ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

BLACKTOWN WORKERS SPORTS CLUB

C/- PAYNTER DIXON CONSTRUCTIONS PTY LTD

ON

STAGE 1 ENVIRONMENTAL SITE ASSESSMENT

FOR

SITE A: PROPOSED OUT DOOR SPORTS FACILITIES – 221 WALTERS ROAD, ARNDELL PARK.

SITE B: RESIDENTIAL AGE CARE FACILITY AND CHILDCARE CENTRE – 170 RESERVOIR ROAD, ARNDELL PARK

AT

BLACKTOWN WORKERS SPORTS CLUB, OFF RESERVOIR ROAD, ARNDELL PARK, NSW

VOLUME 1 OF 2

21 DECEMBER 2015

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Postal Address: PO Box 976, North Ryde BC NSW 1670
Tel: 02 9888 5000 • Fax: 9888 5004
EIS is a division of Jeffery and Katauskas Pty Ltd • ABN 17 003 550 801

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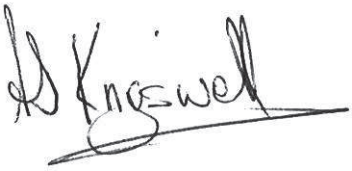
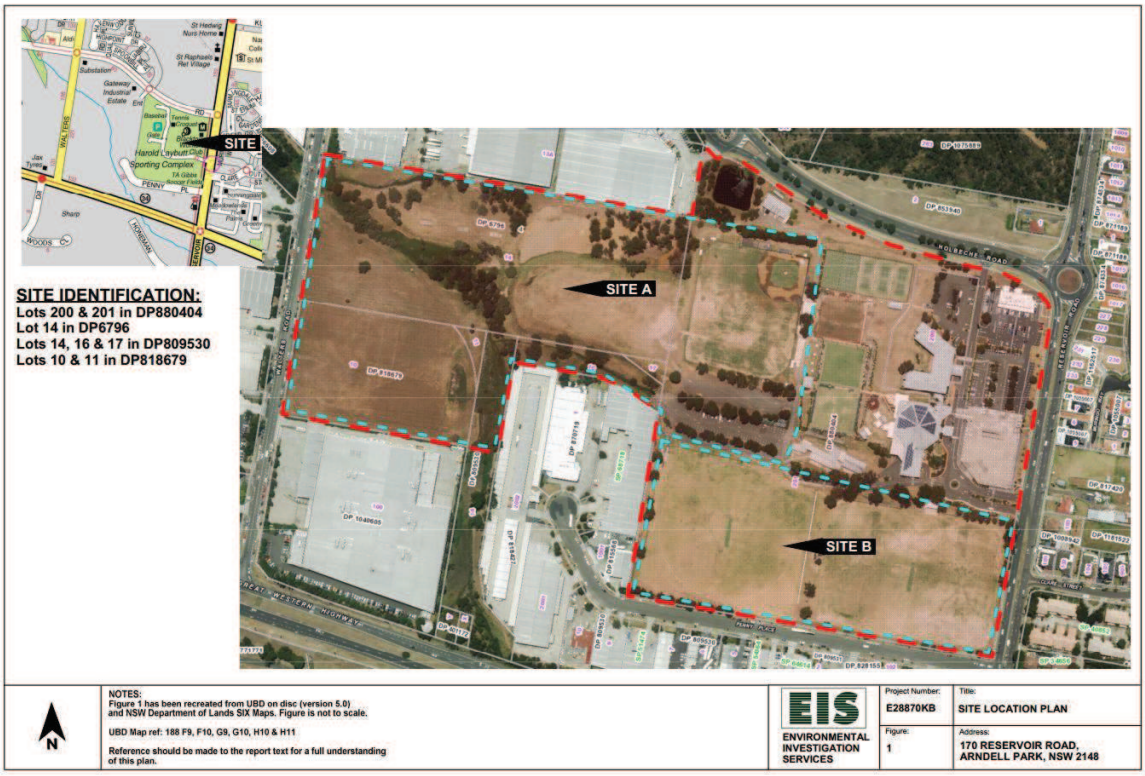
Report prepared by:

Vittal Boggaram
Associate Environmental Scientist

Report reviewed by:



Adrian Kingswell
Principal Environmental Scientist



This report has been prepared to present the results of a Stage 1 Environmental Site Assessment to support the master plan of the Blacktown Workers Sports Club. Given the integrated nature of the master plan this report has been prepared for all three components needed to facilitate the development:

- Planning Proposal to include 'recreation facility (outdoor)' on Lot 14 Sec 4 DP6796 and Lot 10 DP818679.
- Development Application for the outdoor sports facilities on Lot 14 Sec 4 DP6796 and Lot 10 DP818679.
- Site Compatibility Certificate for a Seniors Living Village on Lot 201 DP880404.

EXECUTIVE SUMMARY

Paynter Dixon Construction Pty Ltd on behalf of Blacktown Workers Sports Club (BWSC) ('the client') commissioned Environmental Investigation Services (EIS) to undertake a Stage 1 Environmental Site Assessment (ESA) for the proposed master plan development at the Blacktown Workers Sports Club located off Reservoir Road, Arndell Park, NSW. The site location and the study area are shown on the figures attached in the appendices.

This report has been prepared to support the lodgement of a Development Application (DA) for the proposed master plan development. EIS understand that the proposed masterplan will include the redevelopment of the south and west sections of the wider site to provide improved sporting facilities and a residential complex which will include approximately 800 units for senior living. The master plan will be staged as follows:

- Site A - Sporting Facilities (in the west section); and
- Site B - Residential Complex (in the south-east section).

The scope of work for this study included the following: review of previous investigation reports prepared for the site; review of site information including historical information available for the site; identify Areas of Environmental Concern (AEC); preparation of a Preliminary Conceptual Site Model (CSM); design and implementation of a sampling, analysis and quality plan (SAQP); interpretation of the analytical results against the adopted Site Assessment Criteria (SAC); Data Quality Assessment (DQA); Tier 1 Risk Assessment and review of CSM.

A review of the site history information indicated the following historical landuse:

- Rural / vacant land (1930 to prior 1943) - The 1930 aerial photograph indicates that the site was rural land with large sections occupied by bushland. A few dwellings were located on the wider site;
- Rural / poultry (1943 to prior 1970) - The site history information indicates that a large poultry farm was located on the north-east section of the wider site. The west section of the wider site was occupied by individual rural properties; and
- Recreational / Club House (1970 to present) - The site history information indicates that the wider site was progressively developed for recreational landuse. Significant earthworks was underway in the 1970s to facilitate the new development. The sporting facilities were constructed between 1970 and 1991. New buildings were constructed between 1991 and 2004.

The Conceptual Site Model (CSM) identified the following Areas of Environmental Concern (AEC):

- Fill Material (Entire Site) - The site has been historically filled to achieve the existing levels. The Stage 1 ESA encountered fill ranging in depth from 0.3m to 5.8mbgl. Deep fill was encountered in the central and east sections of the site. The DP 2004 report indicated that fill had been brought onto the site for unknown sources. The fill may have been imported from various sources and can contain elevated concentrations of contaminants.
- Poultry Farm and Rural Landuse (Point Source) - The site has been used for poultry and rural landuse. Numerous sheds containing hazardous building materials were demolished during this period. Chemicals such as pesticides could have been used at the site. Rubbish could have been buried at the site.
- Use of Herbicides in Waterways - The EPA POEO records indicate that herbicides have been used in the waterways which includes Bungarribee Creek. The herbicides could have impacted the sediment and soil along the creek.
- Hazardous Materials (Filled Areas) - The aerial photographs indicate that former buildings at the site were demolished prior to 1980s. The use of hazardous building material in the former buildings could have resulted in potential contamination. The DP 2004 report identified asbestos in fill as a cause of concern.
- Dryland Salinity (Regional Issue) - The site is located in an area classed as having a 'High Hazard or Risk' of dryland salinity. Dryland salinity can have an impact on the landscaping and built structures.

Samples for the Stage 1 ESA were obtained from 29 sampling points as shown on the attached Figure 2. This density is approximately 20% of the minimum sampling density recommended by the EPA. The sampling locations were placed on a judgement plan to obtain a preliminary understanding of the subsurface conditions and to identify the depth of fill for design of a more detailed targeted assessment.

Selected soil samples from the locations were analysed for contaminants of potential concern (CoPC) and salinity parameters. The laboratory results were assessed against the SAC adopted for the study. A review of the results indicated the following:

Soil Contamination – Fill Material:
Significant widespread soil contamination was not encountered in the sampling locations. Minor elevations of EILs were encountered in Site A. These elevations are considered to be associated with the uncontrolled fill imported onto the site from unknown sources.

Two FCF fragments encountered in test pits TP226 and TP227 in Site A were analysed for asbestos. The samples encountered Chrysotile and Amosite asbestos in the bonded form. The site history indicates that numerous former buildings were demolished at the site. The DP 2004 report identified asbestos in fill as a cause of concern. Uncontrolled filling has occurred at the site which could have also resulted in importing asbestos containing material (ACM) along with the fill onto the site.

Due to the limited subsurface investigation undertaken for the study, the distribution of ACM in the fill has not been adequately characterised. Additional investigation will be required to better characterise the extent of asbestos contamination.

Use of Herbicides in Waterways:
The EPA records indicate that herbicides have been used in the waterways which includes Bungarribee Creek. The herbicides could have impacted the sediment and soil along the creek line. Additional investigation is required along the creek to assess the potential for herbicide contamination at the site.

Groundwater:
The groundwater table is relatively shallow in low lying sections of the site. The groundwater could have been impacted by contaminants including herbicides. Groundwater screening is required to better assess the impacts.

Soil Salinity:
The Stage 1 ESA has indicated that the site is impacted by dryland salinity. A summary of the salinity conditions are as follows:

- The soils at the site are either moderate or very saline. No distinct depth profiling was noted. The CCAA 2005 recommended concrete grade for slabs and footings in very saline soils is N32;
- The soil pH results ranged from 4.3 to 8.6 and are classed as very strongly acidic to strongly alkaline. The majority of the soils were generally within the optimum range for plant growth;
- The majority of the CEC values were within the moderate range which is typical of the soil formation encountered at the site and are generally indicative of the low levels of organic matter within the soils;
- The majority of the ESP results were above the 5% threshold and were classed as sodic to highly sodic;
- The soil pH and sulphate results indicate that the soils are mild to moderately aggressive towards buried concrete; and
- The soil resistivity, pH and chloride results indicate that the soils are mild to moderately aggressive towards buried steel.

The groundwater salinity conditions have not been assessed for this study. The salinity conditions in groundwater can be different to the soil conditions. Additional testing will be required in order to prepare a Salinity Management Plan (SMP) for the proposed development at the site.

Conclusion:

EIS consider that the site can be made suitable for the proposed master plan development provided the following recommendations are implemented to address the data gaps and to better manage/characterise the risks:

- Undertake a Preliminary Stage 2 ESA to address the data gaps identified in **Section 9.5;**
- Prepare a Salinity Management Plan (SMP) for the proposed development; and
- Prepare a Remediation Action Plan (RAP) for the proposed development. The RAP should include an Unexpected Finds Protocol (UFP) for the earthworks at the site.

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**
Acid Sulfate Soil	**ASS**
Above Ground Storage Tank	**AST**
Below Ground Level	**BGL**
Bureau of Meteorology	**BOM**
Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene	**BTEXN**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Chain of Custody	**COC**
Contaminant of Primary Concern	**CoPC**
Conceptual Site Model	**CSM**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
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**
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**
Photo-ionisation Detector	**PID**
Practical Quantitation Limit	**PQL**
Preliminary Site Investigation	**PSI**
Quality Assurance	**QA**

ABBREVIATIONS

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**
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**
Volatile Organic Chlorinated Compound	**VOCC**
Workplace, Health and Safety	**WHS**

1 INTRODUCTION

Paynter Dixon Construction Pty Ltd on behalf of Blacktown Workers Sports Club (BWSC) ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake a Stage 1 Environmental Site Assessment (ESA) for the proposed master plan development at the Blacktown Workers Sports Club located off Reservoir Road, Arndell Park, NSW. The site location and the study area are shown on the figures attached in the appendices.

This report has been prepared to support the lodgement of a Development Application (DA) for the proposed master plan development.

EIS understand that the proposed masterplan will include the redevelopment of the south and west sections of the wider site to provide improved sporting facilities and a residential complex which will include approximately 800 units for senior living. The master plan will be staged as follows:

- Site A - Sporting Facilities (in the west section); and
- Site B - Residential Complex (in the south-east section).

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. 28870ADrpt, dated December 2015[3]). This report should be read in conjunction with the JK report.

1.1 Proposed Development Details

The concept plans for the proposed master plan issued to EIS are attached in the appendices. A review of the plans indicate that the development will include the following:

1.1.1 Site A: Sporting Facilities

The development in Site A will include:

- Construction of two soccer fields and associated amenities in the west section;
- Construction of two rugby fields and associated amenities in the central north section;
- Construction of four basketball fields and associated amenities in the north-west section; and
- Construction of hardstands, public roads, pedestrian walkways and landscaping.

Significant earthworks are anticipated for the proposed sporting facilities.

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

[2] Geotechnical consulting division of J&K

[3] Referred to as JK 2015 Report

1.1.2 Site B: Residential Complex

The development in Site B will include:

- Excavation to an maximum depth of about 6m below the existing grade for two individual, two level basement carparks over the eastern and western half of Site B;
- Construction of ten multistorey residential buildings above the basement carparks. The proposed residential buildings range in height between one and eight stories;
- Construction of basement carpark link roads, public access roads, light vehicle and pedestrian external pavements and service roads; and
- Construction of a childcare facility to the north of the Site B development area.

Significant earthworks are anticipated for the proposed residential complex.

1.2 Objectives

The objectives of the study include:

- Assess the potential for site contamination;
- Assess the potential for soil salinity and requirement for a salinity management plan;
- Assess the potential risk the contamination may pose to the site receptors; and
- Comment on the suitability of the site for the proposed master plan development.

1.3 Scope of Work

The study was undertaken generally in accordance with the EIS proposals (Ref: EP9316KB.prop2, EP9316KB.prop3 and EP9316KB.prop4) and a consultancy services agreement CC-AA 10691 between Paynter Dixon Construction Pty Ltd and JK Group of 23 October 2015.

The scope of work included the following:

- Review of previous investigation reports prepared for the site;
- Review of site information including historical information available for the site;
- Undertake a site inspection to identify Areas of Environmental Concern (AEC);
- Preparation of a Preliminary Conceptual Site Model (CSM);
- Design and implementation of a sampling, analysis and quality plan (SAQP);
- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC);
- Data Quality Assessment (DQA);
- Undertake a Tier 1 Risk Assessment and review of CSM; and
- Preparation of a report presenting the results of the assessment.

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

Table 1-1: Guidelines and Regulations

Guidelines and Regulations
NSW Government Legislation (1997), *Contaminated Land Management Act 1997* [4]
NSW Government (1998), *State Environmental Planning Policy No. 55 – Remediation of Land* [5]
NSW Office of Environment and Heritage (OEH) (now EPA) (2011), *Guidelines for Consultants Reporting on Contaminated Sites* [6]
NSW EPA (1995), *Sampling Design Guidelines* [7]
NSW Department of Environment and Conservation (DEC) (now EPA) (2006), *Guidelines for the NSW Site Auditor Scheme (2nd edition)* [8]
NSW EPA (2015), *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* [9]
National Environment Protection Council (NEPC) (2013), *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* [10]
NSW Government/Landcom (2004) (4th Ed) (Blue Book 2004), *Managing Urban Stormwater – Soil and Construction*
Department of Land and Water Conservation (DLWC) (2002), *Site Investigations for Urban Salinity*
Standards Australia (2009) (AS2159-2009), *Piling – Design and Installation*
CCAA (2005) *T56: Guide to Residential Slabs and Footings in Saline Environments*

[4] referred to as CLM Act

[5] referred to as SEPP55

[6] referred to as Reporting Guidelines

[7] referred to as Sampling Design Guidelines

[8] referred to as Site Auditor Guidelines

[9] referred to as the Duty to Report Guidelines

[10] referred to as NEPM 2013

2 SITE INFORMATION

2.1 Background

2.1.1 Previous Investigation Reports

EIS were provided with the following investigation reports previously prepared for the site:

- Golder Associates (1997), *'Preliminary Site Contamination Assessment, Blacktown Workers Club, Reservoir Road, Blacktown',* prepared for Paynter Dixon (Aust) Pty Ltd*,* Ref: 97621082.B, June 1997;
- Johnstone Environmental (JET) (1998), *'Stage 1 Contamination Audit of Two Properties in Walters Road, Arndell Park for Blacktown Workers Club',* Ref: JET00747-001.AMA, May 1998;
- Douglas Partners (DP) (1999), '*Report on Soil Contamination Investigation, Walters Road, Arndell Park, Lot 200 DP880404, Lot 10 DP818679 and Lot 14 Section 4 DP818679',* prepared for Lovegrove Oxley & Associated Pty Ltd, Ref: 24192C, April 1999;
- Douglas Partners (DP) (2004), '*Supplementary Contamination Assessment, Blacktown Workers Club- Walters Road, Arndell Park'* prepared for Paynter Dixon, Ref: 37418, 8 September 2004; and
- Brink and Associates (2007), 'Paynter Dixon Constructions Pty Ltd, Proposed Commercial Development, Blacktown Workers Club, Walters Road, Arndell Park, Geotechnical Investigation Report'. Ref: S06160-A TV:MC, 1 February 2007.

JK and EIS have previously undertaken the following investigations at the site:

- JK (2013), *'Report to Paynter Dixon Constructions Pty Ltd on Geotechnical Investigation for Proposed Extensions to Blacktown Workers Sports Club at 170 Reservoir Road, Blacktown, NSW*'. Ref: 26564Vrpt-Blackton, 4 July 2013; and
- EIS (2013), '*Report to Paynter Dixon Constructions on Stage 1 Environmental Site Assessment and Preliminary Contamination Screening for Proposed Commercial Development at Blacktown Workers Sports Club, 166-170 Reservoir Road, Blacktown, NSW*'. Ref: E26564Krpt, 8 July 2013.

A brief summary of the above investigations is outlined below. Relevant information from the EIS 2013 report is included in this report.

2.1.2 Golder Associates 1997

The investigation was designed as a preliminary screening and included a limited site history study and subsurface investigation with soil sampling. A brief summary of the investigation results is outlined below:

- A review of the historical aerial photos indicated industrial development of the areas to the south of the site occurred from the 1970's;
- Samples for the contamination testing were obtained from a total of 21 boreholes drilled using hand equipment and drill rigs in selected areas of the site. A plan showing the sample locations is attached in the appendices;

- The boreholes were drilled to depths ranging from approximately 0.5m below ground level (bgl) to a maximum of 8.8mbgl;
- Selected soil samples obtained from the boreholes were analysed for the following contaminants of primary concern (CoPC): heavy metals (7); OCP's; TPH's; and pH;
- The boreholes generally encountered fill at all locations which consisted of silty clay of medium plasticity. Relatively deeper fill to a depth of approximately 2.5mbgl was encountered to the south of the bowling green;
- Shale was encountered at a depth of approximately 1.3m in the northern portion of the bowling greens and increased in depth to approximately 2.5m on the southern side;
- Groundwater was not encountered during the investigation;
- The highest PID value recorded was 2.0ppm;
- Traces of metals (mercury) and OCPs were encountered mainly in the fill soils. The pH of the soil ranged from 5.7 to 6.8; and
- The report concluded that the likelihood for ground contamination was low and the site was suitable for continued recreational use.

2.1.3 Johnstone Environmental 1998

Johnstone Environmental was commissioned to undertake a Stage 1 contamination study for the properties identified as Lot 14, Section 4 of DP6796 and DP818679. The study area was located on the eastern side of Walters Road with Bungarribee Creek intersecting through the site.

The study included a site history assessment and sampling of the sediments from selected locations at the creek as shown on the plan attached in the appendices. A summary of the results is presented below:

- DP818679:
  - The site had previously been used as a market garden;
  - At the time of the investigation, the site was occupied by a single storey brick house with a number of small, galvanised iron sheds located to the rear;
  - The site slopes gently to the east;
  - The 1951 aerial photo showed signs of cultivation around the house;
- DP6769 (larger lot with an area of approximately 5 hectares):
  - Lightly vegetated along the creek bank;
  - At the time of the investigation, the western portion of the site was occupied by the ruins of a small brick building which included an old vehicle;
  - There was also evidence of numerous concrete slabs under the grass in this section of the site;
  - A sewer line was identified on the lot;
  - A large volume of soil had been placed on the eastern portion of the lot to depths of approximately 2m to 2.5m. The inclusions in the fill included timber, concrete, plastic and other building wastes;
  - The 1951 aerial photo showed long narrow buildings at the lot;
- Sediment samples from the creek were tested for TRH, PAH, OCP and heavy metals.

2.1.4 Douglas Partners (DP) 1999 and 2004

DP was commissioned to undertake a soil contamination investigation in 1999 and a supplementary contamination assessment in 2004. The study in 1999 was confined to Lot 200 DP880404, Lot 10 DP818679 and Lot 14 Section 4 DP6796 which occupied an area of approximately 8.78 hectares. The 1999 study included a subsurface investigation as shown on the plans attached in the appendices. The 1999 study identified the following:

- The former land use included a poultry farm which was demolished;
- The subsurface conditions revealed fill at DP6796 and DP880404 which consisted of clay, ironstone and silt to depths of greater than 2.5m. Fill material was not observed on DP818679;
- Representative samples were obtained from the fill and natural soil;
- Samples were obtained on a grid pattern and analysed as composite samples. Three surface samples were combined to make up 1 composite sample;
- Selected composite samples were analysed for heavy metals, OCPs and OPPs;
- The laboratory analysis indicated marginal elevations of arsenic and nickel on DP880404 compared to the site assessment criteria adopted for the study;
- The study concluded that the site was suitable for ongoing land use. The report recommended additional investigation be undertaken in the event of change in land use to a more sensitive type.

The DP 2004 study was a desktop review of the 1999 information followed by a site inspection and review of anecdotal information. Subsurface investigation was not undertaken for the 2004 study. The study identified the following:

- The site investigation revealed that the main changes that had occurred to the site since 1999 included:
  - Demolition of poultry sheds;
  - Stockpiling of building rubble and demolition wastes on part of the site;
  - The amount of material stockpiled suggested that some material may have been brought onto the site. There were no records proving or disproving this;
- The report stated that contamination from asbestos materials was cause for concern;
- A club representative stated that asbestos cement sheeting had been located in the kitchen and laundry areas of the former residential building and was now buried beneath the stockpile on Lot 10 DP818679;
- A representative also stated that approximately 100m^3 of fill from an unknown source had been placed on the baseball field to raise ground level since the previous investigation in 1999;
- Additional use of uncontrolled fill material was evident;
- The report concluded that additional sampling was required to assess the suitability for use; and
- The report also stated that it may be necessary to remove the stockpile and fill material from the site.

2.1.5 Brink and Associates 2007

Brink and Associates were commissioned to undertake a geotechnical investigation for the construction of warehouses, driveways, hardstands and pedestrian walkways at the site. The investigation included drilling 17 boreholes at selected locations shown on the plans attached in the appendices. The boreholes encountered the following subsurface conditions:

- Fill – Ranged in depth from approximately 0.6mbgl to 2.2mbgl;
- Natural Soil – Alluvial silty clay was encountered in borehole BH116, the remaining boreholes encountered residual clay soil to depths of approximately 4.9mbgl to 9.8mbgl;
- Bedrock – Shale bedrock was encountered below the natural soils at selected locations; and
- Groundwater – Seepage was encountered in selected boreholes at depths of approximately 1.1mbgl to 8.3mbgl.

2.1.6 EIS Stage 1 ESA 2013

2.1.6.1 Introduction

Paynter Dixon Constructions commissioned EIS to undertake a Stage 1 Environmental Site Assessment (ESA) and Preliminary Contamination Screening (PCS) for the proposed commercial development at Blacktown Workers Sports Club in 2013.

The ESA was undertaken for the proposed extension to the existing main club building (located between the existing bowling greens and the main club building) and the demolition of existing buildings to the south of the bowling greens and replacement with a two-storey building.

At the time of the ESA, the site was occupied by a single-storey concrete block building used as the main clubhouse, a 3-storey concrete building used as a motel, a single-storey brick building used as change rooms, two bowling greens, sports fields, tennis courts, an asphaltic concrete and gravel driveway, and asphaltic concrete parking areas.

2.1.6.2 Summary of Site History and AEC

The site history information indicated that the site may have been used for agricultural or grazing purposes. The site appeared to have been used for sporting fields and club facilities since the 1970s. Areas of Environmental Concern (AEC) were identified to include: imported fill material; bowling green maintenance and agricultural activities that may have involved the use of pesticides; and previously-existing structures that may have contained asbestos-containing materials. Potential contaminants of concern were identified to include heavy metals, petroleum hydrocarbons, BTEX compounds, VOCs, PAHs, pesticides, PCBs and asbestos.

2.1.6.3 PCS

Soil samples for the PCS were collected from five (5) boreholes drilled in locations adjacent to the bowling greens and analysed for potential contaminants of concern. The sampling locations are shown on the figures attached in the appendices.

Fill material was encountered to depths of up to 1.6m in the majority of boreholes, underlain by natural silty clay soils and sandstone/shale bedrock. Soil analytical results were compared to Site Assessment Criteria (SAC) which were established with reference to appropriate guidelines and regulations.

Elevated concentrations of contaminants were not encountered in the soil samples analysed for the investigation. All analytical results were below the SAC.

2.1.6.4 Conclusion

Based on the results, the ESA concluded that the potential for significant widespread soil contamination in the development area was relatively low. The fill material analysed was considered to be suitable for re-use on-site provided it met geotechnical and earthwork requirements. Should the material be disposed off-site, the material was classified as General Solid Waste (non-putrescible).

A detailed assessment of the groundwater conditions was outside the scope of the Stage 1 ESA.

The ESA concluded that the site was suitable for the proposed commercial development provided that:

- A Hazardous Building Material survey of the existing structures is undertaken prior to demolition; and
- An Unexpected Finds Protocol (UFP) is prepared to manage any unexpected discoveries during earthworks (e.g. asbestos, cement fragments, odorous soil etc.).

2.2 Site Identification

The information presented below has been sources from various governmental and council databases. Copies of the relevant information is attached in the appendices.

Table 2-1: Site Identification

Current Site Owner:	Blacktown Workers Club Limited
Site Address:	Site A – 221 Walters Road, Arndell Park, NSW Site B – 170 Reservoir Road, Arndell Park, NSW
Lot & Deposited Plan:	Lots 200 and 201 in DP880404 Lot 14 in DP6796 Lots 14, 16 and 17 in DP809530 Lots 10 and 11 in DP818679
Current Land Use:	Commercial – Recreational
Proposed Land Use:	Sporting Facilities – Site A High Density Residential – Site B
Local Government Authority (LGA):	Blacktown Council
Current Zoning (Blacktown LEP 2015):	RE2 – Private Recreation IN2 – Light Industrial IN1 – General Industrial W1 – Natural Waterway SP2 – Infrastructure
Heritage Items:	None on site
Bushfire Prone Land:	The north section of the site along the site boundary falls in the category 'Vegetation Buffer'.
Ecological Constraints:	The west section of the site is occupied by Alluvial Woodland. The central-north section of the site is occupied by Shale Plains Woodland.
Area of Proposed Development (hectares):	Site A – 7 hectares Site B – 6 hectares
RL (AHD in m) (approx.):	64m in the north-east corner to 52m in the north-west corner
Geographical Location (MGA) (approx.):	Site A – N: 6258815 E: 304838 Site B – N: 6258552 E: 305177
Site Plans:	See Appendices

2.3 Site Location and Regional Setting

The wider site is located in a predominantly commercial/industrial area of Arndell Park as shown on Figure 1. The wider site is bounded by Reservoir Road to the east, by Walters Road to the west, Holbeche Road to the north and by Penny Place to the south. The Great Western Highway is located approximately 200m to the south of the site. Bungarribee Creek runs through the central-west section of the wider site.

2.4 Topography

The site is located in an undulating regional topographic setting which generally slopes from south-east to north-west. The site itself is undulating with a change in RL of 64m in the north-east to a RL of 52m in the north-west. Localised falls occur towards the central section of the site associated with the creek and its gullies. Significant historic filling has changed the natural site topography.

2.5 Site Inspection

A walkover inspection of the site was undertaken by EIS on 29 October 2015. 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 site description is provided below.

2.5.1.1 Site A

Site A is located over the western portion of the wider site. Site A is located within the undulating topography and spans across the northern and southern banks of a local gully feature and Bungarribee Creek. The creek line enters the site along the southern boundary and flows down towards the north-west. A narrow water course traverses the north-west corner of the site merging with the creek line at the western boundary. A stormwater culvert running beneath the site discharges into an open water course along the southern boundary. The water course merges with the Bungarribee Creek line. At the time of the inspection, there was gently flowing water in the creek and water course beds. Small to medium size trees lined the creek and water course.

The eastern end of Site A consists of an existing grass covered baseball playing field and upper and lower on-grade asphaltic concrete (AC) car parks. The upper (northern) and lower (southern) car parks were separated by a batter which sloped down to the south and was approximately 2m high and graded at approximately 21°.

Extending to the west from the baseball field was a grass covered fill knoll. The north, south and east banks of the knoll generally graded to the toe at up to 32° and were approximately 3m high. The creek line ran along the southern toe of the knoll.

The south-east portion of Site A comprised a grass covered slope which graded down to the north-east at approximately 3°- 4° towards Bungarribee Creek.

The northern portion of Site A, to the north of the creek line comprised, gently undulating grass covered terrain with scattered small to medium size trees. An area approximately 30m by 65m located at the northern toe of the knoll had recently been backfilled with material that was loosely placed.

To the north of Site A, located on the site boundary were three concrete block warehouse buildings with hardstand surrounding. The buildings and hardstand all appeared in good external condition when viewed from the subject site. The surface level across the boundary was essentially similar.

A neighbouring concrete panel warehouse with concrete paved surrounds was set-back approximately 15m from the western end of the southern site boundary. A concrete block 'keystone' wall (maximum height of approximately 6.5m) lined the southern site boundary and supported the neighbouring paved surface levels.

The neighbouring property located at the eastern end of the southern site boundary was occupied by two concrete panel warehouse buildings located on the site boundary.

2.5.1.2 Site B

Site B is located on the eastern section of the wider site. Site B is located within undulating topography over the eastern bank of a local shallow gully feature which runs north-south and north-west. The eastern bank sloped at approximately 1° to 2°. The site is bound by Reservoir Road and Penny Place to the east and west, respectively.

At the time of the inspection, the site had been formed into two grass covered, terraced playing fields with an elevation variance of approximately 1.5m between the upper (eastern) and lower (western) field. A grass covered embankment slopping at approximately 27° to the west was supporting the upper (eastern) field. The two playing fields had been formed by cut and fill with the south eastern corner of the upper field in cut and remainder of the upper and lower fields backfilled to raise surface levels.

A sandstone block retaining wall of approximately 1m high was located along the majority of the eastern boundary which supported the neighbouring council footpath and Reservoir Road. The south eastern corner of Site B graded up to the east at approximately 9° to meet the neighbouring surface levels. The remaining portion of the southern boundary had been battered up to the edge of the fields from the boundary. The southern batter was up to approximately 2m high and sloping at approximately 27°. A fill batter up to approximately 2m high and sloping at approximately 32° graded down from the edge of the lower playing field to the site boundary. An asphaltic concrete (AC) carpark and access ramps were located along the northern edge of the lower field. The carpark and lower field were at a similar surface level. Along the northern edge of the playing fields and the adjacent AC

carpark a batter slope graded down to an internal access road and lower level AC carpark. The northern batter was up to about 1.5m high and was sloping at approximately 20°.

A stormwater inlet pit was located centrally along the eastern end of the upper field. The stormwater pipe appeared to connect to a culvert outlet located towards the north-western corner of Site B. The stormwater outlet discharged into an open creek which was running to the west. The alignment of the stormwater pipe between the inlet and outlet was not assessed.

To the west of Site B located on the common site boundary were two single storey concrete panel warehouse building. The buildings appeared in good external condition when viewed from within the subject site. The ground surface levels across the boundary were essentially similar.

2.6 Surrounding Land Use

The immediate surrounds included the following landuse:

2.6.1.1 Site A

- North – Commercial warehouses;
- South – Commercial warehouses;
- East – Existing baseball fields and club house beyond;
- West – Walters Road and commercial landuse beyond.

2.6.1.2 Site B

- North – Existing club hose, car park and associated facilities;
- South – Penny Place and commercial beyond. A 7 Eleven service station was located to the south-east of the site;
- East – Reservoir Road and residences beyond; and
- West – Commercial warehouses.

2.7 Underground Services

The 'Dial Before You Dig' (DBYD) plans were reviewed for the study. Copies of the relevant plans are attached in the appendices. A brief summary of the relevant information is present below:

Table 2-2: Summary of Relevant Services

Service	Location	Potential Migratory Pathway
Telecom	The plan indicates that telecommunication services enter the north-east section of the wider site from Reservoir Road.	These services are not considered to be a potential migratory pathway.
Electrical	The plans indicate that an electrical services enter the north-east section of the wider site from Reservoir Road.	These services are not considered to be a potential migratory pathway.

2.8 Regional Geology

A review of the regional geological map of Penrith (1991[11]) indicates that the wider 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.

2.9 Soil Landscape and Dryland Salinity

2.9.1 Soil Landscape

The majority of the wider site is located within the Blacktown soil landscape which is derived from residual processes. The north-west corner of Site B is located on the boundary of the Blacktown soil and South Creek soil landscape which are alluvial.

Blacktown soils are characterised by moderate erodibility with some higher local occurrences, low dispersivity and localised areas of moderate salinity. South Creek soils are characterised by high to severe and widespread erodibility, moderate dispersivity and high salinity.

2.9.2 Dryland Salinity Hazard

The wider site is located in an area classed as having a 'High Hazard or Risk' of dryland salinity. Areas of high risk occur where soil, geology, topography and groundwater conditions predispose a site to salinity. These areas most commonly occur on lower slopes and drainage systems where water accumulation is high. These areas are most likely to occur in lower slopes, foot slopes, floodplains and creek lines where run-off is high, resulting in seasonally high water tables and soil saturation.

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

2.10 Acid Sulfate Soil (ASS) Risk

The site is not located in an ASS risk area.

2.11 Hydrogeology

A review of groundwater bore records available on the NSW Government Water Information[12] database was undertaken for the assessment. The search was limited to registered bores located within a radius of approximately 1Km of the wider site.

The search indicated six (6) bores within the search area registered for monitoring purposes. A cluster of three (3) boreholes were located at the service station to the immediate south-east of the wider site. These bores are not registered for beneficial use and hence not considered to be potential receptors. Copies of the records are attached in the appendices.

A review of the regional geology and groundwater bore information indicates that the subsurface condition at the wider site is expected to consist of residual soils overlying relatively shallow bedrock. The occurrence of groundwater that could be utilised as a resource for beneficial use is considered to be relatively low under such conditions. A perched aquifer in the subsurface may be present.

2.12 Receiving Water Bodies

The wider site location and regional topography indicates that excess surface water flows have the potential to enter Bungarribee Creek which runs through the central section of the wider site from the north-west. Surface water run-off could also reach the manmade dam located in the north section of the wider site. Both of these water bodies are potential receptors.

[12] http://www.waterinfo.nsw.gov.au/gw/

3 SITE HISTORY INFORMATION

3.1 Review of Historical Aerial Photographs

Historical aerial photographs available for the site and immediate surrounds were reviewed for the study. Copies of the photographs are attached in the appendices. A summary of the relevant information is presented in the table below. The description below is for the wider site which includes Site A and Site B.

Table 3-1: Summary of Historical Aerial Photos

Year	Details
1930	The photograph was of poor quality. The site appeared to form part of a wider lot. The majority of the site was vacant and appeared to be covered with grass/weeds. Dense vegetation was located in the north, east and south sections of the site. A small residential type dwelling and a few sheds were located on the west section of the site. The area to the immediate north of the dwelling appeared to have been disturbed with exposed soil and a few small stockpiles. A small gully feature was located in the north-west section of the site. A few small buildings and exposed soil was located near the north-east site boundary. The immediate surrounds generally appeared to be either rural or bushland. Dense vegetation was located to the immediate north, south and east of the site. A few small dwellings were located further to the south of the site.
1943	Large sections of the site had been developed. A large poultry farm was located on the north-east section of the site with frontage onto Reservoir Road. Numerous small sheds and poultry pens were scattered across this section of the site. The area to the immediate south of the farm was vacant. A small creek/gully feature was located in the central section of this area. The central section of the site was vacant and grassed. The west section of the site appeared to be occupied by a separate rural property with signs of cultivation and numerous small sheds visible in some sections. The north-east and east sections of the site appeared to be bushland. The remaining surrounds appeared to be rural.
1956	The site generally appeared similar to the 1943 photograph. Ponding water was located in the central and east sections of the site along the creek which indicated signs of potential flooding in low lying sections of the site. Two manmade dams were visible one in the central section and the other on the east site boundary. The west section of the site had been extensively cultivated. The bushland to the north and east had been cleared and dirt tracks were visible for the development of new roads.
1961	The site and immediate surrounds generally appeared similar to the 1956 photograph. Relatively long sheds were located in the north-west section of the site.

Year	Details
1970	The poultry farm on the north-east section of the site had been cleared. Significant earthworks was underway in the north-east and east sections of the site. What appeared to be ovals/playgrounds were being created in the south-east section of the site. A large building was located in the central part of the east section. The west section of the site appeared similar to the 1961 photograph. The immediate surrounds generally appeared similar to the 1961 photograph. There was an increase in the number of rural properties to the east of Reservoir Road.
1982	The east section of the site had been developed into a recreational facility with numerous playing fields, four tennis courts, lawn bowling fields, hard stand areas and associated buildings. Six large buildings which appeared to be associated with the club were located in the central and east sections of the site. A paved access driveway ran from Reservoir Road to the main building complex. A large manmade dam was located on the north site boundary. Some signs of filling was evident in the central section of the site. The west section of the site appeared similar to the 1970 photograph. The immediate surrounds appeared similar to the 1970 photograph.
1991	The site and immediate surrounds generally appeared similar to the 1982 photograph. A large residential subdivision was located to the south-east of the site. A large warehouse was located to the west of the site.
2004	New buildings similar to the present layout were located in the east section of the site. A large hardstand area was located near the east and north-east site boundaries. Five tennis courts and a baseball court was located in the north section of the site. A small shed was located next to the large dam on the north site boundary. The central section of the site appeared to have been filled with a section of the creek located along the south boundary. The south-east section of the site was occupied by two large cricket fields. The west section of the site appeared to be vacant. The former rural landuse in the west appeared to have ceased. A small dam located in the south-west section of the site appeared to have been partially filled. The area to the north, south and west of the site was occupied by large warehouses. A new road was located along the north site boundary. A service station was located to the south-west of the site.
2009	The site generally appeared similar to the present layout. A large multi-level car park was located on the east section of the site. Hardstand areas were located to the north of the car park. A restaurant building was located on the north-east corner of the site. Numerous small sheds had been created around the playing fields. The central and west sections of the site appeared to be vacant.
2014	The site and immediate surrounds generally appeared similar to the present layout.

3.2 Review of Land Title Records

Land title records were reviewed for the study. The record search was undertaken by Advance Legal Searchers Pty Ltd. Copies of the title records are attached in the appendices.

The title records indicate the following:

- Sections of the wider site was owned by N.S.W Realty Co. Limited between 1913 to 1918;
- Numerous private individuals owned the wider site between 1918 and 1978;
- Belmore Smallgoods Pty Ltd owned Lot 14 between 1973 and 1977;
- Sections of the wider site was owned by poultry farmers between 1928 and 1973;
- Blacktown Workers Club Limited has owned the site since 1978. The site has been leased to Travelodge Developments Pty Ltd (now Trust Company Limited), Value Lodging Pty Ltd, and McDonalds Australia Limited.

3.3 Review of Blacktown Council Information

A search of council records is currently underway. The results will be summarised in a separate letter when received.

3.4 WorkCover Records

A review of WorkCover records for the wider site is currently underway. The results will be summarised in a separate letter when received.

3.5 NSW EPA Records

The NSW EPA records available online were reviewed for the study. Copies of relevant documents are attached in the appendices. A summary of the relevant information is provided in the following table:

Table 3-2: Summary of NSW EPA Online Records

Source	Details
CLM Act 1997[13]	There were no notices for the wider site under Section 58 of the Act. A search of the records indicated a former listing for Reservoir Road located to the immediate east of the site. The records indicate that the EPA has completed an assessment of the contamination and decided that regulation is not required under the CLM Act.

[13] http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx

Source	Details
NSW EPA List of Contaminated Sites[14]	The wider site is not listed on the NSW EPA register.
POEO Register[15]	The POEO register indicates three former licenses (4653, 4838 and 6630) relating to the application of herbicides in the waterways by Luhrmann Environment Management Pty Ltd, Robert Orchard and Sydney Weed & Pest Management Pty Ltd. The waterways included Bungarribee Creek located in the central section of the site.

3.6 Historical Business Directories

A review of the 1950, 1970 and 1991 historical business directory records available with UBD Business Directory was undertaken for the assessment. Copies of the records are attached in the appendices. The records indicated the following:

- 1950 Directory – The north-east section of the wider site was occupied by poultry farmers operated by Brown C. This information is consistent with the historical aerial photos. A motor accessories dealership operated by Harper G. W. was located adjacent to the east site boundary on Reservoir Road. No drycleaners were located within 2km of the site;
- 1970 Directory – No records within the buffer area. No drycleaners were located within 2km of the site; and
- 1991 Directory – Motor body builders operated by Maxi Cube Fruehauf was located approximately 100m to the west of the site. The business also manufactured and distributed semi-trailer and associated equipment.

3.7 Summary of Site History Information

A summary of the historical land uses is presented in the table below. The land uses and time periods listed in the table are based on a weight of evidence assessment of the site history documentation and observations made during the site inspection.

[14] http://www.epa.nsw.gov.au/clm/publiclist.htm

[15] http://www.epa.nsw.gov.au/prpoeoapp/

Table 3-3: Summary of Historical Land Uses

Year(s)	Potential Land Use	Supporting Evidence
1930 to prior 1943	Rural / vacant	The 1930 aerial photograph indicates that the site was rural land with large sections occupied by bushland. A few dwellings were located on the wider site.
1943 to prior 1970	Rural / Poultry	The site history information indicates that a large poultry farm was located on the north-east section of the wider site. The west section of the wider site was occupied by individual rural properties.
1970 to Present	Recreational / Club House	The site history information indicates that the wider site was progressively developed for recreational landuse. Significant earthworks was underway in the 1970s to facilitate the new development. The sporting facilities were constructed between 1970 and 1991. New buildings were constructed between 1991 and 2004.

3.8 Integrity of Site History Information

The majority of the site history information has been obtained from government organisations as outlined above. 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 age of the development; gap between aerial photographs; and lack of detailed information prior to the 1900's.

4 CONCEPTUAL SITE MODEL (CSM)

The CSM is based on a review of the site information outlined previously in this report. The Areas of Environmental Concern (AEC) identified in the CSM can either be a point source of contamination or widespread area/s impacted by current or historical activities. The CSM should be reviewed and updated when more information becomes available for the site.

Table 4-1: CSM

AEC / Extent	CoPC	Potential Exposure Pathway and Media	Potential Receptors
Fill Material – Entire Site The site has been historically filled to achieve the existing levels. The Stage 1 ESA encountered fill ranging in depth from 0.3m to 5.8mbgl. Deep fill was encountered in the central and east sections of the site. The DP 2004 report indicated that fill had been brought onto the site for unknown sources. The fill may have been imported from various sources and can contain elevated concentrations of contaminants.	Heavy metals, TRH, BTEXN, PAHs, OCPs, OPPs, PCB, and asbestos	Direct Contact – dermal contact; ingestion; and inhalation of dust, vapours and fibres. Media - soil, groundwater and vapour.	Human Receptors – Site occupants; visitors; development and maintenance workers; and off-site occupants. Environmental Receptors – Flora and fauna at the site and immediate surrounds; Alluvial Woodland; Shale Plains Woodland located at the site; Bungarribee Creek.
Poultry Farm and Rural Landuse – Point Source The site has been used for poultry and rural landuse. Numerous sheds containing hazardous building materials were demolished during this period. Chemicals such as pesticides could have been used at the site. Rubbish could have been buried at the site.	Heavy metals, TRH, BTEXN, PAHs, OCPs, OPPs, PCB, and asbestos	Direct Contact – dermal contact; ingestion; and inhalation of dust, vapours and fibres. Media - soil, groundwater and vapour	Human Receptors – As Above Environmental Receptors – As Above

AEC / Extent	CoPC	Potential Exposure Pathway and Media	Potential Receptors
Use of Herbicides – Waterways The EPA POEO records indicate that herbicides have been used in the waterways which includes Bungarribee Creek. The herbicides could have impacted the sediment and soil along the creek.	Herbicides	Direct Contact – dermal contact; and ingestion. Media – soil and groundwater.	Human Receptors – As Above Environmental Receptors – As Above
Hazardous Building Material – Filled Areas The aerial photographs indicate that former buildings at the site were demolished prior to 1980s. The use of hazardous building material in the former buildings could have resulted in potential contamination. The DP 2004 report identified asbestos in fill as a cause of concern.	Asbestos, lead and PCBs	Direct Contact – dermal contact; ingestion; and inhalation of dust and fibres. Media – soil and air.	Human Receptors – As Above Environmental Receptors – As Above
Dryland Salinity - Regional Issue The site is located in an area classed as having a 'High Hazard or Risk' of dryland salinity. Dryland salinity can have an impact on the landscaping and built structures.	EC, pH, CEC, Resistivity, SO4 and Cl	The risk is to landscaping and built structures.	Environmental Receptors – Potential impacts of local flora. Built Structures – Potential impacts on concrete, steel and brickwork in contact with the ground.

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 applicable to this assessment is summarised below.

The DQO process is detailed in the US EPA document *Guidance on systematic planning using the data quality process (2006[16])* and the NSW DEC document *The Guidelines for the NSW Site Auditor Scheme, 2nd Edition (2006[17])*.

5.1.1 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 council Development Application (DA) process.

The EIS project team will include: project principal (PP) and/or project associate (PA); project engineer/scientist (PE); and field engineer/scientist (FE) as outlined in the quality recorded checklist maintained for the project in accordance with our ISO 9001 certification.

5.1.2 Identify the Decisions/ Goal of the Study

The data collection is project specific and has been designed based on the following:

- Review of site information;
- Review of the CSM;
- Development of Site Assessment Criteria (SAC) for each media; and
- Data interpretation based on the following decision statements:
  1) No single value exceeds 250% of the SAC;
  2) Statistical analysis will be used to assess the laboratory data against the SAC when there are results above 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; and
     - The standard deviation (SD) of the results must be less than 50% of the SAC.
  3) Statistical calculations will not be undertaken if all results are below the SAC; and

[16] US EPA, (2006), *Guidance on Systematic Planning using the Data Quality Objectives Process.* (referred to as US EPA 2006)

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

4) 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;
   - Groundwater Investigation Levels (GILs) – elevated GILs can indicate a wider groundwater contamination risk; and
   - Soil vapour results – elevated results can pose a vapour risk.

5.1.3 Identify Information Inputs

The following information will be collected:

- Soil samples based on subsurface conditions;
- Potential Asbestos Containing Material (ACM) encountered during the inspection;
- 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.) and observations made during the field investigation 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.

5.1.4 Define the Study Boundary

The sampling was confined to the proposed development areas (Site A and Site B) 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.

5.1.5 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 as applicable. Non-compliance to be documented in the report; and
- Review of the QA/QC results reported in the laboratory reports. Non-compliance to be documented.

5.1.6 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.

5.1.7 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

5.2.1 Sampling Density

The NSW EPA Sampling Design Guidelines recommend a sampling density based on the size of the investigation/site 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 143 evenly spaced sampling points for the development area of approximately 13 hectares.

Samples for the Stage 1 ESA were obtained from 29 sampling points as shown on the attached Figure 2. This density is approximately 20% of the minimum sampling density recommended by the EPA.

5.2.2 Sampling Plan

The sampling locations were placed on a judgement plan to obtain a preliminary understanding of the subsurface conditions and to identify the depth of fill for design of a more detailed targeted assessment.

5.2.3 Sampling Equipment

Soil samples were obtained between 2nd and 6th November 2015. Sampling locations were set out using a hand held GPS unit (with an accuracy of ±5m). In-situ sampling locations were cleared for underground services by an external contractor prior to sampling.

The samples were obtained using the following equipment as shown on the 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
- Backhoe/excavator bucket. Samples were obtained directly from the bucket using hand equipment (i.e. trowel, rake).

5.2.4 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.

5.2.5 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 calibration records are attached in the appendices.

PID screening for VOCs was undertaken on soil samples using the soil sample headspace method. PID data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases.

5.2.6 Decontamination and 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. Rinsate samples were obtained during the decontamination process as part of the field QA/QC.

Samples were preserved by immediate storage in an insulated sample container with ice or chill packs. 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 Analytical Schedule

The analytical schedule is outlined in the following table:

Table 5-1: Analytical Schedule

CoPC	Fill Samples	Natural Samples	Fibre Cement Fragments (FCF)
Heavy Metals	63	Na	Na
TRH/BTEXN	63	Na	Na
PAHs	63	Na	Na
OCPs/OPPs	32	Na	Na
PCBs	32	Na	Na
Asbestos	29	Na	2
pH	29	31	Na
EC	29	31	Na
Resistivity	29	31	Na

CoPC	Fill Samples	Natural Samples	Fibre Cement Fragments (FCF)
SO4	29	31	Na
Cl	29	31	Na
CEC	7	22	Na

5.3.1 Laboratory Analysis

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

Table 5-2: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including (intra-laboratory duplicates, trip blanks and field rinsate samples)	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	137123
All salinity soil samples	SGS Alexandria Environmental NSW NATA Accreditation Number – 2562(4354) (ISO/IEC 17025 compliance)	SE145929

6 SITE ASSESSMENT CRITERIA (SAC)

The SAC adopted for the study has been derived from NEPM 2013 and other guidelines outlined in this report. The guideline values for individual contaminants are presented in the laboratory summary tables attached in the appendices.

6.1 Soil Contamination Assessment Criteria

6.1.1 Health Investigation Levels (HILs) – NEPM 2013

The following HILs criteria have been adopted for this assessment based on the proposed landuse:

- Proposed Childcare centre: HIL-A – Residential with accessible soils;
- Site A: HIL-C – Parks and recreational open spaces; and
- Site B: HIL-B – Residential with minimum opportunity for soil access.

6.1.2 Health Screening Levels (HSLs) – NEPM 2013

The HSL-A criteria for 'residential with accessible soil' have been adopted for this assessment.

6.1.3 Ecological Assessment Criteria (EAC) - NEPM 2013

The following EAC criteria have been adopted for this assessment based on the proposed landuse and ecological receptors at the site:

- Site A: Areas of Ecological Significance (AES) have been adopted; and
- Site B: Urban residential and public open space (URPOS).

The EILs for selected metals have been derived as follows:

- The ABC values for high traffic (25th percentiles) areas for old suburbs of NSW published in Olszowy et. al. (1995[18]) have been adopted for this assessment; and
- Selected samples obtained from the surficial profile (<2m) across the site were analysed for pH and CEC as part of the salinity study. The average pH and CEC values were used to calculate the ACL.

6.1.4 Asbestos in Soil

The 'presence/absence' of asbestos in soil has been adopted as the assessment criterion.

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

6.1.5 Waste Classification (WC) Criteria

The criteria outlined in the NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014[19]) has been adopted to classify the material for off-site disposal.

6.2 Soil Salinity Assessment Criteria

6.2.1 Background Information to Dryland Salinity

Salinity is the accumulation and concentration of salt at or near the ground surface or within surface water bodies. Salt is naturally present in the landscape through deposition of salt from the ocean in coastal areas and through weathering of bedrock that contains salt, accumulated during deposition of original sediments in a prehistoric marine environment. The salts are commonly soluble chlorides, sulphates or carbonates of sodium and magnesium.

In Sydney, salinity issues are typically associated with the Wianamatta Group shales and their derived soil landscapes. The natural vegetation of western Sydney is dominated by large isolated trees with deep root systems that remove subsurface moisture. Slow rates of percolation through the relatively impermeable clay soil and uptake of a large proportion of rainfall by the trees results in limited recharge of the groundwater system by rainfall. The depth to groundwater has developed a natural equilibrium and there is little tendency for salt contained in the groundwater or subsoils to rise to the surface.

6.2.2 Salinity and Urban Development

Salinity becomes a problem in urban areas when changes in the land use result in changes to the way water moves through the environment. This can result in vegetation die-back, decrease in water quality and damage to urban infrastructure.

Removal of deep rooted tree species during development and replacement with urban infrastructure, houses and industrial developments reduces the mechanism for the removal of subsurface moisture.

The development of urban salinity is commonly associated with changes in the hydrological cycle through the environment (rainfall, surface run-off, water infiltration and groundwater system). An increase in the quantity of water reaching the groundwater table as a result of vegetation clearance, irrigation of parklands, leaking water infrastructure and changes in drainage patterns, can cause a relatively rapid rise in the groundwater table. Earthworks that include excavation of natural soil profiles and exposure of more saline subsurface soils or shale bedrock may also result in an increase in salt concentrations at the ground surface.

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

Construction of roads, pipelines and buildings commonly results in removal of topsoil leading to exposure of the subsoils and interception of surficial and shallow subsurface drainage. In addition, over-irrigation of urban gardens, leaking water infrastructure and concentrated drainage patterns can result in increased water movement through the subsoil to the groundwater system leading to a relatively rapid rise in the groundwater table.

A rise in groundwater levels and impediments to subsurface drainage patterns can transport salt formerly stored in the bedrock to the surficial soil profile. This may result in salt encrustation of exposed soils, building foundations, roads, drainage infrastructure and corrosion of metal, concrete and other building materials. Increasing salt concentrations in surficial soils (and consequently in surface waters) may also result in die-off of the existing vegetation, further reducing the hydrological load on the groundwater system and resulting in further groundwater table rises.

6.2.3 Potential Salinity Impacts on Urban Development

Some of the adverse impacts that can arise from saline conditions include:

- Salt scalds caused by a rise in the subsoil moisture content that mobilises salt to the ground surface;
- Salt scalds caused by modification of former drainage patterns which leads to the day lighting of subsurface seepage (either perched water or groundwater) in areas lower in the catchment, either at breaks in the slope or within drainage lines;
- A rise in groundwater table or accumulation of salt rich seepage leading to corrosion of subsurface facilities including concrete structures, metal pipework, cables, foundations, underground services, etc.;
- Rising damp, where salt rich moisture is drawn into building and pavement materials by capillary action leading to deterioration of brick, mortar and concrete;
- Structural cracking, damage or building collapse which may occur as a result of shifting and or sinking foundations;
- Plant die-back associated with a rise in groundwater table level that mobilises excess salt to the plant root zone; and
- Subsurface water discharge and subsequent pollution of streams and drainage channels.

6.2.4 Soils and Groundwater Planning Strategy in Western Sydney

The aim of the DLWC 2002 document is to provide a framework for the sustainable development and management of new developments in the western region of Sydney. In relation to salinity management, the development should be designed and constructed such that there is no significant increase in the water table level and no adverse salinity impacts.

The proposed development controls that relate to soils and groundwater issues are summarised below:

1. A water management strategy should be prepared to address the following:
    - Reduction of potable water usage onsite;
    - Development of best practice measures for stormwater reuse for open space irrigation;
    - Reduction of potable water demand;
    - Reduction of adverse impacts on local groundwater regimes;
    - Reduction of change in local flow regimes; and
    - Preparation of water maintenance and a monitoring management system.
2. A salinity management plan should be prepared that includes a groundwater management strategy related to:
    - Adoption of small landscaped areas to reduce irrigation requirements;
    - Use of native and other low water requirement plants;
    - Use of mulch cover (not in drainage lines);
    - Use of low flow watering facilities for landscaped areas;
    - Implementation of a tree planting program, especially in high recharge areas, of native, deep rooted, large growing species to assist retention of the groundwater at existing levels;
    - Retention of existing native tree cover where possible; and
    - Not permitting infiltration pits or tanks to disperse surface water.
3. An assessment of soil and rock conditions at the site, including erosion, expansive and dispersive soil conditions, and plant growth potential should be undertaken; and
4. Use of the Blue Book 2004 as a guide to prepare soil and water management plans. The approved plan and subsequent works are to be supervised by appropriately qualified experienced personnel.

6.2.5 Background to Salinity Criteria Development

The Salinity Potential Map 2002 provides local government and state agencies with information to develop a salinity management response. The map indicates the distribution and potential severity of salinity at a 1:100,000 scale based on the current understanding of the factors that may lead to the development of saline conditions.

Western Sydney Salinity Code of Practice 2004 document was developed by the Regional Organisation of Councils Ltd (WSROC) in conjunction with DIPNR (now EPA) as a management tool to assist individual councils to develop policy to address salinity at the local government level.

Government departments (now under EPA) have also released a series of documents under the Local Government Salinity Initiative providing information on salinity in urban areas. This series includes the DLWC 2002 document which provides a frame work for undertaking salinity investigations for urban development.

Salinity management recommendations outlined in this report have been designed generally in accordance with the amended Salinity Code of Practice 2004. The recommendations have been designed with reference to various levels of salinity management response outlined in the publication.

6.2.6 Salinity and Plant Growth

The electrical conductivity (EC) of a 1:5 soil:water extract is commonly used as an indicator of soil salinity conditions as the reading is directly related to the electrolyte (salt) concentration of the extract. In order to compare the laboratory data with published salinity classes, the results are converted to equivalent saturated paste (ECe) using texture adjustment values presented in DLWC 2002.

The following table provides a summary of plant response with reference to salinity:

Table 6-1: Plant Response to Soil Salinity

ECe (dS/m)	Salinity Class	Plant Response[1]
<2	Non-saline	Salinity effects mostly negligible
2-4	Slightly saline	Yields of very sensitive crops may be affected
4-8	Moderately saline	Yield of many crops affected
8-16	Very saline	Only tolerant crops yield satisfactorily
>16	Highly saline	Only a few very tolerant crops yield satisfactorily

Note:

1 - Plant Response to Salinity Class has been adopted from DLWC 2002

6.2.7 Soil pH and Plant Growth

Soil pH is a measure of the acidity or alkalinity of the soils and values have been assessed as an indicator of soil fertility with respect to plant growth.

The optimal pH for plant growth is between 5.5 and 7. Beyond this range, effective revegetation of exposed soil following disturbance is increasingly difficult and the potential for erosion is considered to increase. Highly alkaline soils are commonly associated with saline and sodic soil conditions and can limit the ability of plants to take up water and nutrients. Highly acidic soils exhibit aluminium toxicity toward plants and can limit the ability of plants to take up other essential nutrients including molybdenum.

Interpretation of soil pH with respect to plant growth is undertaken using the ratings published in Bruce and Rayment (1982[20]) presented below:

[20] *Analytical Methods and Interpretations used by the Agricultural Chemistry Branch for Soil and Land Use Surveys,* Bruce, R.C. and Rayment, G.E., 1982 (Bruce and Rayment 1982)

Table 6-2: Plant Response to Soil pH

pH	Rating
<4.5	Extremely acidic
4.5-5.0	Very strongly acidic
5.1-5.5	Strongly acidic
5.6 – 7.3	Optimal plant growth
7.4-7.8	Mildly alkaline
7.9-8.4	Moderately alkaline
8.5-9.0	Strongly alkaline
>9.1	Very strongly alkaline

6.2.8 CEC in Soil

The ability of soils to attract, retain and exchange cations (positively charged ions) is estimated by the calculated CEC value. CEC represents the major controlling factor in stability of clay soil structure, nutrient availability for plant growth, soil pH and the reaction of the soil to chemical applications (fertilisers, conditioners etc.).

High CEC soils have a greater capacity to retain nutrients, however, deficient soils require greater applications of nutrients to correct imbalances. Low CEC soils have a reduced capacity to retain nutrients and may result in leaching of nutrients from the soil in the event of excess nutrient applications.

Metson (1961[21]) developed a set of ratings for effective CEC and the most abundant cations. These are summarised below (values are in meq/100g):

Table 6-3: CEC Rating

Rating	eCEC	Exch Na	Exch K	Exch Ca	Exch Mg
Very low	<6	0-0.1	0-0.2	0-2	0-0.3
Low	6-12	0.1-0.3	0.2-0.3	2-5	0.3-1
Moderate	12-25	0.3-0.7	0.3-0.7	5-10	1-3
High	25-40	0.7-2	0.7-2	10-20	3-8
Very high	>40	>2	>2	>20	>8

6.2.9 Exchangeable Sodium Percentage or Sodicity

Exchangeable sodium is an important soil stability and salinity parameter. Excessive exchangeable sodium leads to unstable soils, increased runoff, potential salinity, dispersivity and water logging problems.

[21] *Methods of Chemical Analysis for Soil Survey Samples,* Metson, A.J, 1961 (Metson 1961)

Normally the sodium content is expressed as a percentage of the CEC as other cations counteract the negative effects of sodium (known as ESP% and termed sodicity). The effect of the exchangeable sodium (exchangeable sodium percentage, ESP) varies with other soil factors such as the type of clay, the relative quantity of magnesium and the quantity of organic matter. However, Charman & Murphy (2000[22]) indicate that a soil is generally considered sodic if the ESP exceeds 6% and extremely sodic if the ESP exceeds 15%.

6.2.10 Recommendations for Concrete Slabs and Footings in Saline Soils

In the absence of endorsed recommendations for buildings in saline environments, reference is made to the CCAA 2005. The guide provides recommendations on the minimum concrete grade/strength required for slabs and footings in saline soils. Reference should be made to the CCAA 2005 publication for future information:

Table 6-4: Minimum Concrete Grade for Slabs and Footings in Saline Soils

ECe (dS/m)	Salinity Class	Concrete Grade
<2	Non-saline	N20
2-4	Slightly saline	N20
4-8	Moderately saline	N25
8-16	Very saline	N32
>16	Highly saline	≥N40

6.2.11 Recommendations for Durability with Reference to AS2159-2009

In designing for durability, reference should be made to the requirements listed in the AS2159-2009. The exposure classification for concrete and steel piles and foundations is outlined in the following tables.

Table 6-5: Exposure Classification for Concrete Piles

Exposure Conditions				Exposure Classification	
Sulphate (expressed as SO_4)		pH	Chlorides in Groundwater (ppm)	Soil Conditions A[1]	Soil Conditions B[2]
In Soil (ppm)	In Groundwater (ppm)				
<5,000	<1,000	>5.5	<6,000	Mild	Non-aggressive
5,000-10,000	1,000-3,000	4.5-5.5	6,000-12,000	Moderate	Mild
10,000-20,000	3,000-10,000	4-4.5	12,000-30,000	Severe	Moderate
>20,000	>10,000	<4	>30,000	Very severe	Severe

Notes:
1 - High permeability soils (eg sands and gravels) which are in groundwater
2 – Low permeability soils (eg silts and clays) or all soils above groundwater

[22] *Soils: Their Management and Properties,* Charman, P.E.V and Murphy, B.W (eds), 2000 (Charman and Murphy 2000)

Table 6-6: Exposure Classification for Steel Piles

Exposure Conditions				Exposure Classifications	
pH	Chlorides		Resistivity (ohm.cm)	Soil Conditions A[1]	Soil Conditions B[2]
	In Soil (ppm)	In Groundwater (ppm)			
>5	<5,000	<1,000	>5,000	Non-aggressive	Non-aggressive
4-5	5,000-20,000	1,000-10,000	2,000-5,000	Mild	Non-aggressive
3-4	20,000-50,000	10,000-20,000	1,000-2,000	Moderate	Mild
<3	>50,000	>20,000	<1,000	Severe	Moderate

Notes:
1 - High permeability soils (eg sands and gravels) which are in groundwater
2 – Low permeability soils (eg silts and clays) or all soils above groundwater

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 logs attached in the appendices for further details.

7.1.1 Stratigraphy

Table 7-1: Summary of Soil Stratigraphy

Profile	Description (m in bgl)
Fill	Silty sandy fill and silty clayey fill was encountered from surface level in all boreholes and test pits. The fill extended to depths ranging from approximately 0.3m (TP221, TP223 & TP224) to 5.8m (BH208). Based on SPT results the fill was assessed to be poorly to well compacted. Inclusions in the fill comprised: sandstone, ironstone and igneous gravel; brick; tile; and fibre cement fragments (FCF); ash and slag.
Natural Soil	Natural silty clays were encountered beneath the fill in all boreholes with the exception of BH206, and in test pits TP221 to TP224 & TP227. The clays extended to depths ranging from approximately 0.9m (BH222) to 8.5m (BH207). The clays were assessed to be medium to high plasticity and of firm to hard strength.
Bedrock	Weathered shale bedrock was encountered beneath the natural clays in BH201 to BH210, BH212, BH214, BH215, BH218 & BH219. The shale bedrock extended to refusal and termination depths ranging from approximately 3.6m (BH202 & BH10) to 10.5m (BH207). On first contact, the shale bedrock was assessed to be extremely to distinctly weathered and of extremely low to low strength. With depth the shale improved in quality, and was assessed to be distinctly weathered and of low to high strength. Weathered sandstone bedrock was encountered beneath the natural clays in BH211, BH213, BH216, BH217 & TP222. The sandstone bedrock extended to refusal depths ranging from 1m (TP222) and 4.3m (BH213). The sandstone bedrock was assessed to be distinctly weathered and of very low to medium strength.

7.1.2 Groundwater Conditions

Groundwater seepage was encountered on completion of drilling in BH204 to BH207 at depths ranging from approximately 2.9m (BH204) to 8.2m (BH206). The boreholes were left open and the standing water level (SWL) was measured after approximately 24 hours of drilling. The SWL ranged in depth

from approximately 0.3mbgl (BH205) to 4.3mbgl (BH207). SWL was measured at approximately 6.3mbgl in BH212 after 30 minutes after completion of drilling. BH208 was 'dry' on completion of drilling. The SWL in this boreholes was at a depth of approximately 5.3mbgl after 24 hours.

All remaining boreholes and test pits were noted as 'dry' on completion and the short time following completion. We note that groundwater levels may not have stabilised during the relatively short period between borehole completion and measurement of water levels. Long term monitoring of groundwater levels was outside the scope of this study.

7.2 Field Screening

7.2.1 PID Screening for VOCs

PID soil sample headspace readings are presented in attached report tables and the COC documents attached in the appendices. All results were 0 ppm equivalent isobutylene which indicates a lack of PID detectable VOCs.

7.2.2 Aesthetic Issues

The fill encountered inclusions of FCF, ash and slag. No major odours or discolouration of the soil was noted.

7.3 Summary of Soil Contamination 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 7-2: Summary of Soil Contamination Results

Analyte	Results Compared to SAC
Heavy Metals	**HILs:** All heavy metal results were below the HIL-A, HIL-B and HIL-C criteria. **EILs:** The majority of the heavy metal results were below the EIL-AEC and EIL-URPOS criteria. Fill sample BH203 (0.1-0.2m) encountered a zinc elevation of 400mg/kg above the EIL-AEC criterion of 252mg/kg. Fill sample BH208 (0.2-0.4m) encountered an arsenic elevation of 41mg/kg above the EIL-AEC criterion of 40mg/kg. **WC:** All heavy metal results were less than the CT1 criteria.

Analyte	Results Compared to SAC
TRH	**HSLs:** All TRH results were below the HSL-A criteria. **ESLs:** All TRH results were below the EIL-AEC and EIL-URPOS criteria. **WC:** All TRH results were less than the CT1 criteria.
BTEXN	**HSLs:** All BTEXN results were below the HSL-A criteria. **ESLs:** All BTEXN results were below the EIL-AEC and EIL-URPOS criteria. **WC:** All BTEX results were less than the CT1 criteria.
PAHs	**HILs:** All PAH results were below the HIL-A, HIL-B and HIL-C criteria. **HSLs:** All naphthalene results were below the HSL-A criteria. **ESLs:** All benzo(a)pyrene results were below the ESL-AEC and ESL-URPOS criteria. **EILs:** All naphthalene results were below the EIL-AEC and 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, HIL-B and HIL-C criteria. **EILs:** All DDT results were below the EIL-AEC and 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, HIL-B and HIL-C criteria.

Analyte	Results Compared to SAC
	WC: All PCB results were less than the CT1 criterion.
Asbestos	Asbestos was detected in the FCF samples encountered in test pits TP226 and TP277.

7.4 Summary of Soil Salinity Results & Interpretation

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

Table 7-3: Summary of Soil Salinity Results & Interpretation

Analyte	Results Compared to SAC
Soil Salinity and Plant Growth	The ECe results generally ranged from 0.56dS/m to 15.2dS/m. The majority of the samples were classed as either moderate or very saline. No distinct depth profiling was noted.
Soil pH and Plant Growth	The soil pH results ranged from 4.3 to 8.6 and are classed as very strongly acidic to strongly alkaline. The majority of the soils were generally within the optimum range for plant growth.
CEC in Soil	The total CEC values ranged from 6.6meq/100g to 38meq/100g in the low to high range. The majority of the samples were within the moderate range which is typical of the soil formation encountered at the site and are generally indicative of the low levels of organic matter within the soils.
ESP%	The ESP% values of the samples ranged from 1% to 32%. The majority of the ESP results were above the 5% threshold and were classed as sodic to highly sodic.
Concrete Slabs and Footings in Saline Soils (CCAA 2005)	The soils at the site are generally classed as moderate to very saline. The CCAA 2005 recommended concrete grade for slabs and footings in very saline soils is N32. Reference should also be made to AS2159-2009 for minimum concrete strengths and reinforcement cover for concrete piles/foundations.
Soil Conditions for Exposure Classification (AS2159-2009)	The subsurface conditions at the site generally comprise of low permeability soils (i.e. silts and clays). Based on this, the exposure classification outlined under 'Soil Conditions B' has been adopted for the assessment.
Exposure Classification for Concrete	The soil pH and sulphate results indicate that the soils are mild to moderately aggressive towards buried concrete.

Analyte	Results Compared to SAC
Piles/Foundations (AS2159-2009)	
Exposure Classification for Steel Piles/Foundations (AS2159-2009)	The soil resistivity, pH and chloride results indicate that the soils are mild to moderately aggressive towards buried steel.

8 DATA QUALITY ASSESSMENT

8.1 Assessment of Data Quality Indicators (DQIs)

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

Table 8-1: Assessment of DQIs

	Precision	Accuracy	Representativeness	Completeness	Comparability
Field Considerations:					
The investigation was designed to obtain appropriate media encountered during the field work as outlined in the SAQP. Due to the preliminary nature of the study groundwater, surface water or sediments have not been assessed.			Y	Y	
Samples were obtained from various depths based on the subsurface conditions encountered at the sampling locations. All samples were recorded on the appropriate logs and documentation attached in the appendices.				Y	
The investigation was undertaken by trained staff in accordance with the EIS Standing Sampling Procedures (SSP). Consistency was maintained during sampling in accordance with the SSP. The SSP is part of the AS/NZS ISO 9001 quality system maintained by JK Group. The SSP is reviewed on a regular basis.	Y	Y		Y	Y
Field work documentation outlined in the SAQP is attached in the appendices. Field observations and climate conditions were noted on the site description record.				Y	Y
Laboratory Considerations:					
Appropriate sample preservation, handling, holding time and COC procedures were adopted for the investigation.				Y	
Selected samples were analysed for a range of CoPC as outlined in the SAQP.			Y	Y	
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.				Y	Y
All field QA/QC were analysed by the primary and secondary laboratories as outlined in the SAQP. The same units were used by the laboratory/s for all of the analysis.					Y

	Precision	Accuracy	Representativeness	Completeness	Comparability
Field Duplicate Samples The field QA/QC analysis adopted for the study is outlined below. Calculation of the Relative Percentage Difference (RPD) from the primary and duplicate results was undertaken in accordance with the procedure outlined in the attached appendices. Assessment of RPD results against the acceptance criteria is outlined in **Section 5.1**. Intra-laboratory RPD Results: Soil Samples at a frequency of 5% of the primary samples: • Dup JS1 is a soil duplicate of primary sample BH205 (0-0.2m) • Dup JS2 is a soil duplicate of primary sample BH215 (0-0.2m) • Dup JS3 is a soil duplicate of primary sample TP221 (0.1-0.2m) The intra-laboratory results are presented in the attached report tables. The results indicated that field precision was acceptable. The RPD value for zinc (Table CG-1) was outside the acceptance criteria. This could be attributed to sample heterogeneity and the difficulties associated with obtaining homogenous duplicate samples of heterogeneous 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.	Y				
Field Rinsate (FR): FR1 and FR2 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.	Y	Y			
Trip Blank (TB): Five soil trip blanks TB1 to TB5 were analysed for BTEX at a frequency of one blank per day of field work. The results are presented in the attached report tables. The results were all less than the PQLs.	Y	Y			
Review of Laboratory QA/QC Procedures: A review of the laboratory report/s indicate that the analytical results were generally within the acceptance criteria adopted by the laboratory/s.	Y	Y			

8.2 QA/QC Review

A review of the QA/QC program adopted for the study indicates an acceptable level of confidence in the analytical program. The field and laboratory data are considered to be valid and acceptable to achieve the objectives of the study.

9 REVIEW AND DISCUSSION OF RESULTS

9.1 Summary of Site Contamination

9.1.1 Soil Contamination – Fill Material

Significant widespread soil contamination was not encountered in the sampling locations. Minor elevations of EILs were encountered in Site A. These elevations are considered to be associated with the uncontrolled fill imported onto the site from unknown sources.

Two FCF fragments encountered in test pits TP226 and TP227 in Site A were analysed for asbestos. The samples encountered Chrysotile and Amosite asbestos in the bonded form. The site history indicates that numerous former buildings were demolished at the site. The DP 2004 report identified asbestos in fill as a cause of concern.

Uncontrolled filling has occurred at the site which could have also resulted in importing asbestos containing material (ACM) along with the fill onto the site.

Due to the limited subsurface investigation undertaken for the study, the distribution of ACM in the fill has not been adequately characterised. Additional investigation will be required to better characterise the extent of asbestos contamination.

9.1.2 Use of Herbicides in Waterways

The EPA records indicate that herbicides have been used in the waterways which includes Bungarribee Creek. The herbicides could have impacted the sediment and soil along the creek line. Additional investigation is required along the creek to assess the potential for herbicide contamination at the site.

9.1.3 Groundwater

The groundwater table is relatively shallow in low lying sections of the site. The groundwater could have been impacted by contaminants including herbicides. Groundwater screening is required to better assess the impacts.

9.2 Tier 1 Risk Assessment

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 in FCF	Human Receptors: Inhalation of airborne asbestos fibres	The investigation encountered FCF containing asbestos. During sampling the FCF 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. EIS are of the opinion that the risk posed to human receptors is low to moderate and will require remediation and/or management. Additional testing is required to assess the extent of asbestos contamination at the site.
Arsenic and Zinc in Site A	Environmental Receptors: Direct exposure to plants and animals	The CoPC were above the EAC for Areas of Ecological Significance adopted for the investigation in Site A. These elevations may pose a risk to environmental receptors. However the elevations are relatively marginal and were only detected at two locations i.e. the potential impacts are unlikely to be significant and widespread. An ecological risk assessment may be required for the site.

9.3 Soil Salinity

The Stage 1 ESA has indicated that the site is impacted by dryland salinity. A summary of the salinity conditions are as follows:

- The soils at the site are either moderate or very saline. No distinct depth profiling was noted. The CCAA 2005 recommended concrete grade for slabs and footings in very saline soils is N32;
- The soil pH results ranged from 4.3 to 8.6 and are classed as very strongly acidic to strongly alkaline. The majority of the soils were generally within the optimum range for plant growth;
- The majority of the CEC values were within the moderate range which is typical of the soil formation encountered at the site and are generally indicative of the low levels of organic matter within the soils;
- The majority of the ESP results were above the 5% threshold and were classed as sodic to highly sodic;
- The soil pH and sulphate results indicate that the soils are mild to moderately aggressive towards buried concrete; and

- The soil resistivity, pH and chloride results indicate that the soils are mild to moderately aggressive towards buried steel.

The groundwater salinity conditions have not been assessed for this study. The salinity conditions in groundwater can be different to the soil conditions. Additional testing will be required in order to prepare a Salinity Management Plan (SMP) for the proposed development at the site.

9.4 Preliminary Waste Classification for Soil Disposal

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

Table 9-2: Preliminary Waste Classification

Site Extent / Material Type	Classification	Disposal Option
Fill material in Site B	General Solid Waste (non-putrescible) (GSW)	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. Alternatively, the fill material is considered to be suitable for re-use on the subject site (only) provided it meets geotechnical and earthwork requirements.
Fill material in Site A	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. Soil contaminated with asbestos can be managed on-site by implementing a remediation and management strategy.
Natural silty clay soil and shale/sandstone bedrock	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.

9.5 Data Gaps

The assessment has identified the following data gaps:

- Large areas of the site has not been investigated. Sampling for the Stage 1 study was confined to 20% of the minimum density recommended by the EPA;
- Groundwater, surface water, creek sediments and creek soil samples were not analysed for the Stage 1 study;
- Additional testing of the fill will be required to characterise the extent of asbestos contamination;
- Additional waste classification will be required for the off-site disposal of fill; and
- Salinity management plan will be required for the proposed development.

10 CONCLUSION

10.1 Site Suitability

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

EIS consider that the site can be made suitable for the proposed master plan development provided the following recommendations are implemented to address the data gaps and to better manage/characterise the risks:

1. Undertake a Preliminary Stage 2 ESA to address the data gaps identified in **Section 9.5;**

2. Prepare a Salinity Management Plan (SMP) for the proposed development; and

3. Prepare a Remediation Action Plan (RAP) for the proposed development. The RAP should include a Unexpected Finds Protocol (UFP) for the earthworks at the site.

10.2 Regulatory Requirement

The regulatory requirements applicable for the proposed development is summarised in the section below. Reference should be made to the development consent for more information.

10.2.1 Contaminated Land Management Act 1997 (CLM Act)

The CLM Act establishes a legal framework that gives the EPA powers to require the assessment and remediation of sites where contamination is significant enough to warrant regulation. Where the EPA's intervention is not needed, the NSW planning and development framework will determine the appropriate use of sites in the future.

Under section 60 of the CLM Act the following people are required to notify the EPA as soon as practical after they become aware of the contamination:

- Anyone whose activities have contaminated land; and
- An owner of land that has been contaminated.

10.2.1.1 Duty to Report Contamination

The duty to report contamination to the EPA is outlined in the NSW EPA (2015[23]) *Guidelines on the Duty to Report Contamination under the Contaminated land Management Act 1997*.

[23] referred to as Duty to Report Contamination 2015

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.

10.2.2 NSW EPA Requirements

10.2.2.1 Protection of the Environment Operation 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.

10.2.2.2 Water Management Act 2000

The remediation of contaminated groundwater may require treatment. Relevant approval should be obtained from NSW EPA and NSW Department of Primary Industries Water (DPIW) prior to the commencement of pumping and treatment.

10.2.3 Local Government Requirements

10.2.3.1 Dewatering Approvals

In the event groundwater is intercepted during excavation works, dewatering will be required. Council and other relevant approvals will be required prior to disposal of groundwater into the stormwater system.

10.2.3.2 Work Health and Safety

Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan in accordance with the WHS Code of Practice 2011[24].

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

11 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.

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.

TABLE CA - PROPOSED CHILDCARE DEVELOPMENT
SOIL LABORATORY RESULTS COMPARED TO HIL-A
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)		
			Arsenic	Cadmium	Chromium VI [2]	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P TEQ [3]	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos	TOTAL PCBs	ASBESTOS FIBRES
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC) [1]			100	20	100	6000	300	40	400	7400	300	3	10	270	300	6	50	240	6	160	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH211	0-0.2	FILL: Silty Clay	8	LPQL	17	25	31	LPQL	12	69	0	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH211	0.9-1.2	FILL: Silty Clay	12	LPQL	14	30	15	LPQL	33	61	0	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Number of Samples			2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
Maximum Value			12	LPQL	17	30	31	LPQL	33	69	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NC

Explanation:
1 - Site Assessment Criteria (SAC): NEPM 2013, HIL-A: 'Residential with garden/accessible soils; children's day care centers; preschools; and primary schools'
2 - The results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
3 - B(a)P TEQ - Benzo(a)pyrene Toxicity Equivalence Quotient has been calculated based on 8 carcinogenic PAHs and their Toxic Equivalence Factors (TEFs) outlined in NEPM 2013

Concentration above the SAC **VALUE**

Abbreviations:

PAHs: Polycyclic Aromatic Hydrocarbons	UCL: Upper Level Confidence Limit on Mean Value
B(a)P: Benzo(a)pyrene	HILs: Health Investigation Levels
PQL: Practical Quantitation Limit	NA: Not Analysed
LPQL: Less than PQL	NC: Not Calculated
OPP: Organophosphorus Pesticides	NSL: No Set Limit
OCP: Organochlorine Pesticides	SAC: Site Assessment Criteria
PCBs: Polychlorinated Biphenyls	NEPM: National Environmental Protection Measure

TABLE CB - SITE B RESIDENTIAL DEVELOPMENT
SOIL LABORATORY RESULTS COMPARED TO HIL-B
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)	TOTAL PCBs	ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium VI [2]	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P TEQ [3]	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos		
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC) [1]			500	150	500	30000	1200	120	1200	60000	400	4	15	400	500	10	90	600	10	340	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH212	0-0.2	FILL: Sandy Silt	7	LPQL	11	18	20	LPQL	9	89	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH212	1.0-1.2	FILL: Silty Clay	7	LPQL	16	38	20	LPQL	29	85	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH212	1.0-1.2	FILL: Silty Clay	6	LPQL	16	39	20	LPQL	31	89	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH212	2.0-2.2	FILL: Silty Clay	8	LPQL	14	39	13	LPQL	20	93	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH213	0-0.3	FILL: Sandy Silt	7	LPQL	13	19	20	LPQL	11	83	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH213	1.0-1.2	FILL: Silty Clay	13	LPQL	10	38	13	LPQL	22	80	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH213	2.0-2.2	FILL: Silty Clay	5	LPQL	13	17	14	LPQL	8	25	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH214	0-0.4	FILL: Silty Clay	6	LPQL	19	110	26	LPQL	10	94	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH214	1.0-1.3	FILL: Silty Clay	13	LPQL	12	37	18	LPQL	17	84	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH215	0-0.2	FILL: Sandy Silt	8	LPQL	11	24	24	LPQL	13	86	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH215	1.0-1.2	FILL: Sandy Silt	10	LPQL	13	39	16	LPQL	25	79	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH215	1.0-1.2	FILL: Sandy Silt	11	LPQL	12	41	16	LPQL	24	81	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH215	2.0-2.2	FILL: Silty Clay	6	LPQL	10	16	10	LPQL	3	19	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH215	2.8-3.0	FILL: Silty Clay	12	LPQL	18	19	13	LPQL	9	28	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH216	0-0.2	FILL: Sandy Silt	4	LPQL	10	12	16	LPQL	6	51	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH216	1.0-1.3	FILL: Silty Clay	5	LPQL	18	14	14	LPQL	9	22	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH217	0-0.3	FILL: Sandy Silt	10	LPQL	23	17	30	LPQL	9	36	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH217	0.9-1.2	FILL: Silty Clay	8	LPQL	22	17	16	LPQL	10	26	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH218	0-0.3	FILL: Sandy Silt	11	LPQL	9	46	18	LPQL	25	98	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH218	0.9-1.2	FILL: Silty Clay	9	LPQL	20	21	17	LPQL	9	33	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH218	1.8-2.1	FILL: Silty Clay	6	LPQL	19	20	12	LPQL	11	34	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH219	0-0.2	FILL: Sandy Silt	LPQL	LPQL	8	11	12	LPQL	5	35	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH219	0-0.2	FILL: Sandy Silt	LPQL	LPQL	9	11	12	LPQL	5	37	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
TP220	0-0.1	FILL: Sandy Silt	4	LPQL	11	13	26	LPQL	7	56	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP220	0.4-0.5	FILL: Sility Clay	5	LPQL	12	15	12	LPQL	4	18	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP220	1.5-1.7	FILL: Silty Clay	10	LPQL	26	12	21	LPQL	6	19	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP228	0.1-0.2	FILL: Sandy Silt	11	LPQL	19	23	22	LPQL	15	67	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP229	0-0.1	FILL: Sandy Silt	7	LPQL	13	15	20	LPQL	9	53	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
Total Number of Samples			28	28	28	28	28	28	28	28	28	28	12	12	12	12	12	12	12	12	12	11
Maximum Value			13	LPQL	26	110	30	LPQL	31	98	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NC

Explanation:

1 - Site Assessment Criteria (SAC): NEPM 2013, HIL-B: 'Residential with minimal opportunities for soil access; including dwellings with fully/permanently paved yards like high-rise buildings'

2 - The results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.

3 - B(a)P TEQ - Benzo(a)pyrene Toxicity Equivalence Quotient has been calculated based on 8 carcinogenic PAHs and their Toxic Equivalence Factors (TEFs) outlined in NEPM 2013

Concentration above the SAC **VALUE**

Abbreviations:

PAHs: Polycyclic Aromatic Hydrocarbons
B(a)P: Benzo(a)pyrene
PQL: Practical Quantitation Limit
LPQL: Less than PQL
OPP: Organophosphorus Pesticides
OCP: Organochlorine Pesticides
PCBs: Polychlorinated Biphenyls
UCL: Upper Level Confidence Limit on Mean Value
HILs: Health Investigation Levels
NA: Not Analysed
NC: Not Calculated
NSL: No Set Limit
SAC: Site Assessment Criteria
NEPM: National Environmental Protection Measure

TABLE CC - SITE A PLAYING FIELDS
SOIL LABORATORY RESULTS COMPARED TO HIL-C
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)		
			Arsenic	Cadmium	Chromium VI [2]	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P TEQ [3]	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos	TOTAL PCBs	ASBESTOS FIBRES
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC) [1]			300	90	300	17000	600	80	1200	30000	300	3	10	340	400	10	70	400	10	250	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH201	0.1-0.2	FILL: Silty Clay	6	LPQL	18	20	17	LPQL	5	25	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH201	0.1-0.2	FILL: Silty Clay	6	LPQL	17	25	16	LPQL	4	26	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH202	0.1-0.2	FILL: Silty Clay	11	LPQL	25	11	17	LPQL	3	14	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH203	0.1-0.2	FILL: Silty Clay	18	0.5	20	30	92	LPQL	16	400	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH204	0-0.1	FILL: Sandy Silt	6	LPQL	14	13	29	LPQL	6	59	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH205	0-0.2	FILL: Silty Clay	6	LPQL	13	20	28	LPQL	10	58	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH206	0.2-0.4	FILL: Silty Clay	6	0.5	16	29	24	LPQL	8	99	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH206	2.0-2.2	FILL: Silty Clay	LPQL	LPQL	15	31	13	LPQL	13	46	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH207	0.2-0.4	FILL: Silty Sand	5	LPQL	16	31	14	LPQL	29	46	1.5	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH207	1.2-1.4	FILL: Silty Clay	9	LPQL	20	23	18	LPQL	12	52	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH207	2.8-3.0	FILL: Silty Clay	9	LPQL	19	37	21	LPQL	21	64	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH208	0.2-0.4	FILL: Gravelly Silty Sand	35	LPQL	15	41	19	LPQL	21	71	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH208	0.2-0.4	FILL: Gravelly Silty Sand	41	LPQL	13	38	21	LPQL	21	67	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH208	1.6-2.0	FILL: Silty Clay	9	LPQL	19	39	26	LPQL	21	62	8.1	0.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH208	3.6-4.0	FILL: Silty Clay	9	LPQL	18	21	25	LPQL	10	29	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH209	0.1-0.2	FILL: Silty Sand	9	LPQL	13	40	15	LPQL	19	69	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH209	1.0-1.2	FILL: Silty Sand	20	LPQL	8	52	16	LPQL	22	81	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH209	3.6-3.8	FILL: Silty Clay	8	LPQL	18	18	22	LPQL	8	20	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH210	0.1-0.4	FILL: Silty Clay	6	LPQL	14	26	13	LPQL	14	38	0.07	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH210	1.0-1.3	FILL: Silty Clay	18	LPQL	10	42	13	LPQL	26	69	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH210	1.9-2.1	FILL: Silty Clay	17	LPQL	8	42	15	LPQL	20	70	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP221	0.1-0.2	FILL: Silty Clay	11	LPQL	22	11	25	LPQL	4	27	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP222	0-0.2	FILL: Silty Clay	13	LPQL	19	23	39	LPQL	10	89	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP223	0-0.2	FILL: Silty Clay	10	LPQL	19	18	36	LPQL	8	60	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP224	0-0.2	FILL: Silty Clay	5	LPQL	15	13	19	LPQL	6	25	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP225	0-0.2	FILL: Silty Clay	10	LPQL	17	29	48	LPQL	17	91	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP225	0.7-0.8	FILL: Sandy Silt	6	LPQL	14	36	23	LPQL	20	67	2.9	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP225	1.1-1.3	FILL: Silty Clay	5	LPQL	14	33	28	LPQL	22	77	0.25	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP225	1.1-1.3	FILL: Silty Clay	6	LPQL	15	33	22	LPQL	19	60	0.06	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP226	0-0.2	FILL: Sandy Silt	LPQL	LPQL	9	15	29	0.1	6	76	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
TP226	0.4-0.5	FILL: Silty Clay	6	LPQL	19	30	29	0.3	22	68	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP226	1.3-1.5	FILL: Silty Clay	7	LPQL	12	16	10	LPQL	5	24	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TP227	0-0.2	FILL: Silty Clay	5	LPQL	13	20	35	LPQL	10	160	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
FTP226	0.2	Fibre Cement Fragment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Asbestos Detected**
FTP227	0.1	Fibre Cement Fragment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**Asbestos Detected**
Total Number of Samples			33	33	33	33	33	33	33	33	33	33	19	19	19	19	19	19	19	19	19	19
Maximum Value			41	0.5	25	52	92	0.3	29	400	8.1	0.9	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NC

Explanation:

1 - Site Assessment Criteria (SAC): NEPM 2013, HIL-C: 'Public open space; secondary schools; and footpaths'

2 - The results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.

3 - B(a)P TEQ - Benzo(a)pyrene Toxicity Equivalence Quotient has been calculated based on 8 carcinogenic PAHs and their Toxic Equivalence Factors (TEFs) outlined in NEPM 2013

Concentration above the SAC **VALUE**

Abbreviations:

PAHs: Polycyclic Aromatic Hydrocarbons
B(a)P: Benzo(a)pyrene
PQL: Practical Quantitation Limit
LPQL: Less than PQL
OPP: Organophosphorus Pesticides
OCP: Organochlorine Pesticides
PCBs: Polychlorinated Biphenyls
UCL: Upper Level Confidence Limit on Mean Value
HILs: Health Investigation Levels
NA: Not Analysed
NC: Not Calculated
NSL: No Set Limit
SAC: Site Assessment Criteria
NEPM: National Environmental Protection Measure

TABLE CD1 - SITE A & SITE B
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID [2]
PQL - Envirolab Services					25	50	0.2	0.5	1	3	1	
HSL Land Use Category [1]					RESIDENTIAL WITH ACCESSIBLE SOIL							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH201	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH201	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH202	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH203	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH204	0-0.1	FILL: Sandy Silt	0m to < 1m	Silt	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH205	0-0.2	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH206	0.2-0.4	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH206	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH207	0.2-0.4	FILL: Silty Sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH207	1.2-1.4	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH207	2.8-3.0	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH208	0.2-0.4	FILL: Gravelly Silty Sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH208	0.2-0.4	FILL: Gravelly Silty Sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH208	1.6-2.0	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH208	3.6-4.0	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH209	0.1-0.2	FILL: Silty Sand	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH209	1.0-1.2	FILL: Silty Sand	1m to <2m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH209	3.6-3.8	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH210	0.1-0.4	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH210	1.0-1.3	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH210	1.9-2.1	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH211	0-0.2	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH211	0.9-1.2	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH212	0-0.2	FILL: Sandy Silt	0m to < 1m	Silt	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH212	1.0-1.2	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH212	1.0-1.2	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH212	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH213	0-0.3	FILL: Sandy Silt	0m to < 1m	Silt	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH213	1.0-1.2	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH213	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH214	0-0.4	FILL: Silty Clay	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH214	1.0-1.3	FILL: Silty Clay	1m to <2m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH215	0-0.2	FILL: Sandy Silt	0m to < 1m	Silt	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH215	1.0-1.2	FILL: Sandy Silt	1m to <2m	Silt	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH215	1.0-1.2	FILL: Sandy Silt	1m to <2m	Silt	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH215	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH215	2.8-3.0	FILL: Silty Clay	2m to <4m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
Total Number of Samples					37	37	37	37	37	37	37	37
Maximum Value					LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL

Explanation:
1 - Site Assessment Criteria (SAC): NEPM 2013
2 - Field PID values obtained during the investigation

Concentration above the SAC **VALUE**
The guideline corresponding to the elevated value is highlighted in grey in the Site Assessment Criteria Table below

Abbreviations:

UCL: Upper Level Confidence Limit on Mean Value	NC: Not Calculated	PQL: Practical Quantitation Limit
HSLs: Health Screening Levels	NL: Not Limiting	LPQL: Less than PQL
NA: Not Analysed	SAC: Site Assessment Criteria	NEPM: National Environmental Protection Measure

SITE ASSESSMENT CRITERIA

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
PQL - Envirolab Services					25	50	0.2	0.5	1	3	1
HSL Land Use Category [1]					RESIDENTIAL WITH ACCESSIBLE SOIL						
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**							
BH201	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH201	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH202	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH203	0.1-0.2	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH204	0-0.1	FILL: Sandy Silt	0m to < 1m	Silt	40	230	0.6	390	NL	95	4
BH205	0-0.2	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH206	0.2-0.4	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH206	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL
BH207	0.2-0.4	FILL: Silty Sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH207	1.2-1.4	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH207	2.8-3.0	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL
BH208	0.2-0.4	FILL: Gravelly Silty Sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH208	0.2-0.4	FILL: Gravelly Silty Sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH208	1.6-2.0	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH208	3.6-4.0	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL
BH209	0.1-0.2	FILL: Silty Sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH209	1.0-1.2	FILL: Silty Sand	1m to <2m	Sand	70	240	0.5	220	NL	60	NL
BH209	3.6-3.8	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL
BH210	0.1-0.4	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH210	1.0-1.3	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH210	1.9-2.1	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH211	0-0.2	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH211	0.9-1.2	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH212	0-0.2	FILL: Sandy Silt	0m to < 1m	Silt	40	230	0.6	390	NL	95	4
BH212	1.0-1.2	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH212	1.0-1.2	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH212	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL
BH213	0-0.3	FILL: Sandy Silt	0m to < 1m	Silt	40	230	0.6	390	NL	95	4
BH213	1.0-1.2	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH213	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL
BH214	0-0.4	FILL: Silty Clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH214	1.0-1.3	FILL: Silty Clay	1m to <2m	Clay	90	NL	1	NL	NL	310	NL
BH215	0-0.2	FILL: Sandy Silt	0m to < 1m	Silt	40	230	0.6	390	NL	95	4
BH215	1.0-1.2	FILL: Sandy Silt	1m to <2m	Silt	65	NL	0.7	NL	NL	210	NL
BH215	1.0-1.2	FILL: Sandy Silt	1m to <2m	Silt	65	NL	0.7	NL	NL	210	NL
BH215	2.0-2.2	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL
BH215	2.8-3.0	FILL: Silty Clay	2m to <4m	Clay	150	NL	2	NL	NL	NL	NL

ERROR: undefinedresult
OFFENDING COMMAND: itransform

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