA) Guidelines for the Assessment and Management of Groundwater Contamination (2007[15]) require an assessment of environmental values including: **1. <u>Aquatic Ecosystems:</u>** The closest receiving water body in the vicinity of the site is Claremont Creek. This water body predominantly sustains a freshwater ecosystem. Hence the freshwater trigger values presented in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000[16]) have been adopted for the assessment (referred to as GIL-ANZECC-Fresh). The NSW EPA promotes the use of trigger values for the protection of 95% of aquatic ecosystems, except where the contaminants have the potential to bio-accumulate, in which case the 99% trigger values are recommended. The 95% trigger values have been adopted for this assessment. Where necessary, the low reliability trigger values are quoted. **2. <u>Human Uses</u>:** The groundwater bore search did not indicate the presence of bores registered for domestic use in the vicinity of the site. The extraction and use of groundwater for drinking purposes is unlikely to occur at the site. The site is also connected to the mains water supply. Based on this, the Australian Drinking Water Guidelines (2011[17]) have not been adopted for this assessment (referred to as GIL-ADWG). **3. <u>Health Risk in Non-use Scenarios</u>:** Health risks in non-use scenarios are usually associated with the presence of vapours associated with volatile contaminants. The HSL-B for 'high density residential' have been adopted for this investigation. These criteria were considered most appropriate for the proposed new buildings.

[14] NSW EPA, (2014), *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

[15] NSW DEC (2007), *Guidelines for the Assessment and Management of Groundwater Contamination* (referred to as Groundwater Guidelines 2011)

[16] ANZECC, (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* (referred to as ANZECC 2000)

[17] National Health and Medical Research Council, (2011), *Australian Drinking Water Guidelines.* (referred to as ADWG 2011)

Guideline	Applicability
	4. <u>Buildings and Structures:</u> An assessment of the risk posed by contaminated groundwater towards built structures has not been undertaken for this assessment. In the event elevated levels of contaminants are present, this can be addressed in the Tier 1/2 Risk assessment if applicable.

7 INVESTIGATION RESULTS

7.1 Subsurface Conditions

A summary of the subsurface conditions encountered during the investigation is presented in the table below. Reference should be made to the borehole logs attached in the appendices for further details.

Table 7-1: Summary of Subsurface Conditions

Profile	Description (m in bgl)
Fill	Fill material was encountered beneath the asphaltic concrete or at the surface in all boreholes and extended to depths of approximately 0.1m (BH136) to 2.0m (BH139). BH133 to BH135, BH137, BH138 and BH141 were terminated in the fill at depths of between approximately 0.2m and 0.5m. The fill typically comprised: gravelly sand, silty clay and silty sand. The fill contained inclusions of: ironstone, igneous and sandstone gravels; ash and slag. Building associated demolition rubble (eg. brick and concrete fragments) were encountered in boreholes BH134, BH137 and BH138. A fibre cement fragment was identified within the fill material in borehole BH135.
Natural Soil	Natural silty clay was encountered beneath the fill material in boreholes BH131, BH132, BH136, BH139, BH140, BH142 to BH145, BH201 and BH202. The natural clay contained inclusions of ironstone gravel and ironstone banding in some of the boreholes.
Bedrock	Natural shale bedrock was encountered in boreholes BH132, BH140, BH143, BH201 and BH202 at depths of between approximately 1.7m (BH143) and 4.0m (BH1201) and extended to the termination of the boreholes.
Groundwater	Groundwater seepage was not encountered in the boreholes during drilling. All boreholes remained dry on completion of drilling and a short time after.

7.2 Field Screening

A summary of the field screening results are presented in the table below.

Table 7-2: Summary of Field Screening

Aspect	Details (m in bgl)
PID Screening of Soil Samples for VOCs	PID soil sample headspace readings are presented in attached report tables and the COC documents attached in the appendices. All results were either 0 ppm or <0.9 ppm equivalent isobutylene which indicates a lack of PID detectable VOCs.
Groundwater Depth & Flow	All boreholes were dry during and a short time after completion of drilling or excavation.

Aspect	Details (m in bgl)
	SWL measured in the monitoring wells installed at the site ranged from 1.35m (MW12) to 3.67m (MW140). Groundwater (RLs) calculated on these measurements ranged from 47.01m to 49.60m (Australian Height Datum – AHD). EIS cannot provide a comment regarding the potential for excavation works to encounter groundwater, as excavation details have not been provided to EIS at this preliminary stage. EIS understand that the development does not include the extraction or use of groundwater. A contour plot was prepared for the groundwater levels using Surfer v11.0 (Surface Mapping Program) as shown on Figure 4. Groundwater flow generally occurs in a down gradient direction perpendicular to the groundwater elevation contours. The contour plot indicates that groundwater appears to flow onto the site from the west and south towards the north section of the site. However, EIS note that further data points in the central/west section of the site would provide further confidence for the assessment of groundwater directional flow.
Groundwater Field Parameters	Field measurements recorded during sampling are as follows: - pH ranged from 4.2 to 6.51; - EC ranged from 28,172µS/cm to 33,287µS/cm; - Eh ranged from 175mV to 240.5mV; and - DO ranged from 0.9ppm to 4.5ppm.
LNAPLs petroleum hydrocarbons	Free phase LNAPLs were not detected using the interphase probe, no free phase separation were visible and no hydrocarbon odours were observed during groundwater well development and sampling.

7.3 Soil Laboratory Results

The soil laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented below.

Table 7-3: Summary of Soil Laboratory Results

Analyte	Results Compared to SAC
Heavy Metals	**HILs:** All heavy metal results were below the HIL-C criteria. **EILs:** All heavy metal results were below the EIL- commercial/industrial criteria.

Analyte	Results Compared to SAC
	WC: The nickel results from the fill soil samples BH131 (0.1-0.3m), BH144 (0.1-0.3m) and the shale sample BH140 (5.8-6.0m) were greater than the CT1 and less than the SCC1 criteria. The lead result from the silty clay soil sample BH202 (0.05-0.15m) was greater than the CT1 and less than the SCC1 criteria. All remaining heavy metal results were less than the relevant heavy metal CT1 criteria. TCLP leachates were prepared from the above samples and analysed for nickel or lead. The results were less than the TCLP1 criteria.
TRH	**HSLs:** All TRH results were below the HSL-B criteria. **ESLs:** All TRH results were below the ESL - commercial/industrial criteria. **WC:** All TRH results were less than the relevant CT1 and SCC1 criteria.
BTEXN	**HSLs:** All BTEXN results were below the HSL-B criteria. **ESLs:** All BTEXN results were below the ESL - commercial/industrial criteria. **WC:** All BTEX results were less than the relevant CT1 and SCC1 criteria.
PAHs	**HILs:** All PAH results were below the HIL-C criteria. **HSLs:** All naphthalene results were below the HSL-B criteria. **ESLs:** All benzo(a)pyrene results were below the ESL - commercial/industrial criteria. **EILs:** All naphthalene results were below the EIL - commercial/industrial criteria. **WC:** All total PAHs results were less than the SCC1 and SCC2 criteria.

Analyte	Results Compared to SAC
	The Benzo(a)pyrene result for the fill soil sample BH139 (0.1-0.3m) was greater than the CT1 criterion and less than the SCC2 criterion. A TCLP leachate was prepared from the fill sample BH139 (0.1-0.3m) and analysed for PAHs (including Benzo(a)pyrene). The results were less than the TCLP1 criteria.
OCPs & OPPs	**HILs:** All OCP and OPP results were below the HIL-C criteria. **EILs:** All DDT results were below the EIL - commercial/industrial criteria. **WC:** All OCP and OPP results were less than the relevant CT1 and SCC1 criteria.
PCBs	**HILs:** All PCB results were below the HIL-C criterion. **WC:** All PCB results were less than the SCC1 criterion.
Asbestos	Asbestos fibres were not detected in the soil samples analysed for the investigation. However, asbestos fibres were detected in the following suspected ACM: • Fibre cement fragment sample MDF2 obtained from the surface in the central/west section of the site; • Fibre cement fragment sample BH134-S obtained from the surface in the central/west section of the site adjacent to borehole BH134; and • Fibre cement fragment sample BH135 (0-0.3m) obtained from the fill material at borehole sampling location BH135.

7.4 Groundwater Laboratory Results

The groundwater laboratory results are presented in the attached report tables. A summary of the results assessed against the SAC is presented below.

Table 7-4: Summary of Groundwater Laboratory Results

Analyte	Results Compared to SAC
Heavy Metals	**GIL-ANZECC-Fresh:** Elevated concentrations of individual metals were encountered above the GIL-ANZECC criteria as outlined below:

<table>
<tr><th>Analyte</th><th>Results Compared to SAC</th></tr>
<tr><td></td><td>
<table>
<tr><th>Analyte</th><th>GIL</th><th>Sample and Concentration</th></tr>
<tr><td>Cadmium</td><td>0.2 µg/L</td><td>MW132 – 2.1 µg/L
MW140 – 2.4 µg/L
MW143 – 0.7 µg/L</td></tr>
<tr><td>Copper</td><td>1.4 µg/L</td><td>MW12 – 5 µg/L</td></tr>
<tr><td>Nickel</td><td>11 µg/L</td><td>MW132 – 94 µg/L
MW140 – 160 µg/L</td></tr>
<tr><td>Zinc</td><td>8 µg/L</td><td>MW12 – 17 µg/L
MW132 – 78 µg/L
MW140 – 170 µg/L
MW143 – 33 µg/L</td></tr>
</table>
</td></tr>
<tr><td>TRH & BTEXN</td><td><u>GIL-ANZECC-Fresh:</u>
All BTEXN results were below the GIL-ANZECC criteria.

<u>HSLs:</u>
All TRH and BTEXN results were less than the practical quantitation limit (LPQL). The results for groundwater monitoring well samples MW132, MW140 and MW143 were below the GIL-HSL D criteria. EIS note that there are no GIL-HSL guideline values for groundwater at depths between 0-2m below ground or in contact with basement levels. A site specific assessment is required under these circumstance. Groundwater was encountered at monitoring well location MW12 at approximately 1.35mbgl. However, as the TRH and BTEXN results were LPQL a site specific assessment is not considered necessary.</td></tr>
<tr><td>PAHs</td><td><u>GIL-ANZECC-Fresh:</u>
All PAH results were below the GIL-ANZECC criteria.</td></tr>
<tr><td>Other Parameters</td><td>The results for pH ranged between pH 6.6 (MW140) to pH 7.1 (MW143).</td></tr>
</table>

8 DATA QUALITY ASSESSMENT

As part of the data quality assessment the following data quality indicators (DQIs) were assessed: precision, accuracy, representativeness, completeness and comparability as outlined in the table below. Reference should be made to the appendices for an explanation of the individual DQI.

Table 8-1: Assessment of DQIs

Completeness

Field Considerations:

- The investigation was designed to target the AEC identified at the site. Generally, a systematic and targeted sampling plan was adopted based on the AEC as outlined in the report;
- Samples were obtained from various depths based on the subsurface conditions encountered at the sampling locations. All samples were recorded on the borehole or test pit logs. All sampling points are shown on the attached Figure 2;
- The investigation was undertaken by trained staff in accordance with the SSP; and
- Documentation maintained during the field work is attached in the appendices where applicable.

Laboratory Considerations:

- Selected samples were analysed for a ranged of CoPC;
- All samples were analysed by NATA registered laboratory/s in accordance with the analytical methods outlined in NEPM 2013;
- Appropriate analytical methods and PQLs were used by the laboratory/s; and
- Appropriate sample preservation, handling, holding time and COC procedures were adopted for the investigation.

Comparability

Field Considerations:

- The investigation was undertaken by trained staff in accordance with the SSP;
- The climate conditions encountered during the field work were noted on the site description record maintained in the job file. EIS note that no significant rainfall events had occurred during the field work programme; and
- Consistency was maintained during sampling in accordance with the SSP.

Laboratory Considerations:

- All samples were analysed in accordance with the analytical methods outlined in NEPM 2013;
- Appropriate PQLs were used by the laboratory/s for all analysis (other than those outlined above);
- All primary, intra-laboratory duplicate/s and other QA/QC samples were analysed by the same laboratory; and
- The same units were used by the laboratory/s for all of the analysis.

Representativeness

Field Considerations:

- The investigation was designed to obtain appropriate media encountered during the field work as outlined in the SAQP. Dust and/or vapour sampling was outside the scope of this assessment; and
- All media based on the subsurface conditions encountered during the field work was sampled.

Laboratory Considerations:

- All samples were analysed in accordance with the SAQP.

Precision

Field Considerations:

- The investigation was undertaken in accordance with the SSP.

Laboratory Considerations:

- Analysis of field QA/QC samples including inter and intra-laboratory duplicates, trip blanks (TB), field rinsate (FR) and trip spikes (TS) as outlined below;
- The field QA/QC frequency adopted for the investigation is outlined below;
- Calculation of the Relative Percentage Difference (RPD) from the primary and duplicate results (the RPD calculation equation is outlined in the attached appendices);
- Assessment of RPD results against the acceptance criteria outlined in **Section 6.1.**

Intra-laboratory RPD Results:

Soil Samples at a frequency of approximately 7% of the primary samples:

- DUPMD-5A is a soil duplicate of primary sample BH133 (0-0.3m);
- DUPMD-3A is a soil duplicate of primary sample BH139 (0.1-0.3m); and
- DUPAB is a soil duplicate of primary sample BH202 (0.05-0.15m).

The intra-laboratory results are presented in the attached report tables. The RPD values for a range of individual heavy metals (chromium and nickel) were outside the acceptance criteria. Values outside the acceptable limits have been attributed to sample heterogeneity and the difficulties associated with obtaining homogenous duplicate samples of heterogenous matrices. As both the primary and duplicate sample results were less than the SAC, the exceedances are not considered to have had an adverse impact on the data set as a whole.

EIS are of the opinion that the field precision was acceptable.

Inter-laboratory RPD Results:

Soil Samples at a frequency of approximately 3.5% of the primary samples:

- DUPMD-4A is a soil duplicate of primary sample BH140 (0.1-0.3m).

Groundwater Samples at a frequency of 25% of the primary samples:

- DUPJDCW2 is a groundwater duplicate of primary sample MW143.

The inter-laboratory results are presented in the attached report tables. The RPD values for the groundwater copper analysis of the samples DUPJDCW2/MW143 was outside the acceptance criteria. The higher duplicate value has been adopted as a conservative measure (see attached report tables). The high RPD value has been attributed to the very low concentrations of the copper in the samples.

EIS are of the opinion that the field precision was acceptable.

Trip Spike (TS):

One soil and one groundwater TS were analysed for BTEX at a frequency of one spike per batch of volatiles. The results are presented in the attached report tables.

The results ranged from 78% to 129% and indicated that field preservation methods were appropriate.

Field Rinsate (FR):

Three FR samples obtained from the field equipment decontamination process were analysed for BTEX. The results are presented in the attached report tables.

All results were below the PQL which indicates that cross-contamination artefacts associated with sampling equipment were not present.

Trip Blank (TB):

Two soil and one groundwater TB were analysed for BTEX at a frequency of one blank per batch of volatiles. The results are presented in the attached report tables.

The results were all less than the PQLs.

Accuracy

Field Considerations:

- The investigation was undertaken in accordance with the SSP.

Laboratory Considerations:

- The analytical quality assessment adopted by the laboratory/s was in accordance with the NATA and NEPM 2013 requirements as outlined in the analytical report/s; and
- A review of the report/s indicates that the analytical results were generally within the acceptance criteria adopted by the laboratory/s.

9 TIER 1 RISK ASSESSMENT AND REVIEW OF CSM

For a contaminant to represent a risk to a receptor, the following three conditions must be present:

1. Source – The presence of a contaminant;
2. Pathway – A mechanism or action by which a receptor can become exposed to the contaminant; and
3. Receptor – The human or ecological entity which may be adversely impacted following exposure to contamination.

If one of the above components is missing, the potential for adverse risks is relatively low.

The assessment has identified the following contamination issues at the site:

Table 9-1: Tier 1 Risk Assessment and Review of CSM

Contaminant of Primary Concern (CoPC)	Receptor and Exposure Pathway	Discussion and Risk Rating
Asbestos	Human Receptors: Inhalation of airborne asbestos fibres	The investigation identified ACM both within the fill material and on the surface of the site. The ACM detected during the investigation is summarised below: • Fibre cement fragment sample MDF2 obtained from the surface in the central/west section of the site; • Fibre cement fragment sample BH134-S obtained from the surface in the central/west section of the site adjacent to borehole BH134; and • Fibre cement fragment sample BH135 (0-0.3m) obtained from the fill material at borehole sampling location BH135. The contamination data is shown in the attached Tables and Figure 3. During sampling the ACM were assessed to be in good conditions and could not be broken by hand pressure. Hence the material was assessed to be 'non-friable' based on field information. The risk posed to receptors identified in the CSM is outlined below: Human Receptors – Site Workers Site workers (construction workers) will be exposed to the fill soil during development excavation works. The risk posed by the Asbestos contaminated fill soil to workers is considered to

Contaminant of Primary Concern (CoPC)	Receptor and Exposure Pathway	Discussion and Risk Rating
		be moderate and should be managed in accordance with a remediation action plan (RAP). <u>Human Receptors</u> – <u>Future Occupants</u> Remnant fill on site is considered to be Asbestos contaminated and poses a risk to future site occupants and should be managed in accordance with a remediation action plan (RAP).
Soil - nickel and benzo(a)pyrene	<u>Environmental Receptors:</u> Direct exposure to plants and animals	The EIS PESA 2017 investigation identified the following soil CoPC greater than the EAC: • An elevated concentration of nickel (69 mg/kg) was encountered in the fill soil sample BH15 (0.05-0.1m) above the EIL- commercial/industrial criteria (60 mg/kg); and • An elevated concentration (1.9 mg/kg) of benzo(a)pyrene in the fill sample BH10 (0.04-0.1m) above the respective ESL commercial/industrial SAC (1.4 mg/kg). EIS have reassessed the above elevated nickel result for the fill soil sample (0.05-0.1m) against a revised EIL based on the additional average data for (pH, CEC and clay content) obtained for the preliminary Stage 2 ESA. EIS note that pH, CEC and clay content concentrations/parameters are utilized in the calculation of the ABC for the calculation of site specific EAC. Based on the additional data the revised EIL for nickel is 605 mg/kg. Therefore the nickel result for the fill soil sample BH15 (0.05-0.1m) is below the EAC. Since the issues of the EIS PESA 2017 the criteria for benzo(a)pyrene has been increased from the value presented in NEPM (2013) based on the information presented in the CRC Care Technical Report No. 39 – Risk-based management and guidance for benzo(a)pyrene (2017)[18]. Therefore, the benzo(a)pyrene result for the fill sample BH10 (0.04-0.1m) is below the EAC. EIS note that the new ESL commercial/industrial criteria guideline value is 172 mg/kg.

[18] CRC Care, (2011). *Technical Report No. 39 - Risk-based management and guidance for benzo(a)pyrene*

Contaminant of Primary Concern (CoPC)	Receptor and Exposure Pathway	Discussion and Risk Rating
		The concentrations of the soil samples analysed for the Preliminary Stage 2 ESA were below the EAC. Based on the results of the assessment and discussions above the there is a very low risk to the ecological receptors identified in the CSM and soil remediation is not required.
Groundwater - Cadmium, copper, nickel and zinc	Environmental Receptors: Freshwater receiving bodies	Elevated concentrations of cadmium, copper, nickel and zinc were identified within groundwater samples above the GIL SAC. The groundwater contamination data is shown in the attached tables and Figure 3. EIS are of the opinion that the elevated concentration of cadmium, copper, nickel and zinc detected in the groundwater samples are typical of urban/regional groundwater conditions for the following reasons: • No significant point sources of cadmium, copper, nickel or zinc were identified in the fill soil; • Elevated concentrations of heavy metals (including copper, nickel and zinc) are very common in urban groundwater as a result of leaking water infrastructure and surface run-off; and • Elevated concentrations of heavy metals are commonly encountered in shale associated groundwater aquifers. Based on the groundwater contour plan (Figure 4), groundwater appears to flow onto the site from the east and west towards the central section of the site. Therefore, the nearest groundwater receiving body is considered to be Claremont Creek which is located approximately 3.4km to the south of the site. Surface water at the site is considered to flow towards the north-east and to the Somerset Street stormwater system. Based on the regional topography, EIS are of the opinion that the stormwater from the area would likely discharge into the Nepean River located approximately 3.5km to the west of the site. Due to the considerable distance, the receiving water bodies are highly unlikely to be considered to be a potential receptor.

Contaminant of Primary Concern (CoPC)	Receptor and Exposure Pathway	Discussion and Risk Rating
		EIS are of the opinion that elevated concentrations of cadmium, copper, nickel and zinc detected in the groundwater samples pose a very low risk to the receptors identified in the CSM and groundwater remediation is not required.

9.1 Source and Extent of ACM Contamination

9.1.1 Sources

The source of the ACM is considered likely to be associated with the importation of fill material onto the site or possibly the demolition of former buildings at the site. EIS note that fill material contained building demolition rubble (eg. brick and concrete fragments) in boreholes BH134, BH137 and BH138, with the ACM identified within the fill material in borehole BH135.

9.1.2 ACM Condition

The ACM detected at the site were assessed by EIS field staff and considered to be in reasonable condition and could not be crushed, broken or compressed using hand pressure.

9.1.3 Known Extent

The fill ranged in depth from approximately 0.1m bgl to 2.0m bgl as shown on the attached Figure 2.

Due to the heterogeneous nature of the fill material and extent of contamination, no distinct hotspots can be identified at the site. All fill material in the proposed development area is considered to be contaminated and should be treated accordingly.

However, based on a review of the field logs and the laboratory data, EIS are of the opinion that the ACM soil contamination may be confined to the central section of the site. The extent of the ACM soil contamination can be further assessed by undertaking a detailed asbestos quantification in accordance with the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia Western Australian (2009[19]) (endorsed in NEPM 2013).

9.1.4 Unknown Extent

Sampling was not undertaken in the central and north-west section of the site beneath the existing building. The extent of contamination beneath the buildings is currently unknown. However,

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

considering the elevation of the land in this section of the site, it is considered likely that fill would be present beneath the buildings.

EIS also note that hand auger refusal was encountered within the fill material at boreholes BH133, BH134, BH135, BH137, BH138 and BH141 at approximate depths of between 0.2mbgl and 0.5mbgl. The vertical extent of the fill material in these areas of the site have not been assessed.

9.1.5 Hazardous Building Materials in Existing Buildings

There is a possibility of the presence of hazardous building materials in the existing buildings at the site. This is considered to pose a relatively low risk to the receptors provided that the demolition works are undertaken in accordance with the relevant codes and standards.

9.2 Groundwater

As outlined in Table 9.1, the elevated concentrations of heavy metals in the groundwater are considered to pose a low risk to the identified receptors and therefore groundwater remediation is not considered necessary.

In the event groundwater is intercepted during excavation works, dewatering may be required. Council, NSW Office of Water (NOW) and other relevant approvals (from discharge authorities like Sydney Water etc.) should be obtained prior to the commencement of dewatering.

9.3 Fate and Transport of Contaminants

The potential fate and transport of CoPC identified at the site is summarised in the following table:

Table 9-2: Fate and Transport of CoPC

CoPC	Fate and Transport
Non-volatile contaminants including: Asbestos	The potential transport of asbestos fibres is associated with the disturbance of asbestos contaminated soils and release of fibres into the atmosphere. This is likely to occur during excavation works. A number of studies have found that soils effectively filter out asbestos fibres and retain them within the soil matrix. The studies concluded that there is no significant migration of asbestos fibres, either through soil or groundwater.

9.4 Underground Storage Tank (UST) located to the east of the site

At the time of the investigation a potential diesel UST was identified approximately 50m to the south-west of the north-west section of the site (see Figure 2). Potential on-site groundwater impacts from the UST were considered to be a low risk to the human receptors associated with the proposed development and further assessment was recommended (EIS Report ref: E29845KDrpt2.3, dated 30 October 2017).

Based on the revised proposed development details, the proposed development area has moved further to the east. EIS are of the opinion that the UST poses a very low contamination risk to the proposed development for the following reasons:

- The UST is located approximately 100m from the western site boundary. Heavy fraction hydrocarbons (e.g. Diesel) are considered highly unlikely to migrate through the groundwater distances of over 100m, especially considering that the subsurface conditions at the site comprise of silty clay and shale bedrock which are of low permeability; and
- All groundwater laboratory results for UST associated CoPC were below the laboratory detection limits.

9.5 Data Gaps

The assessment has identified the following data gaps:

- The area beneath the existing building in the central and north-west sections of the site were not accessible at the time of the investigation;
- The vertical and horizontal extent of fill material at the site has not been fully assessed; and
- The proposed development area has been moved to the east, increased in area to the south-east and therefore requires further assessment.

10 WASTE CLASSIFICATION OF SOIL FOR OFF-SITE DISPOSAL

The waste classification of soil for off-site disposal is summarised in the following table:

Table 10-1: Waste Classification

Site Extent / Material Type	Classification	Disposal Option
Fill material	General Solid Waste (non-putrescible) (GSW) containing asbestos	A NSW EPA landfill licensed to receive the waste stream. The landfill should be contacted to obtain the required approvals prior to commencement of excavation.
Natural silty clay soil and shale bedrock. Notes: • A concentration of nickel was encountered within the bedrock shale sample BH140 (5.8-6.0m) and a concentration of lead in the silty clay sample BH201 (1.5-1.95m) were above the CT1 Waste Classification Guideline Criteria. Based on the entire data set for the site, EIS are of the opinion that the results are considered to be an anomaly; and • The VENM classification must be confirmed by issue of an Asbestos Clearance certificate and/or additional sampling and analysis following the removal of contaminated fill material.	Virgin excavated natural material (VENM)	VENM is considered suitable for re-use on-site, or alternatively, the information included in this report may be used to assess whether the material is suitable for beneficial reuse at another site as fill material. Alternatively, the natural material can be disposed of as VENM to a facility licensed by the NSW EPA to receive the waste stream.

11 ACID SULFATE SOIL RISK AND PLANNING

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.

Based on the scope of review of available information, the risk posed by ASS are considered to be negligible due to the following:

- The ASS risk map indicates that the site is not located within an ASS risk area;
- The geological map for the site indicates the site is underlain by Bringelly Shale;
- The borehole drilled by JK Geotechnics and EIS indicated a residual soil profile over shale and/or sandstone bedrock. ASS is not usually associated with residual soil profiles or in sandstone or shale bedrock; and
- The site is located at approximately RL 50.0m AHD with excavations to extend to a minimum elevation of approximately 43.0m AHD. ASS are not usually associated with soil horizons above 5m AHD; and
- The proposed development is not expected to lower the water table below 1m AHD on adjacent land.

Based on this information, preparation of an Acid Sulfate Soil Management Plan (ASMP) is not considered necessary for the proposed development.

12 CONCLUSION

EIS consider that the report objectives outlined in **Section 1.2** have been addressed.

The decision statements are addressed in the table below:

Table 12-1: Decision Statements and Conclusions

Decision Statement	Conclusion
Are any of the results above the SAC?	Yes. Elevated concentrations of CoPC were encountered within the fill soil samples and groundwater samples analysed for the investigation. Surface ACM were also identified.
Do any of the contaminants pose a risk to the site receptors?	The elevated concentrations of CoPC encountered within the fill soil samples and groundwater are not considered to pose a risk to the ecological receptors. The ACM identified within the fill soils and at the surface of the site pose a risk to the receptors if not managed.
Is remediation required to render the site suitable for the proposed development?	Yes. Soil remediation is considered necessary for the proposed development. A Remediation Action Plan (RAP) should be prepared.

EIS consider that the site can be made suitable for the proposed development provided that the following recommendations are implemented to address the data gaps and to minimise risks:

1. Prepare a Remediation Action Plan (RAP) to outline remedial measures for the site. The RAP should address the data gaps identified in **Section 9.4**; and

2. Prepare a Validation Assessment (VA) report on completion of remediation.

In the event unexpected conditions are encountered during development work or between sampling locations that may pose a contamination risk, all works should stop and an environmental consultant should be engaged to inspect the site and address the issue.

12.1 Regulatory Requirement

The regulatory requirements applicable for the site are outlined in the following table:

Table 12-2: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination 2015[20]	At this stage, EIS consider that there is no requirement to notify the NSW EPA of the site contamination. After successful implementation of the RAP, the site contamination is unlikely to meet the Notification Triggers.
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.
Work Health and Safety Code of Practice 2011[21]	Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan.
Dewatering Consent	In the event groundwater is intercepted during excavation works, dewatering may be required. Council, NSW Office of Water (NOW) and other relevant approvals (from discharge authorities like Sydney Water etc.) should be obtained prior to the commencement of dewatering.

[20] NSW EPA, (2015), *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.* (referred to as Duty to Report Contamination 2015)

[21] WorkCover NSW, (2011), *WHS Regulation: Code of Practice – How to Manage and Control Asbestos in the Workplace.*

13 LIMITATIONS

The report limitations are outlined below:

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

LIST OF IN-TEXT TABLES

IMPORTANT INFORMATION ABOUT THIS REPORT

These notes have been prepared by EIS 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 EIS 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.

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

Changes in Subsurface Conditions

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

This Report is based on Professional Interpretations of Factual Data

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

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

Assessment Limitations

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

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

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

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

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