ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

TANNER KIBBLE DENTON ARCHITECTS PTY LTD

ON

PRELIMINARY STAGE 1 ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED CURL CURL NORTH PUBLIC SCHOOL REDEVELOPMENT

AT

PLAYFAIR ROAD, NORTH CURL CURL, NSW

10 MAY 2018 **REF: E29816KDrpt.rev3**

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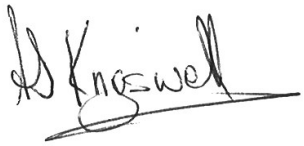

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EXECUTIVE SUMMARY

Tanner Kibble Denton Architects Pty Ltd (TKD) ('the client') commissioned Environmental Investigation Services (EIS) to undertake a Preliminary Stage 1 Environmental Site Assessment (ESA) for the proposed Curl Curl North Public School redevelopment at Playfair Road, Curl Curl, NSW. The site location is shown on Figure 1 and the assessment was confined to the site boundaries/proposed development area as shown on Figure 2. The proposed development area is referred to as 'the site' in this report.

Based on the supplied plans EIS understand that the majority of the existing buildings will be demolished and a new school will be constructed. In general this will consist of;

- Two rows of buildings extending from the central section of the site to the south boundary;
- The two rows of building will be divided by an area of soft and hard landscaping and synthetic turf;
- A swale will run north to south between the new buildings;
- The north/north-east section of the site will be landscaped an include a synthetic turf sports field and asphalt/concrete paved sports court;
- A paved car park will be located on the south boundary of the site;
- The majority of existing trees will be retained around the perimeter of the site.

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 contamination conditions.

The scope of work included the following:

- Review of site information, including background and site history information from a Lotsearch Pty Ltd *Environmental Risk and Planning Report* and other sources;
- 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.

A summary of the historical land uses and activities is presented in the table below.

Year(s)	Potential Land Use / Activities	Supporting Evidence
Pre-1951	Residential	Aerial photographs indicate that the site was used for residential purposes prior to 1951.
1951 to present	School/ educational	Curl Curl North Public School website indicates that the site has been a school since 1951.

Samples for this investigation were obtained from 13 sampling points as shown on the attached Figure 2. This density is approximately 32% of the minimum sampling density recommended by the EPA.

The investigation encountered FCF containing asbestos on the ground surface across the site. During sampling the some of the FCFs were assessed to be in poor conditions could be broken easily by hand pressure. Hence this material was assessed to be 'friable' based on field information. The remaining FCFs were considered to be bonded.

Approximately 40 suspected FCF (fibre cement fragments) were noted across the surface of the site (particularly in the north and south sections) on 4 October 2016. WSP | PB were subsequently engaged by the NSW Department of Education (DoE) – Asbestos Management Unit (AMU) to provide an Asbestos Remediation Clearance Certificate. Approximately 134 FCF, were collected from the surface of the site by WSP | PB. The WSP | PB Asbestos in Grounds Management Plan dated January 2013 was subsequently revised by WSP | PB, dated

October 2016. Approximately 30 additional suspected FCF, were collected from the site surface during the EIS works on 11 December 2016. Although the FCF were not encountered within the soils samples analysed EIS are of the opinion that the continual discovery of FCF, in large numbers, on the ground surface following surface clearances indicates that the source of on-ground FCF are within the fill soils. It would appear that the FCF are being brought to the surface by human disturbance (traffic), along with weathering and erosion processes.

EIS are of the opinion that the risk posed to human receptors is moderate and will require remediation and/or management.

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/better manage/characterise the risks:

1. The NSW Department of Education (DoE) – Asbestos Management Unit (AMU) should be contacted and advised of the continual discovery of ACM at Curl Curl North Public School. WSP | Parsons Brinckerhoff (PB) who prepared the Asbestos in Grounds, Asbestos Management Plan (AMP) report for Curl Curl North Public School should also be contacted and advised of the continual discovery as their report may need to be revised. Management procedures from the WSP | Parsons Brinckerhoff (PB) Asbestos in Grounds, Asbestos Management Plan (AMP) report should be implemented as a priority to reduce the risk to potential receptors;

2. Depending on the clients preferred remediation/management strategy, undertake a Detailed Site Investigation (DSI) to characterise the extent of asbestos contamination at the site**;**

3. Prepare a Remediation Action Plan (RAP) to outline remedial measures for the site;

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

5. Undertake a Hazardous Materials Assessment (Hazmat) for the existing buildings prior to the commencement of demolition work.

In the event that any contaminated material remains on the site after completion of remediation (eg if the contaminated material is capped) and an Environmental Management Plan (EMP) will be required for the ongoing management of contamination remaining on site. The EMP will require establishment of appropriate public notification under Section 149(2) of the E&PAA 1979 or a covenant registered on the title to land under Section 88B of the Conveyancing Act 1919.

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.

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**
International Organisation of Standardisation	**ISO**
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**

ABBREVIATIONS

Photo-ionisation Detector	**PID**
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**
Standard 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

Tanner Kibble Denton Architects Pty Ltd (TKD) ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake a Preliminary Stage 1 Environmental Site Assessment (ESA) for the proposed Curl Curl North Public School redevelopment at Playfair Road, Curl Curl, NSW. The site location is shown on Figure 1 and the assessment was confined to the site boundaries/proposed development area as shown on Figure 2. The proposed development area is referred to as 'the site' in this report.

A geotechnical investigation was undertaken in conjunction with this assessment by JK Geotechnics[2]. The results of the investigation are presented in a separate report (Ref. 29816ZHrpt, dated 23 December 2016[3]). This report should be read in conjunction with the JK report.

1.1 Proposed Development Details

Based on the supplied plans EIS understand that the majority of the existing buildings will be demolished and a new school will be constructed. In general this will consist of;

- Two rows of buildings extending from the central section of the site to the south boundary;
- The two rows of building will be divided by an area of soft and hard landscaping and synthetic turf;
- A swale will run north to south between the new buildings;
- The north/north-east section of the site will be landscaped an include a synthetic turf sports field and asphalt/concrete paved sports court;
- A paved car park will be located on the south boundary of the site;
- The majority of existing trees will be retained around the perimeter of the site.

EIS note that Figures 2 and 3 show that outline of the original proposed development.

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 contamination conditions. The assessment objectives were to:

- Provide an appraisal of the past site use(s) based on a review of historical records;
- 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 contamination conditions via implementation of a preliminary sampling and analysis program;

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

[2] Geotechnical consulting division of J&K

[3] Referred to as JK 2016 Report

- 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 an EIS proposal (Ref: EP43445KD) of 26 September 2016 and written acceptance from the client of 26 September 2016. The scope of work included the following:

- Review of site information, including background and site history information from a Lotsearch Pty Ltd *Environmental Risk and Planning Report* and other sources;
- 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)[4]
State Environmental Planning Policy No.55 – Remediation of Land (1998)[5]
Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)[6]
Guidelines for Consultants Reporting on Contaminated Sites (2011)[7]
Guidelines for the NSW Site Auditor Scheme, 2nd Edition (2006)[8]

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

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

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

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

[8] NSW DEC, (2006). *Guidelines for the NSW Site Auditor Scheme, 2nd ed.* (referred to as Site Auditor Guidelines 2006)

Guidelines/Regulations/Documents
National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)[9]

[9] 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 Asbestos Management Plan – NSW Department of Education and Training (September 2008)

EIS were made aware of an overarching Asbestos Management Plan (AMP) for all NSW schools and educational facilities prepared by the Department of Education and Training (DET) (Asbestos Management Plan, Asset Management Directorate, NSW Department of Education and Training, September 2008[10]). This documents sets out the approach to be taken for management of asbestos hazards in DET facilities.

2.1.2 Asbestos in Grounds, Asbestos Management Plan (WSP | Parsons Brinckerhoff, October 2016[11])

EIS were provided with an Asbestos in Grounds, Asbestos Management Plan (AMP) report, prepared by WSP | Parsons Brinckerhoff (PB), during the investigation phase of the EIS Preliminary Stage 1 ESA. WSP | PB conducted an asbestos inspections of the grounds of the site in 2013 and 2016. WSP|PB initially prepared the Asbestos in Grounds, Asbestos Management Plan (AMP) document for Curl Curl North Public school in 2013. Following the EIS October 2016 site inspection WSP|PB were engaged to provide a clearance certificate. During these works approximately 134 suspected ACM fragments were collected from the site surface and the AMP was revised.

Section 3 of the AMP (Asbestos register (Grounds)), outlined the findings of the inspection of the grounds and indicated the areas requiring management. The areas of management are below:

Table 3-1 Asbestos Register – Asbestos zones only for Curl Curl North Public School

Event	Location	Description of Material	Extent	Condition	Risk Status	Control Priority	Control Recommendation /Comments
A&B (2008)	Play area north of Block J	Possible buried asbestos cement fragments	Throughout – below ground surface	Unknown	Low	Low	The area should be regularly monitored for any fragments and a record kept of how many are found and at what frequency. Fragments should be collected and disposed of as asbestos waste.
C (2016)	External ground surfaces along the northern	Possible buried asbestos	Throughout – below ground surface	Unknown	Low	Low	The area should be regularly monitored for any fragments and a record kept of how many

[10] DET (2008), Asbestos Management Plan, Asset Management Directorate, dated September 2008 (referred to as DET 2008 AMP).

[11] WSP|PB, (2016), Asbestos in Grounds, Asbestos Management Plan, Curl Curl North Public School, North Curl Curl, NSW. (Report Ref: 2171479A PR_0157, dated October 2016) (referred to as WSP|PB 2016 Report)

	boundary fence	cement fragments					are found and at what frequency. Fragments should be collected and disposed of as asbestos waste.
D (2016)	External ground surfaces at the southern sports field	Possible buried asbestos cement fragments	Throughout – below ground surface	Unknown	Low	Low	The area should be regularly monitored for any fragments and a record kept of how many are found and at what frequency. Fragments should be collected and disposed of as asbestos waste.
E (2016)	Northern playground area including sports court and mulched area	Possible buried asbestos cement fragments	Throughout – below ground surface	Unknown	Low	Low	The area should be regularly monitored for any fragments and a record kept of how many are found and at what frequency. Fragments should be collected and disposed of as asbestos waste. Consideration should be given to maintenance of the turf to prevent soil erosion as a result of foot traffic and weathering. Disturbance of the soil should be avoided. If the soil must be a disturbed, work must be conducted in accordance with this document. Soil must be classified prior to removal off site.
F (2016)	Southern playground area/soccer field, including mulched areas and areas surrounding demountables	Possible buried asbestos cement fragments	Throughout – below ground surface	Unknown	Low	Low	The area should be regularly monitored for any fragments and a record kept of how many are found and at what frequency. Fragments should be collected and disposed of as asbestos waste. Consideration should be given to maintenance of

							the turf to prevent soil erosion as a result of foot traffic and weathering. Disturbance of the soil should be avoided. If the soil must be a disturbed, work must be conducted in accordance with this document. Soil must be classified prior to removal off site.

A permit to work system is a requirement of the WSP|PB 2016 AMP report for works that may disturb asbestos materials at the site.

2.2 Site Identification

Table 2-1: Site Identification

Current Site Owner:	The State of New South Wales and Minister for Education and Youth Affairs
Site Address:	Playfair Road, North Curl Curl, NSW
Lot & Deposited Plan:	Lot 1 DP731454 and Lot 286 DP752038
Current Land Use:	School
Proposed Land Use:	School
Local Government Authority (LGA):	Northern Beaches Council
Current Zoning:	R2 – Low Density Residential
Site Area/Area of Proposed Development (m^2):	28,000
RL (AHD in m) (approx.):	8
Geographical Location (decimal degrees) (approx.):	Latitude: -33.764505 Longitude: 151.289143

2.3 Site Location and Regional Setting

The site is located in a predominantly residential area of North Curl Curl. The site is bounded by Playfair Road to the west and Abbott Road to the south. The site is located approximately 170m to the north and north west of Greendale Creek and Curl Curl Lagoon.

2.4 Topography

The site is located in relatively flat to gently sloping topography, which grades down to the south at approximately 1 ° to 2°.

2.5 Site Inspection

A walkover inspection of the site was undertaken by EIS on 4 October 2016 and 11 December 2016. The inspection was limited to accessible areas of the site and immediate surrounds. An internal inspection of buildings was not undertaken. Selected site photographs obtained during the inspection are attached in the appendices. A summary of the findings are outlined in the following subsections:

At the time of the fieldwork, the central portion of the site was occupied by several one and two storey brick buildings and weatherboard demountable buildings. The buildings were surrounded by asphaltic concrete (AC) pavements and concrete pathways. Grass covered and synthetic grass playing fields occupied the northern and southern portions of the site, with numerous medium sized trees located around the perimeter of the site. Numerous fibre cement fragments (FCF) were observed on the ground surface of the site, most notably the northern and southern playing fields. A number of the FCF were in a degraded state and could easily be broken by hand.

The neighbouring properties to the north were occupied by two storey brick houses. The neighbouring properties located to the east of the site boundary were occupied by several one and two storey weatherboard, fibro and brick houses. Ground surface levels across the site boundaries were similar.

2.6 Surrounding Land Use

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

- North – Residential properties;
- South – Sports courts and public open space;
- East – Residential properties; and
- West – Residential properties.

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.

The DBYD plans indicated that a sewer main extends through the northern section of the site in an east-west direction. The sewer is understood to be at a depth of approximately 2.1m below ground and also extends through the neighbouring properties. It is unlikely there is a potential for the sewer trench to act as a preferential pathway for contamination migration (i.e. through relatively permeable backfill).

2.8 Section 149 Planning Certificate

The s149 (2 and 5) planning certificates were reviewed for the assessment. Copies of the certificates are attached in the appendices. A summary of the relevant information is outlined below:

- The site is not located in an area of ecological significance;
- The site is not deemed to be: significantly contaminated; subject to a management order; subject of an approved voluntary management proposal; or subject to an on-going management order under the provisions of the CLM Act 1997;
- The site is not subject to a Site Audit Statement (SAS);
- The site is located within an ASS Class 5 risk area; and
- The site is not located in a heritage conservation area.

3 GEOLOGY AND HYDROGEOLOGY

3.1 Regional Geology

Regional geological information presented in the Lotsearch report (attached in the appendices) indicated that the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses in the northern part of the site. The southern part of the site has been indicated to be underlain by man-made fill (dredged estuarine sand and mud, demolition rubble, industrial and household waste) overlying silty to peaty quartz sand, silt and clay with ferruginous & humic cementation in places and common shell layers.

3.2 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.

ASS information presented in the Lotsearch report (attached in the appendices) indicated that the site is located within a Class 5 area. Works in Class 5 areas that could pose an environmental risk in terms of ASS include works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent land.

3.3 Hydrogeology

Hydrogeological information presented in the Lotsearch report (attached in the appendices) indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. There were a total of 29 registered bores within the report buffer of 2,000m. In summary:

- The nearest registered bore was located approximately 96m from the site. This was utilised for domestic purposes. This appears to be downgradient of the site;
- The bores were registered for various purposes including domestic, monitoring, irrigation and recreation; and
- The drillers log information from the closest registered bores typically identified sands and/or clay soils. The standing water level (SWL) in the closest bore was 1.90mBGL.

The information reviewed for this assessment indicated that the subsurface conditions at the site are expected to consist of alluvial soils overlying relatively deep bedrock. Abstraction and use of groundwater at the site or in the immediate surrounds may be viable under these conditions. It is worth noting that the surrounding area is connected to the main urban water supply infrastructure and use of groundwater as a drinking water resource is unlikely.

3.4 Receiving Water Bodies

The site location and regional topography indicates that excess surface water flows have the potential to enter Greendale Creek and Curl Curl Lagoon located approximately 170m south and south west of the site. These water bodies could be potential receptors.

4 SITE HISTORY INFORMATION

4.1 Review of Historical Aerial Photographs

Historical aerial photographs were included in the Lotsearch report (attached in the appendices). EIS has reviewed the photographs and summarised relevant information in the following table:

Table 4-1: Summary of Historical Aerial Photographs

Year	Details
1943	A small residential like building was visible in the north west corner of the site along with five small structures along the eastern boundary in the south east corner of the site. Two circular excavations were visible towards the centre of the site (this was subsequently identified as a WWII gun emplacement). Trees were visible towards the northern and south western areas of the site. The remaining parts of the site appeared vacant and grassed. Residential properties were visible in the surrounding areas.
1956	Buildings and structures that were visible in the 1943 photo appeared to have been demolished. The circular excavation appeared to have been filled in. Four larger buildings were visible towards the centre of the site with four small structures visible to the east and south of the larger buildings. Several small structures were visible in the north east corner of the site. The remainder of the site appeared grassed. The immediate surrounds appeared similar to the 1943 photograph.
1961	Three additional larger buildings were visible towards the centre of the site. Three small structures visible to the south of these buildings appeared to have been demolished. The remaining parts of the site and the immediate surrounds appeared generally similar to the 1956 photograph.
1965	A larger building was visible to the north west of the larger buildings visible in the 1961 photograph. The remaining parts of the site and its immediate surround generally appeared similar to the 1961 photograph.
1970	Two additional buildings were visible towards the centre of the site. Some of the structures visible towards the north eastern corner in the earlier photographs appeared to have been demolished. The site and its immediate surrounds generally appeared similar to the 1965 photograph.
1982	The site and its immediate surrounds generally appeared similar to the 1970 photograph.
1991	The remaining structures visible in the north eastern corner of the site in the earlier photographs appeared to have been demolished. Landscaped gardens were visible along the boundary in this area. The site and its immediate surrounds generally appeared similar to the 1982 photograph.

Year	Details
2005	The southern part of the site appeared to be used as a car park with numerous cars visible in this area. Smaller structures were visible towards the centre of the site and close to the eastern boundary. Remaining parts of the site and its immediate surrounds generally appeared similar to the 1991 photograph.
2009	Small buildings increased in density towards the northern eastern half of the site and towards the south western corner of the site. Cars were no longer visible in the southern part of the site. The remaining areas of the site and its immediate surrounds generally appeared similar to the 2005 photograph.
2015	The site and its immediate surrounds generally appeared similar to the 2009 photograph.

4.2 Review of Historical Land Title Records

Historical land title records were reviewed for the assessment. The record search was undertaken by Advance Legal Searchers Pty Ltd. Copies of the title records are attached in the appendices. The historical land title records did not identify any particular land uses which could have resulted in significant contamination. The professions of the individuals listed on the title records are not considered to be associated with site related activities.

4.3 Review of Council Records

4.4 Records

Council records available under the access to public information were reviewed for the assessment. A summary of the relevant information is provided in the following table:

Table 4-2: Summary of Council Records

Record Number	Application Details
DA2002/0437	Development application approved for construction of a new open carpark for the Primary School
DA2004/0295	Development application was approved for a hall extension.
DA2006/0222	Development application was approved for a canteen and staff play area.
CDC2009/0056	Development application was approved externally for a homebase and administration refurbishment

4.1 State Significant Development (SSD) Application

An earlier version of this report was submitted with an initial State Significant Development (SSD) application lodgement and the various authorities (Council, EPA etc) provided comments.

Following the initial SSD application, Northern Beaches Council provided information in October 2017 relating to an existing Environmental Management plan (EMP) and on-going monitoring of landfill gas associated with John Fisher Park to the south of the site. Elevated concentrations of carbon dioxide have been identified in nearby (off-site) gas wells within John Fisher Park.

4.2 SafeWork NSW Records

SafeWork NSW records were reviewed for the assessment. Copies of relevant documents are attached in the appendices. The search did not identify any licences to store dangerous goods including underground fuel storage tanks (USTs) or above ground storage tanks (ASTs) at the site.

4.3 NSW EPA Records

The Lotsearch report (attached in the appendices) included information from the NSW EPA databases for the following:

- Records maintained in relation to contaminated land under Section 58 of the CLM Act 1997;
- Records of notified sites under Section 60 of the CLM Act 1997 (Duty to Report Contamination); and
- Licensed activities under the Protection of the Environment Operations Act (1997[12]).

The search included the site area and surrounding areas in the report buffer of 1,000m. The search indicated the following:

- There were no records for the site under Section 58 of the CLM Act 1997;
- The site has not been notified under Section 60 of the CLM Act 1997. A property located 16m south west of the site has been listed on the NSW EPA Contaminated Land list. A landfill was listed as the activity on this neighbouring site. The EPA has completed an assessment of the contamination and decided that regulation under the Contaminated Land Management Act 1997 is not required;
- There were no records for licenced activities at the site under the POEO Act 1997. Current and historical licenses were identified for several properties within the report buffer, however these activities are considered unlikely to pose a contamination risk to the site.

4.4 Historical Business Directory and Additional Lotsearch Information

Historical business records for the site and surrounding areas in the report buffer were included in the Lotsearch report (attached in the appendices). There were no businesses listed for the site. Motor garages were road matched within 50m of the site however the exact location of these is unknown. EIS are of the opinion that the historical businesses in the report buffer are unlikely to represent potential off-site sources of site contamination.

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

In addition to the above, EIS have reviewed additional information contained within the Lotsearch report and note the following:

- There were no local or state heritage items at the site or in the immediate surrounds; and
- There were no significant ecological constraints at the site or in the immediate surrounds.

4.5 Curl Curl North Public School Website[13]

The Curl Curl North Public School website indicates that an infant's school was established in 1951. Buildings were manufactured by the Bristol Aircraft company and were exported to Australia. In 1954 facilities were extended. Further extensions were undertaken in 1959, 1960s, 1970s, 1996 and 1998.

4.6 Summary of Site History Information

A summary of the historical land uses and activities is presented in the table below. The information presented in the table is based on a weight of evidence assessment of the site history documentation and observations made by EIS.

Table 4-3: Summary of Historical Land Uses

Year(s)	Potential Land Use / Activities	Supporting Evidence
Pre-1951	Residential	Aerial photographs indicate that the site was used for residential purposes prior to 1951. A WWII gun emplacement was located in the central section of the site in 1943.
1951 to present	School/ educational	Curl Curl North Public School website indicates that the site has been a school since 1951.

4.7 Integrity of Site History Information

The majority of the site history information has been obtained from government organisations as outlined and the relevant sections of this report. The veracity of the information from these sources is considered to be relatively high. A certain degree of information loss can be expected given the lack of specific land use details over time. EIS has relied upon the Lotsearch report and has not independently verified any information contained within. However, it is noted that the Lotsearch report is generated based on databases maintained by various government agencies and is expected to be reliable.

[13] http://www.curlcurln-p.schools.nsw.edu.au/our-school/school-history

5 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.

5.1 Potential Contamination Sources/AEC and CoPC

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

Table 5-1: Potential Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
Fill material - The site appears to have been historically filled to achieve the existing levels. The fill may have been imported from various sources and could be contaminated.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos.
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
Hazardous Ground Gas – Northern beaches Council have identified elevated concentrations of carbon dioxide in John Fisher Park to the south of the site.	Carbon Dioxide

5.2 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 5-2: 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);

	• Hazardous building materials – 'top-down' (e.g. demolition resulting in surficial impacts in unpaved areas); • Off-site land uses – 'top-down', spill or sub-surface release. Impacts to the site could occur via migration of contaminated groundwater; • Hazardous Ground Gas – Sub-surface release.
Affected media	Soil and soil vapour have been identified as potentially affected media.
Receptor identification	Human receptors include site occupants/users, construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users, groundwater users and recreational water users within Curl Curl Lagoon and Greendale Creek. Ecological receptors include terrestrial organisms and plants within unpaved areas, and freshwater/marine ecology in Curl Curl Lagoon and Greendale Creek.
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). Potential exposure pathways for ecological receptors include primary contact and ingestion.

The carbon dioxide issue was not identified until sometime after the initial investigation had been completed and therefore was not included in the following Sampling, Analysis and Quality Plan.

6 SAMPLING, ANALYSIS AND QUALITY PLAN

6.1 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 6-1: 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.
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 site history; • 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) 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. 2) Statistical calculations will not be undertaken if all results are below the SAC; and 3) Statistical calculations will not be undertaken on Health Screening Levels (HSLs) – elevated point source contamination associated with petroleum hydrocarbons can pose a vapour risk to receptors; The decisions to be addressed by the investigation are: 1. Do any of the soil samples contain contamination concentrations above the SAC? 2. Was asbestos detected in any of the samples? and 3. Can the site be made suitable for the proposed development?
Identify Information Inputs	The following information will be collected: • Soil samples based on subsurface conditions; • Fibre Cement Fragments (FCF) in the vicinity of the sampling points;

Step	Input
	• 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 site boundaries 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 PCC occurring in random pockets or layers. The presence of PCC 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. • The following acceptance criteria will be used to assess the primary laboratory QA/QC results. Non-compliance to be documented: ➢ <u>RPDs</u>: - Results that are < 5 times the PQL, any RPD is acceptable; and - Results > 5 times the PQL, RPDs between 0-50% are acceptable; ➢ <u>LCS recovery and matrix spikes</u>: - 70-130% recovery acceptable for metals and inorganics; - 60-140% recovery acceptable for organics; and - 10-140% recovery acceptable for VOCs; ➢ <u>Surrogate spike recovery</u>: - 60-140% recovery acceptable for general organics; and - 10-140% recovery acceptable for VOCs; ➢ <u>Blanks</u>: All less than PQL.
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.

Step	Input
	The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. In this case, for example, the PCC identified in the PCSM 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.

6.2 Soil Sampling Plan and Methodology

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

Table 6-2: Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	The NSW EPA Contaminated Sites Sampling Design Guidelines (1995[14]) 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 40 evenly spaced sampling points for this site with an area of approximately 28,000m^2. Samples for this investigation were obtained from 13 sampling points as shown on the attached Figure 2. This density is approximately 32% of the minimum sampling density recommended by the EPA.
Sampling Plan	The sampling locations were placed on a judgemental plan due to the existing buildings/structures and the unknown proposed development plan. This was considered suitable to address the potential contaminants associated with the fill material. An additional 3 sampling points were specifically targeted to assess the potential free asbestos fibres in the surface soils in the vicinity of areas of abundant FCF at the ground surface.
Exclusion Areas (Data Gaps)	Sampling was not undertaken in inaccessible areas of the site such as beneath existing buildings. These areas have been excluded from the investigation.
Sampling Equipment	Soil samples were obtained on 4 October 2016 and 11 December 2016 in accordance with the standard sampling procedure (SSP) attached in the appendices.

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

Aspect	Input
	Sampling locations were set out using a tape measure. 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 hard to access areas (surface samples).
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. 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. 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 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.
Decontami-nation and	The decontamination procedure adopted during sampling is outlined in the SSP.

Aspect	Input
Sample Preservation	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. 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.

6.3 Analytical Schedule

The analytical schedule is outlined in the following table:

Table 6-3: Analytical Schedule

CoPC	Fill Samples	Natural Soil Samples	Fibre Cement Fragments (FCF) Samples
Heavy Metals	13	7	Na
TRH/BTEXN	13	7	Na
PAHs	13	7	Na
OCPs/OPPs	13	3	Na
PCBs	13	3	Na
Asbestos	16	Na	4
TCLP Metals	4	Na	Na

6.3.1 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 6-4: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including (intra-laboratory duplicate samples)	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	155059, 155059-A, 159066 & 159066

7 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 7-1: SAC Adopted for this Investigation

Guideline	Applicability
Health Investigation Levels (HILs) (NEPM 2013)	The HIL-A criteria for 'residential with accessible soil' have been adopted for this assessment.
Health Screening Levels (HSLs) (NEPM 2013)	The HSL-A criteria for 'residential with accessible soil' have been adopted for this assessment.
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 EAC criteria for 'urban residential and public open space (URPOS)' exposure setting have been adopted. Soil parameters: pH; cation exchange capacity (CEC); and clay content have not been analysed for the assessment. On this basis, the EIL and ESL calculations have taken the 'worst case' scenario in order to generate the EAC. The EILs for selected metals have been derived from the ABC values for high traffic (25th percentiles) areas for old suburbs of NSW published in Olszowy et. al. (1995[15]) has been adopted for this assessment.
Management Limits for TRH	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 criterion for the Preliminary Site Investigation (PSI).
Waste Classification (WC) Criteria	The criteria outlined in the NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014[16]) has been adopted to classify the material for off-site disposal.

[15] 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.

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

8 INVESTIGATION RESULTS

8.1 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 8-1: Summary of Subsurface Conditions

Profile	Description (m in bgl)
Pavement	Asphaltic Concrete (AC) pavement was encountered at the ground surface in BH5 only with a thickness of 50mm.
Fill	Fill material was encountered at the surface or beneath the pavement in all boreholes and extended to depths of approximately 0.1 to 0.4m. The fill typically comprised of: gravel and silty sand. The fill contained inclusions of: igneous gravel; root fibres; and roots.
Natural Soil	Alluvial soils comprising sand, silty sand and clayey sand, with occasional sandy clay (BH10 and BH13) and silty clay (BH12 and BH13) bands, were encountered below the fill and extended down to the borehole termination depths.
Groundwater	BH2 and BH4 were 'dry' during and on completion of drilling. In the remaining boreholes, groundwater seepage was observed during drilling in each borehole at depths between 1.2m (BH12) and 5.8m (BH3). Groundwater was measured on completion of drilling in BH1, BH3 and BH5 to BH13 at depths between 1.2m (BH12) and 6.2m (BH3). Groundwater was also measured at depths of 3.1m (BH1) and 2.4m (BH8), 1 and 3 hours, respectively, after the completion of drilling. Groundwater levels may not have stabilised within the short observation period. No long term groundwater monitoring was carried out.

8.2 Field Screening

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

Table 8-2: 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. The results ranged from 0ppm to 4.5ppm equivalent isobutylene. These results indicate PID detectable VOCs. Samples with elevated PID readings were analysed for TRH and BTEX.
Visual observations of site surface for ACM	Fragments of ACM were observed on the ground surface across the majority of site.

8.3 Soil Laboratory Results

The soil laboratory results are compared to the relevant SAC in the attached report tables. Statistical calculations undertaken on the results using ProUCL (version 5) are attached in the appendices. A summary of the results assessed against the SAC is presented below.

Table 8-3: Summary of Soil Laboratory Results

Analyte	Results Compared to SAC
Heavy Metals	**HILs:** The lead result of 420mg/kg in the BH5 (0.2-0.3m) sample was above the HIL-A criteria of 300mg/kg. The remaining heavy metal results were below the HIL-A criteria of 300mg/kg. Summary of Statistical Calculation: All of the lead results were below 250% of the SAC. The 95% UCL was calculated using the lead data from the fill soil samples. The 95% UCL for lead was 227.7mg/kg which is below the HIL-A criterion of 300mg/kg. The Standard Deviation (SD) of the lead results was less than 50% of the SAC. **EILs:** All heavy metal results were below the EIL-UR&POS criteria. **WC:** Four fill samples encountered lead concentrations above the CT1 criteria of 100mg/kg. The remaining heavy metal results were less than the CT1 criteria of 100mg/kg. TCLP leachates were prepared from the elevated samples and analysed for lead. The results were less than the TCLP1 criteria.
TRH	**HSLs:** All TRH results were below the HSL-A criteria. **ESLs:** All TRH results were below the ESL-URPOS criteria. **WC:** All TRH results were less than the relevant CT1 criteria.
BTEXN	**HSLs:** All BTEXN results were below the HSL-A criteria. **ESLs:** All BTEXN results were below the ESL-URPOS criteria. **WC:** All BTEX results were less than the relevant CT1 criteria.

Analyte	Results Compared to SAC
PAHs	**HILs:** All PAH results were below the HIL-A criteria. **HSLs:** All naphthalene results were below the HSL-A criteria. **ESLs:** All benzo(a)pyrene results were below the ESL-URPOS criteria, **EILs:** All naphthalene results were below the EIL-URPOS criteria. **WC:** All PAH results were less than the relevant CT1 criteria.
OCPs & OPPs	**HILs:** All OCP and OPP results were below the HIL-A criteria. **EILs:** All DDT results were below the EIL-URPOS criteria. **WC:** All OCP and OPP results were less than the relevant CT1 criteria.
PCBs	**HILs:** All PCB results were below the HIL-A criterion. **WC:** All PCB results were less than the CT1 criteria.
Asbestos	Chrysotile, Amosite and Crocidolite asbestos were detected in the surface FCF samples MDF1, MDF2, MDF3 and MDF4. FCF samples MDF3 and MDF4 were degraded, easily broken by hand and were assessed in the field as 'friable'. No asbestos fibres were identified in the soil samples that were analysed.

9 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 9-1: Assessment of DQIs

Completeness

Field Considerations:

- The investigation was designed to target the AEC identified at the site. A judgemental 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 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 range of CoPC.
- All samples were analysed by NATA registered laboratory in accordance with the analytical methods outlined in NEPM 2013;
- Appropriate analytical methods and PQLs were used by the laboratory; 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; 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 and intra-laboratory duplicate 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. Groundwater, 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 intra-laboratory duplicate 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 5% of the primary samples:

- Dup A is a soil duplicate of primary sample BH5 (0.2-0.3m)

The intra-laboratory results are presented in the attached report tables. The results indicated that field precision was acceptable.

Accuracy

Field Considerations:

- The investigation was undertaken in accordance with the SSP.

Laboratory Considerations:

- The analytical quality assessment adopted by the laboratory was in accordance with the NATA and NEPM 2013 requirements as outlined in the analytical reports;
- A review of the reports indicates the following comments noted by the laboratory/s:

Envirolab Report 159066 – Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures.

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 within the site boundaries	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. The off-site disposal of the material will need to be registered with the NSW EPA Waste Locate tracking system to comply with legislation in regards to the transportation/movement of waste containing asbestos.
Natural soils	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 TIER 1 RISK ASSESSMENT AND REVIEW OF PCSM

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 11-1: Tier 1 Risk Assessment and Review of PCSM

Contaminant of Primary Concern (CoPC)	Receptor and Exposure Pathway	Discussion and Risk Rating
Asbestos in FCF	Human Receptors: Inhalation of airborne asbestos fibres	The investigation encountered FCF containing asbestos on the ground surface across the site. During sampling some of the FCFs were assessed to be in poor conditions could be broken easily by hand pressure. This material was assessed to be 'friable' based on field information. The remaining fragments were considered to be bonded. Approximately 40 suspected FCF (fibre cement fragments) were noted across the surface of the site (particularly in the north and south sections) on 4 October 2016. WSP | PB were subsequently engaged by the NSW Department of Education (DoE) – Asbestos Management Unit (AMU) to provide an Asbestos Remediation Clearance Certificate. Approximately 134 FCF, were collected from the surface of the site by WSP | PB. The WSP | PB Asbestos in Grounds Management Plan dated January 2013 was subsequently revised by WSP | PB, dated October 2016. Approximately 30 additional suspected FCF, were collected from the site surface during the EIS works on 11 December 2016. Although the FCF were not encountered within the soils samples analysed EIS are of the opinion that the continual discovery of FCF, in large numbers, on the ground surface following surface clearances indicates that the source of on-ground FCF are within the fill soils. It would appear that the FCF are being brought to the surface by human disturbance (traffic), along with weathering and erosion processes.

Contaminant of Primary Concern (CoPC)	Receptor and Exposure Pathway	Discussion and Risk Rating
		EIS are of the opinion that the risk posed to human receptors is moderate and will require remediation and/or management.

11.1 Source and Extent of Contamination

11.1.1 Sources

A review of the site information indicates that the site is located in an area which has been historically filled to achieve existing levels. Fill material on site may have been imported from various sources. FCF could have been imported onto the site along with the fill. Alternatively demolition of the former structures at the site could have resulted in remnant FCF in the fill.

11.1.2 Known Extent

Based on the information at hand, including a review of the field logs and the laboratory data, EIS are of the opinion that the soil contamination is confined to the fill material at the site. The fill ranges in depth from approximately 0.1m to 0.4m 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. Asbestos containing materials are usually present in discrete random fragments through the fill. All fill material in the proposed development area is considered to be contaminated and should be treated accordingly. An additional investigation could be undertaken to better characterise the extent of asbestos contamination using the WA DoH 2009 method endorsed by the NEPM 2013.

11.1.3 Unknown Extent

Sampling was not undertaken beneath the existing buildings. The extent of contamination beneath the buildings is currently unknown.

11.1.4 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.

11.2 Fate and Transport of Contaminants

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

Table 11-2: Fate and Transport of PCC/CoPC

PCC/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 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. Surface water has the potential to infiltrate into the subsurface at the subject site via garden beds, grassed areas, unlined water retention facilities etc. Surface water infiltration could increase the migration potential of certain contaminants and could potentially transport FCF to other parts of the site and/or off-site.

11.3 Data Gaps

The assessment has identified the following data gaps:

- The minimum sampling density for a Stage 2 Environmental Site Assessment has not been met;
- Groundwater at the site has not been assessed;
- Areas beneath the existing buildings have not been included in the assessment;
- The presence of hazardous building materials in the existing buildings has not been assessed; and
- Additional testing of the fill may be required to characterise the extent of asbestos contamination.

EIS were made aware of elevated concentrations of carbon dioxide in monitoring wells associated with John Fisher Park to the south of the site after completion of the initial investigation. Any site assessment undertaken in the future should include some gas monitoring along the south boundary of the school.

12 CONCLUSION

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

The decision statements specified in Section 6.1 are addressed below:

	Decision Statement	Decision Result
1.	Do any of the soil contain contamination concentrations above the SAC?	No.
2.	Was asbestos detected in any of the samples?	Yes. Asbestos was detected in fibre cement fragments encountered on the ground surface.
3.	Can the site be made suitable for the proposed development?	Yes. See below

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/better manage/characterise the risks:

1. The NSW Department of Education (DoE) – Asbestos Management Unit (AMU) should be contacted and advised of the continual discovery of ACM at Curl Curl North Public School. WSP | Parsons Brinckerhoff (PB) who prepared the Asbestos in Grounds, Asbestos Management Plan (AMP) report for Curl Curl North Public School should also be contacted and advised of the continual discovery as their report may need to be revised. Management procedures from the WSP | Parsons Brinckerhoff (PB) Asbestos in Grounds, Asbestos Management Plan (AMP) report should be implemented as a priority to reduce the risk to potential receptors;

2. Depending on the clients preferred remediation/management strategy, undertake a Detailed Site Investigation (DSI) to characterise the extent of asbestos contamination at the site**;**

3. Undertake gas monitoring along the south boundary of the school;

4. Prepare a Remediation Action Plan (RAP) to outline remedial measures for the site;

5. Prepare a Validation Assessment (VA) report on completion of remediation; and

6. Undertake a Hazardous Materials Assessment (Hazmat) for the existing buildings prior to the commencement of demolition work.

In the event that any contaminated material remains on the site after completion of remediation (eg if the contaminated material is capped) and an Environmental Management Plan (EMP) will be required for the ongoing management of contamination remaining on site. The EMP will require establishment of appropriate public notification under Section 149(2) of the EP&A Act 1979 or a covenant registered on the title to land under Section 88B of the Conveyancing Act 1919.

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 12-1: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination 2015[17]	The requirement to notify the NSW EPA regarding site contamination should be assessed once the remedial strategy has been selected. After successful implementation of the remedial strategy, the site contamination is unlikely to meet the Notification Triggers. However if during remediation works elevated levels of airborne asbestos fibres at or above 0.01 fibres/mL are encountered work should cease and the NSW EPA should be notified of the site contamination. Please note that in the event the recommendations for additional work and remediation/management are not undertaken, there may be justification to notify the EPA. EIS can be contacted for further advice regarding notification.
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.
POEO (waste) Regulation 2014	Clause 79 of the Protection of the Environment Operations (waste) Regulation 2014 requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10 square meters of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use WasteLocate. Asbestos contaminated soil has been exempt from this clause until 28 February 2017.

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

Guideline	Applicability
Work Health and Safety Code of Practice 2011[18]	Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan.
WHS Code of Practice 2011[19]	Section 3.6 indicates a licensed asbestos removalist must notify the regulator (WorkCover NSW) in writing at least 5 days before the licensed asbestos removal works commence.

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

[19] WHS Regulation, (2011), *Code of Practice – How to Safely Remove Asbestos.*

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 landuse. 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

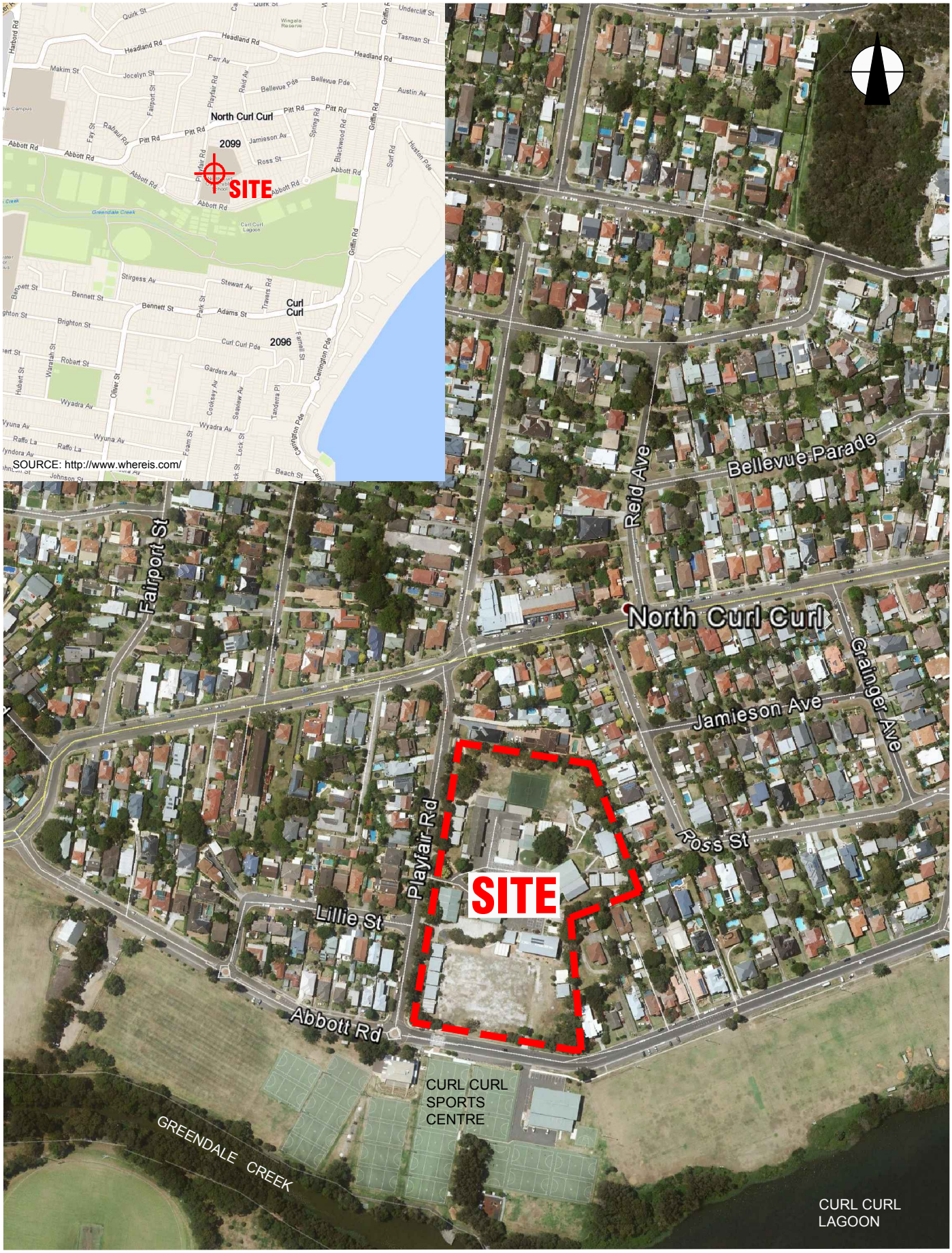
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other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

REPORT FIGURES



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

Title: **SITE LOCATION PLAN**

Location: CURL CURL NORTH PUBLIC SCHOOL
CURL CURL, NSW

Report No: E29816KD

Figure No: 1

ENVIRONMENTAL INVESTIGATION SERVICES

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