ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

DEMARA PTY LTD

ON

ADDITIONAL ENVIRONMENTAL SITE ASSESSMENT AND REMEDIAL ACTION PLAN

FOR

PROPOSED RESIDENTIAL DEVELOPMENT

AT

35-39 DUMARESQ AND 32-34 MCINTYRE STREETS, GORDON, NSW

APRIL 2011

REF: E24170Krpt2

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

EXECUTIVE SUMMARY

Demara Pty Ltd commissioned EIS to undertake an additional environmental assessment and prepare a remedial action plan for a proposed residential development at 35-39 Dumaresq and 32-34 McIntyre Streets, Gordon, NSW. A Phase 1 Environmental Site Assessment was conducted by EIS in 2010 in which hotspots containing elevated levels of lead and benzo(a)pyrene were detected. A fibre cement fragment containing asbestos was also detected in one of the boreholes. The proposed development will include demolition of the existing five residential buildings and construction of two new residential structures with basement car parking.

Drilling and soil sampling was conducted using hand tools on 11 March 2011. Seventeen boreholes were drilled in addition to the nine drilled during the Phase 1 investigation. Soil samples were collected from the fill and natural material and selected samples were analysed for lead, PAHs and/or asbestos. At all borehole locations, fill material was encountered to a depth of approximately 0.4m, with natural silty clay soils beneath.

Analytical results were compared to site assessment criteria which were derived with reference to relevant guidelines and regulations. Elevated concentrations of lead were detected in four fill samples collected from the north-western portion of the site, while elevated concentrations of total PAHs and benzo(a)pyrene were detected in two fill samples collected from the southern portion of the site. The source of the contamination is considered to be associated with ash material contained within the fill matrix.

Analytical results were also compared to the Waste Classification guidelines. The fill material around BH6 is classified as 'General Solid Waste (containing asbestos).' The fill material excavated from the remainder of the site is classified as 'General Solid Waste (non-putrescible)'.

EIS consider that the site can be made suitable for the proposed development provided that certain recommendations are implemented, including the undertaking of remedial works as specified in the Remedial Action Plan (RAP). The most appropriate remediation option was considered to be the excavation and removal of the contaminated material to an appropriate facility.

Following excavation of the contaminated material, validation soil samples are required to be collected from the excavation walls and bases. A validation sampling plan is included within the RAP.

The conclusions presented in this report have been made within the limitations of the scope of works undertaken for the investigation. The conclusions and recommendations should be read in conjunction with the limitations presented in the body of the report.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES:

LIST OF FIGURES:

LIST OF APPENDICES:

1 INTRODUCTION

Demara Pty Ltd commissioned Environmental Investigation Services (EIS), a division of Jeffery & Katauskas Pty Ltd (J&K), to undertake an additional environmental assessment and prepare a remedial action plan (RAP) for a proposed residential development at 35-39 Dumaresq and 32-34 McIntyre Streets, Gordon, NSW. A Phase 1 Environmental Site Assessment was conducted by EIS in 2010 and the results were reported in September 2010[1].

The site is identified as Lot 1 in DP136683, Lot C and D in DP355865, Lot D in DP348677 and Lot 1 in DP119688 and at the time of this investigation was occupied by five residential developments. The site location is shown on Figure 1 and the investigation was confined to the site boundaries as shown on Figure 2.

The assessment was undertaken generally in accordance with an EIS proposal (Ref: EP5455K2) of 9 March 2011.

This report describes the investigation procedures and presents the results of the additional environmental site assessment, together with comments, discussion, recommendations and a Remedial Action Plan.

1.1 Proposed Development Details

EIS understands that the proposed development will include demolition of the existing five residential buildings and construction of two new residential structures with basement car parking.

2 ADDITIONAL INVESTIGATION - OBJECTIVES AND SCOPE OF WORK

2.1 Objectives

The primary objectives of the investigation were to:

- assess the soil contamination conditions at the site in relation to the proposed development of the site for residential land use; and
- attempt to assess the extent of the elevated benzo(a)pyrene and lead hotspots encountered during the initial assessment (Phase 1 report).

[1] *Report to Demara Pty Ltd on Phase 1 Environmental Site Assessment for Proposed Residential Development at 35-39 Dumaresq and 32-34 McIntyre Streets, Gordon, NSW*, EIS, September 2010, Ref: E24170Krpt (Phase 1 report)

2.2 Scope of Work

The scope of work undertaken to achieve the objectives included:

- Soil Sampling and Laboratory Analysis:
  - Soil sampling from a total of 17 locations:
  - Due to access difficulties, the boreholes were drilled using hand tools, which imposed limitations on the depth of the boreholes;
  - Boreholes were re-instated and backfilled with the cuttings from the boreholes;
  - Sampling of fill and natural soil during drilling was undertaken based on field observations;
  - All samples obtained during the assessment were screened for volatile organic compounds, using a photoionisation detector (PID);
  - Selected fill/soil samples were analysed for one or more of the following contaminants identified at the site: lead, polycyclic aromatic hydrocarbons (PAHs), asbestos;
  - Leachate analyses (TCLPs) were conducted on ten soil samples to classify the fill material for off-site disposal, based on the criteria outlined in the *NSW DECC (now DECCW) Waste Classification Guidelines 2009.*
- Implementation of field QA/QC procedures (duplicates) during the soil sampling;
- Preparation of this report presenting the results of the assessment.

Drilling and soil sampling field work for this investigation was undertaken on 11 March 2011.

3 SITE INFORMATION

3.1 Site Identification

The site identification details are summarised in the following table:

Site Owners:	Kwok Keung Ng, Sau Wah Ng; Donald Claud Hamilton, Jann Thornton Hamilton; Paul Cutler, Bettina Cutler; Jane Louise Robson; William Leith Porges and Reingard Porges.
Site Address:	35-39 Dumaresq And 32-34 McIntyre Streets, Gordon, NSW
Lot & Deposited Plan:	Lot 1 in DP136683, Lots C and D in DP355865, Lot D in DP348677 and Lot 1 in DP119688
Current Land Use:	Residential
Proposed Land Use:	Residential
Local Government Authority:	Ku-ring-gai Council
Current Zoning:	Residential (R4)
Site Area:	Approximately 6,000m^2
AHD:	Approximately 88 to 97m
Geographical Location (MGA):	N: 6263515 E: 328504 (approximately)
Site Locality Plan:	Refer to Figure 1
Borehole Location Plan:	Refer to Figure 2

3.2 Site Description

The site is located on the north side of Dumaresq Street approximately 300m west of Pacific Highway. The site is also bounded to the north by McIntyre Street.

At the time of the investigation, the site was divided into five residential properties, No. 35 Dumaresq Street, No. 37 Dumaresq Street, No. 39 Dumaresq Street, No. 32 McIntyre Street and No. 34 McIntyre Street which were occupied by residential buildings with sheds, landscaped and paved areas. A detailed description of each site is presented below:

- No. 35 Dumaresq Street was occupied by a one and two storey brick residential building in the south section of the lot. An in-ground swimming pool was located in the north-west section of the lot. A creek with palm trees and grassed areas was located in the north section of the lot. The creek flowed in a south-west direction. A garden bed retained by a sandstone block retaining wall (approximately 2m high) was located on the south-east corner of the lot. The

central section of the lot was occupied by landscaped grassed and garden areas with paved areas, retaining walls and steps that dropped down to the north.

- No. 37 Dumaresq Street was occupied by a one and two storey weatherboard residential building in the south section of the lot. An approximately 1m high timber retaining wall was located in the central section of the east lot boundary. The timber wall retained material to the east. A creek with palm trees and grassed areas was located in the north section of the lot. The creek flowed in a west direction. Two sheds and broken metal/ wood play equipment were located in the north section of the lot. Grassed areas with scattered trees were located in the central section of the lot. A garden area was located in the south section of the lot.
- No. 39 Dumaresq Street was occupied by a one and two storey brick residential building with a carport and lower level garage in the central section of the lot. An enclosed swimming pool was located in the north-west section of the lot. A creek with palm trees and grassed areas was located in the north section of the lot. The creek flowed in a west direction. The central and south sections of the lot were occupied by landscaped grassed and garden areas with paved areas, retaining walls and steps that dropped down to the north.
- No. 32 McIntyre Street was occupied by a one and two storey brick and cement rendered residential building with a garage in the north section of the lot. An approximately 1m high timber retaining wall was located in the north section of the lot. The timber wall retained material to the east. An approximately 1m high sandstone retaining wall was located in the central section of the lot. The sandstone wall retained material to the east. A terraced garden area was located in the central section of the west lot boundary that fell to the east. Garden and grassed areas were also located in the south and north sections of the lot. Dense vegetation was located along the south lot boundary.
- No 34 McIntyre Street was occupied by a one storey brick residential building in the north section of the lot. A small shed was located in the east section of the lot. The remaining sections of the lot were opened grassed areas with a small garden area along the north site boundary.

3.3 Surrounding Land Use

The areas to the north of McIntyre Street were generally occupied by low to medium density residential developments. The areas to the south of Dumaresq Street were generally occupied by low to medium density residential developments. Residential properties were located beyond the site boundaries to the east and west. An unknown development under construction (possibly high density residential) was located to the south-east of the site.

3.4 Topography

The regional topography is undulating. The north section of the site generally slopes gently down to the south-west at approximately 1° to 3°. The south section of the site generally slopes down to the north-west at approximately 3° to 4°. The natural site topography has been altered to accommodate the existing residential buildings.

3.5 Regional Geology

The geological map of Sydney (1983[2]) indicates the site to be underlain by Ashfield Shale of the Wianamatta Group, which typically consists of black to dark grey shale and laminite.

3.6 Hydrogeology

NSW Office of Water (formerly Department of Water and Energy[3]) records were researched for the Phase 1 report and indicated that eleven registered groundwater bores lie within 1km of the site.

The stratigraphy of the site consists of shallow fill material overlying residual clayey soils overlying relatively shallow bedrock. Based on these conditions and the results of the groundwater bore search, groundwater is not considered to be a significant resource in the immediate area of the site.

4 SUMMARY OF SITE HISTORY

EIS has previously undertaken a site history assessment as part of the Phase 1 investigation. A brief summary of the assessment results are presented in this section of the report. Reference should be made to the Phase 1 report for further details.

The search of historical information has indicated the following:

- The site has been used for residential/rural purposes since and prior to the 1930s;
- The site has been used for residential purposes with the same residential building footprints since the mid 1980s;
- There were a number of building applications lodged for extensions, additions and swimming pools during 1980s and 1990s;
- There are no recorded notices listed on the NSW DECCW CLM or POEO register; and

---

[2] *1:100,000 Geological Map of Sydney (Series 9130),* Department of Mineral Resources (1983) [now Department of Primary Industries]

[3] http://www.waterinfo.nsw.gov.au/gw/ visited on 26 July 2010

- WorkCover have no records of underground storage tank licenses issued for the site.

Based on the available historical data, the professions listed in the Land Title documents are considered to be associated with owners of residential properties and not with potentially contaminating activities carried out on the site.

5 ASSESSMENT CRITERIA

5.1 Regulatory Background

In 1997 the NSW Government introduced the CLM Act. This Act has been amended by the *Contaminated Land Management Amendment Act* (2008[4]).

The CLM Act 1997, associated regulations, SEPP55 and NSW DECCW (EPA) guidelines, were designed to provide uniform state-wide control of the management, investigation and remediation of contaminated land.

Prior to granting consent for any proposed rezoning or development, SEPP55 requires the consent authority to:

- Consider whether the land is contaminated;
- Consider whether the site is suitable, or if contaminated, can be made suitable by remediation, for the proposed land use; and
- Be satisfied that remediation works will be undertaken prior to use of the site for the proposed use.

Should the assessment indicate that the site poses a risk to human health or the environment, remediation of the site may be required prior to occupation of the proposed development. SEPP55 requires that the relevant local council be notified of all remediation works, whether or not development consent is required. Where development consent is not required, 30 days written notice of the proposed works must be provided to council. Details of validation of remediation work must also be submitted to Council within one month of completion of remediation works.

The consent authority may request that a site audit be undertaken during, or following the completion of the site assessment process. Under the terms of the CLM Act 1997 the NSW DECCW (EPA) Site Auditor Scheme was developed to provide a system of independent review for assessment reports. An accredited Contaminated Site Auditor

[4] *Contaminated Land Management Amendment Act,* NSW Government Legislation, 2008 (CLM Amendment Act 2008)

is engaged to review reports prepared by suitably qualified consultants to ensure that the investigation has been undertaken in accordance with the guidelines and confirm that the sites are suitable for their intended use.

Section 59(2) of the CLM Act 1997 states that specific notation relating to contaminated land issues must be included on Section149 (s149) planning certificates prepared by Council where the land to which the certificate relates is:

- Within an investigation or remediation area;
- Subject to an investigation or remediation order by the DECCW (EPA);
- The subject of a voluntary investigation or remediation proposal; and/or
- The subject of a site audit statement.

Submission of contaminated site investigation and validation reports to council as part of rezoning or development application submissions may also result in notation of actual or potential site contamination on future s149 certificates prepared for the site.

Section 60 of the CLM Amendment Act 2008 sets out a positive duty on a land owner, or person whose activities have caused contamination, to notify the DECCW if they are or become aware that contamination exists on a site that generally poses *"an unacceptable risk to human health or the environment, given the site's current or approved use"*. This duty to report is based on trigger values, above which notification is required.

Off-site disposal of fill, contaminated material and excess soil/rock excavated as part of the proposed development works is regulated by the provisions of the *Protection of the Environment Operations Act* (1997[5]) and associated regulations and guidelines including the *NSW DECC (now DECCW) Waste Classification Guidelines - Part 1: Classifying Waste* (2009[6]). All materials should be classified in accordance with these guidelines prior to disposal.

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.

---

[5] *Protection of Environment Operations Act,* NSW Government, 1997 (POEO Act 1997)

[6] *Waste Classification Guidelines, Part 1: Classifying Waste,* NSW DECC, 2009 (Waste Classification Guidelines 2009)

5.2 Soil Contaminant Threshold Concentrations

The soil investigation levels adopted for this investigation are derived from the NSW DEC (now DECCW) document *Guidelines for the NSW Site Auditor Scheme, 2nd Edition* (2006[7]) and the National Environmental Protection Council document *National Environmental Protection (Assessment of Site Contamination) Measure* (1999[8]). The contaminant thresholds listed below are levels at which further investigation and evaluation is required to assess whether the site is considered suitable for the proposed urban land use.

To accommodate the range of human and ecological exposure settings, a number of generic settings are used on which the Health based Investigation Levels (HILs) can be based. Four categories of HILs are adopted for urban site assessments. Contaminant levels for a standard residential site with gardens and accessible soil (Column A in Table A-1) are based on protection of a young child resident at the site. The remaining categories (Columns D to F) present alternative exposure settings where there is reduced access to soil or reduced exposure time. These categories include residential land use with limited soil access, recreational and public open space and commercial/industrial use. Where the proposed land use will include more than one land use category (e.g. mixed residential/commercial development) the exposure setting of the most "sensitive" land use is adopted for the site.

Threshold concentrations for petroleum hydrocarbon contaminants including total TPH and BTEX compounds have previously been established in the *NSW EPA (now DECCW) Contaminated Sites: Guidelines for Assessing Service Station Sites* (1994[9]) publication and this document is referenced in the Site Auditor Guidelines 2006. Heavy fraction petroleum hydrocarbon aliphatic/aromatic component threshold concentrations have also been introduced in NEPM 1999.

5.2.1 Provisional Phyto-toxicity Investigation Levels (PPILs)

The Provisional Phyto-toxicity Investigation Levels (PPILs) are generic values based on phytotoxicity data for plant response to specific contaminants in a sandy loam matrix and are included in the contaminated site assessment where the proposed land use includes gardens or accessible soils. The PPILs are listed in the Site Auditor Guidelines 2006. The PPILs are identical to the Ecological Investigation Levels (EILs) originally specified in NEPM 1999.

---

[7] *Guidelines for the NSW Site Auditor Scheme, 2nd ed.,* NSW DEC, 2006 (Site Auditor Guidelines 2006)

[8] *National Environmental Protection (Assessment of Site Contamination) Measure,* National Environment Protection Council (NEPC), 1999 (NEPM 1999)

[9] *Guidelines for Assessing Service Station Sites,* NSW EPA, 1994 (Service Station Guidelines 1994)

5.2.2 Asbestos

NEPM 1999 does not provide numeric guidelines for the assessment of asbestos in soil. NSW DECCW (EPA) advice (2006) has indicated that consultants should use their 'professional judgement' regarding determination of appropriate investigation and remediation levels for asbestos in soils; however the NSW DECCW (EPA) have not published numerical guidelines for the assessment of asbestos in subsurface soils.

The WorkCover publication *Working with Asbestos Guide* (2008[10]) states that, where buried asbestos is encountered, "A competent occupational hygienist should assess the site to determine:

- If asbestos material is bonded or friable
- The extent of asbestos contamination
- Safe work procedures for the remediation of the site"

"Any asbestos cement products that have been subjected to weathering, or damaged by hail, fire or water blasting are considered to be friable asbestos and an asbestos removal contractor with a WorkCover license for friable asbestos removal is required for its removal". Under the *NSW Occupational Health and Safety (OHS) Regulations 2001*[11] and WorkCover requirements all necessary disturbance works associated with asbestos containing materials must be conducted by a licensed AS-1 Asbestos Removal Contractor.

5.2.3 Assessment Criteria for Soil Contaminants

The 'residential (Column A) exposure setting has been adopted for this assessment and the appropriate soil criteria are listed in the following table:

[10] *Working with Asbestos Guide,* NSW WorkCover, 2008 (WorkCover Working with Asbestos Guide 2008)
[11] *Occupational Health and Safety Regulation,* NSW Government, 2001 (NSW OH&S Regulation 2001)

Soil Assessment Criteria (mg/kg)			
Contaminant	**Health Investigation Levels (HILs) Column A**	**Guidelines for Assessing Service Station Sites (1994)**	**Phyto-toxicity Investigation Levels (PPILs)**
Inorganics			
Arsenic (total)	100	-	20
Cadmium	20	-	3
Chromium (III)	12%	-	400
Copper	1000	-	100
Lead	300	-	600
Mercury (inorganic)	15	-	1
Nickel	600	-	60
Zinc	7000	-	200
Organic Contaminants			
TPH (C_6-C_9)	-	65	-
TPH (C_{10}-C_{36})	-	1000	-
Benzene	-	1	-
Toluene	-	1.4	-
Ethylbenzene	-	3.1	-
Total Xylenes	-	14	-
Total PAHs	20	-	-
Benzo(a)pyrene	1	-	-
Aldrin + Dieldrin	10	-	-
Chlordane	50	-	-
DDT+ DDD + DDE	200	-	-
Heptachlor	10	-	-
PCBs (Total)	10	-	-
Total OPPs	0.1*	-	-
NOTE: * In the absence of local guidelines, the laboratory Practical Quantitation Limit (PQL) has been adopted.			

5.2.4 Assessment Criteria for Waste Classification

For the purpose of off-site disposal, the classification of soil into 'General Solid Waste (non-putrescible)', 'Restricted Solid Waste (non-putrescible)' and 'Hazardous Waste (non-putrescible)' categories is defined by chemical contaminant criteria outlined in the Waste Classification Guidelines 2009. The contaminant criteria are summarised in Table A-2.

5.3 Evaluation of Soil Analysis Data and Contaminant Threshold Concentrations

Assessment of the soil analytical data using the soil contaminant threshold concentrations has been undertaken in accordance with the methodology outlined in

the NEPM 1999 Schedule 7(a) and the statistical analysis methods outlined in the *NSW EPA (now DECCW) Contaminated Sites Sampling Design Guidelines* (1995[12]).

The following criteria have been adopted for assessment of the analytical data:

- For a site to be considered suitable for the proposed land use the 95% Upper Confidence Limit (UCL) value of the arithmetic mean concentration of each contaminant should be less than the applicable contaminant threshold concentration.
- The relevance of localised elevated values must also be considered and should not be obscured by consideration only of the arithmetic mean of the results. The results must also meet the following criteria:
  - the standard deviation of the results must be less than 50% of the soil assessment criteria; and
  - no single value exceeds 250% of the relevant soil assessment criteria.
- Where the concentration of each contaminant is less than the applicable contaminant threshold concentration (site assessment criteria, or SAC) in all samples, UCL calculations may not be required and the suitability of the site for the proposed use may be assessed based solely on individual analytical results.

Where contamination results exceed the site criteria developed above a method of remediating the site is to physically and selectively remove the contamination hotspots from the site. This process should be continued until statistical analysis of the data meets the above criteria. Validation of the remediated site is generally required to demonstrate that the site is suitable for the proposed land use.

6 ASSESSMENT PLAN

6.1 Soil Sampling Density

The EPA Sampling Design Guidelines 1995 for contaminated site investigations state that samples should be obtained from a minimum of 15 evenly spaced sampling points for a site of this size (approximately 6,000m^2).

Samples were obtained from nine sampling locations for the Phase 1 Investigation and from seventeen sampling locations for the additional investigation, a total of twenty-six sampling locations. This density exceeds the minimum sampling density.

[12] *Contaminated Sites Sampling Design Guidelines,* NSW EPA, 1995 (EPA Sampling Design Guidelines 1995)

The nine locations drilled for the Phase 1 Investigation were drilled on a systematic grid sampling plan with a spacing of up to approximately 50m between sampling points. The additional seventeen boreholes were drilled as follows:

- Six boreholes were drilled to increase the sampling density across the site to characterise site fill and natural soil conditions;
- Two boreholes were drilled around the location of BH4 (Phase 1 report) to attempt to assess the extent of the elevated benzo(a)pyrene hotspot in the setback area;
- Eight boreholes were drilled around the locations of BH2 and BH3 (Phase 1 report) to attempt to assess the extent of the lead hotspot in the setback area; and
- One borehole was drilled to the north west of BH6 to assess asbestos containing materials in the fill soils.

6.1.1 Soil Sample Laboratory Analysis Schedule

Selected soil samples obtained from the seventeen boreholes were analysed for a range of contaminants as shown on Table B.

6.2 Data Quality Objectives (DQOs)

The DQOs for the additional assessment are outlined in the following table:

DQOs	
State the problem	Historical information and the Phase 1 investigation identified the following potential contaminants of concern: • Heavy metals: lead; • Polycyclic aromatic hydrocarbons (PAHs) including benzo(a)pyrene; and • Asbestos.
Identify the decision	The principal objective of the investigation was to assess the extent of the contaminants encountered in the Phase 1 investigation (within the constraints of the site). A secondary objective was to assess whether the site could be made suitable for the proposed residential development.

DQOs	
Identify inputs into the decision	The following data will be reviewed to resolve the decision statement: • Site history information. • Site investigation results including soil laboratory analysis data. • Physical site data that includes topography and other relevant information. The soil contamination assessment included: • Soil sampling from seventeen boreholes drilled at the site; and • Laboratory analysis of seventeen soil samples for one or more of the following contaminants: lead, PAHs, and asbestos. Details of the field QA/QC adopted for the assessment is outlined in Section 5.3 below.
Study Boundaries	The study was confined to the boundaries of the site as shown in Figure 2.
Develop a Decision Rule	The results of the laboratory analyses were compared with the SAC adopted for the investigation. The QA/QC program implemented for the project was assessed by comparison with the criteria outlined in Section 5.3.
Specify Limits on Decision Errors	Decision errors are false positive or false negative i.e. stating the site is clear when it is contaminated; or stating that the site is contaminated when it is not. The most significant of these is a false positive i.e. stating that the site is suitable for proposed use when, if fact, it is contaminated. This error could potentially impact on the health of the site users. This study has assumed that elevated concentrations of the contaminants of concern are present in the surficial soils at the site unless demonstrated otherwise.
Optimise the Design for Obtaining data	The overall data set was optimised by reviewing the data as the project proceeded. When necessary, adjustments were made to the sampling or analytical program.

6.3 Data Quality Indicators (DQIs) and Quality Assurance

The validation, as part of the DQOs, involves the technical review of the data using defined Quality Assurance (QA) Assessment Criteria. The success of the DQIs is based on assessment of the data set as a whole and not on individual acceptance or exceedance within the data set. The following table provides the DQIs and the methods adopted to achieve these.

DQIs	Method of Achievement
Documentation Completeness	• Preparation of sampling and analysis location plan • Preparation of chain of custody (COC) records • Laboratory sample receipt information • NATA registered laboratory results
Data Completeness	• Appropriately distributed sampling, covering potentially contaminated areas identified during the previous investigations • Sampling program exceeding the minimum sampling density in the Sampling Design Guidelines 1995 • On-site visual and PID assessment of samples • Analysis for all potential contaminants of concern
Data Comparability	• The use of appropriate sampling techniques • The use of appropriate preservation, storage and transport methods • The use of NATA registered laboratories for all analyses
Data Representativeness	• Adequate coverage of sample locations across the site including the contaminated areas previously identified • Representative coverage of analysis for contaminants of concern
Data Precision and Accuracy	• Use of trained and qualified field staff • Appropriate industry standard sampling equipment and decontamination procedures • Field QA/QC including collection and analysis of the following for the contaminants of concern: ➢ approximately 12% of field soil samples as intra-laboratory duplicates. • Acceptable RPDs for duplicate comparison. The RPD is calculated as the absolute value of the difference between the initial and repeat result divided by the average value, expressed as a percentage. The following acceptance criteria will be used to assess the RPD results: ➢ For results that were greater than 10 times the Practical Quantitation Limit (PQL) RPDs less than 50% were considered acceptable; ➢ For results that were between 5 and 10 times PQL RPDs less than 75% were considered acceptable; and ➢ For results that were less than 5 times the PQL RPDs less than 100% were considered acceptable. • Review of laboratory QA/QC data (including surrogate recovery, repeat analysis, duplicates, matrix spikes and method blanks) • Acceptable concentrations in blank samples • Check of laboratory quality control methods and results

7 INVESTIGATION PROCEDURE

7.1 Subsurface Investigation and Soil Sampling Methods

Seventeen sampling locations (BH10 to BH26) were undertaken using hand equipment. The hand equipment was decontaminated using a scrubbing brush, potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water after each sampling event. Details of the decontamination procedure adopted during sampling are presented in Appendix D.

Soil samples were obtained at various depths, based on observations made during the field investigation. During sampling, soil at selected depths was split into initial and duplicate samples for QA/QC assessment.

All 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.

During the investigation, soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with AS 4482.1-2005[13] and AS 4482.2-1999[14] as summarised in the following table:

Analyte	Preservation	Storage
Heavy metals	Unpreserved glass jar with Teflon lined lid	Store at <4°, analysis within 28 days (mercury and Cr[VI]) and 180 days (other metals).
PAHs		Store at <4°, nil headspace, extract within 14 days, analysis within forty days
Asbestos	Sealed plastic bag	None

The samples were labelled with the job number, sampling location, sampling depth and date. All samples were recorded on the borehole logs presented in Appendix A and on the laboratory chain of custody (COC) record presented in Appendix B.

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. Detailed EIS field sampling protocols are included in Appendix D.

---

[13] *Guide to the Investigation and Sampling of sites with Potentially Contaminated Soil,* Standards Australia, 2005 (AS 2005)

[14] *Guide to the Sampling and Investigation of Potentially Contaminated Soil Part2: Volatile Substances,* Standards Australia, 1999 (AS 1999)

7.2 Photoionisation Detector (PID) Screening

A portable PID was used to screen the samples for the presence of volatile organic compounds (VOCs).

The sensitivity of the PID is dependent on the organic compound and varies for different mixtures of hydrocarbons. Some compounds give relatively high readings and some can be undetectable even though present in identical concentrations. The portable PID is best used semi-quantitatively to compare samples contaminated by the same hydrocarbon source.

The PID is calibrated before use by measurement of an isobutylene standard gas. All the PID measurements are quoted as parts per million (ppm) isobutylene equivalents.

PID screening of detectable volatile organic compounds (VOCs) was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases. The PID headspace data is presented on the COC documents.

7.3 Laboratory Analysis - Soil Samples

Analysis of soil samples was undertaken by NATA registered laboratories using analytical methods detailed in the Schedule B(3) NEPM (1999) Guideline on Laboratory Analysis of Potentially Contaminated Soils.

Laboratory analysis was undertaken by Envirolab Services Pty Ltd (NATA Accreditation No. 2901).

For this investigation selected soil samples were analysed for contaminants using the following laboratory techniques:

- Heavy metals – Nitric acid digestion. Analysis by ICP/AES.
- PAHs – Soil extracted with dichloromethane/acetone. Analysis by GC/MS.
- Asbestos – Polarizing light microscopy.

Toxicity characteristic leaching procedure (TCLP) leachates were prepared by rotating soil samples in a mild acid solution for 18 hours (NSW EPA WD-3 Method). Leachates were analysed using the analytical procedures outlined above.

7.4 Surface Water Sampling

An attempt was made to sample water from the stream running east-west through the centre of the site. However the stream was dry when fieldwork was undertaken for the additional investigation.

8 RESULTS OF INVESTIGATION

8.1 Subsurface Conditions

Borehole locations are shown on Figure 2. For details of the subsurface soil profile reference should be made to the borehole logs in Appendix A. A summary of the subsurface conditions encountered in the boreholes is presented below:

Fill

Fill material was encountered at the surface at all locations and extended to a maximum depth of approximately 0.5m in BH14. The fill material was generally silty clay, silty sandy clay and igneous gravel. The fill material was generally dark brown or brown and light orange brown with inclusions of igneous, ironstone and sandstone gravel, ash and root fibres.

Natural Soils

Natural sandy silty clay and silty clay soils were encountered beneath the fill material at locations BH11, BH13, BH14, BH19, BH20, BH22, and BH24 and extended to the maximum depth of the boreholes. The natural soils were brown and orange-brown with traces of ash and inclusions of ironstone gravel.

Bedrock

Bedrock was not encountered during the drilling works for this investigation.

Groundwater

Groundwater seepage was not encountered during the drilling works for this investigation.

8.2 Laboratory Results – Soil Samples

The laboratory results are presented in Table B to Table C inclusive and analysis reports are presented in Appendix B. The assessment criteria adopted for this investigation are specified in Section 4.2.3. Statistical calculations have been undertaken using ProUCL version 4.1 (USEPA) and the reports are presented in Appendix F. The results of the analyses are summarised below.

Lead

Thirteen fill soil samples were analysed for lead. Elevated concentrations of lead above the health based site assessment criterion were encountered in four fill samples analysed.

The upper level 95% confidence limit on mean value (95% UCL) was calculated on the lead results of all fill samples analysed, including those samples collected during the initial phase 1 investigation. The 95% UCL lead result was 230.3mg/kg which is less than the site assessment criterion.

The results were assessed against the *NSW DECC (now DECCW) Waste Classification Guidelines Part 1: Classifying Waste – 2009.* The results indicated that:

- Nine fill samples, BH13 (0.0-0.2), BH16 (0.0-0.2), BH17 (0.0-0.1), BH19 (0.1-0.2), BH20 (0.2-0.3), BH21 (0.1-0.2), BH24 (0.0-0.1), BH25 (0.1-0.2) and BH26 (0.0-0.1) contained lead concentrations greater than the CT1 criterion (100mg/kg) but less than the SCC1 criterion (1500mg/kg), with the concentrations detected ranging from 120mg/kg (BH16) to 340mg/kg (BH26).
- The remaining results of the analyses were less than the respective CT1 criteria.

TCLP leachates were prepared from the BH16 (0.0-0.2), BH17 (0.0-0.1), BH19 (0.1-0.2), BH20 (0.2-0.3), BH21 (0.1-0.2), BH24 (0.0-0.1), BH25 (0.1-0.2) and BH26 (0.0-0.1) fill samples and analysed for lead. The results were less than the TCLP1 lead criterion outlined in the Waste Classification Guidelines 2009.

Polycyclic Aromatic Hydrocarbons (PAHs)

Two fill samples, BH10 (0.1-0.2m) and BH11 (0.0-0.1m) contained elevated benzo(a)pyrene concentrations of 9.1mg/kg and 17mg/kg respectively. The SAC for benzo(a)pyrene is 1mg/kg. The same two fill samples also contained elevated total PAH concentrations of 69.2mg/kg and 216.8mg/kg respectively. The SAC for PAHs is 20mg/kg.

The 95% UCL was calculated on the total PAH and benzo(a)pyrene results of all fill samples analysed, including those samples collected during the initial phase 1 investigation. The 95% UCL for total PAHs was 93.45mg/kg and the 95% UCL for benzo(a)pyrene was 16.23mg/kg, both of which exceed the site assessment criterion of 20mg/kg and 1mg/kg respectively.

The results were assessed against the *NSW DECC (now DECCW) Waste Classification Guidelines Part 1: Classifying Waste – 2009.* The results indicated that:

- One fill sample, BH11 (0.0-0.1) contained a benzo(a)pyrene concentration of 17mg/kg, greater than the SCC1 criterion (10mg/kg).
- Two fill samples, BH10 (0.1-0.2) and BH13 (0.0-0.2) contained benzo(a)pyrene concentrations greater than or equal to the CT1 criterion (0.8mg/kg) but less than the SCC1 criterion (10mg/kg), with the concentrations detected ranging from 0.8mg/kg (BH13) to 9.1mg/kg (BH10).
- The remaining benzo(a)pyrene results of the analyses were less than the CT1 criterion.

TCLP leachates were prepared from the BH10 (0.1-0.2m) and BH11 (0.0-0.1) fill samples and analysed for PAHs. The results were less than the TCLP1 criterion outlined in the Waste Classification Guidelines 2009.

Asbestos

Six soil samples were screened for the presence of asbestos fibres. No asbestos was detected in the samples analysed. No respirable fibres were detected at concentrations above the reporting limit in any of the samples analysed.

9 ASSESSMENT OF ANALYTICAL QA/QC

The objective of the assessment of the laboratory QA/QC is to assess whether the sample data is reliable. All laboratory reports have been checked and issued as final by Envirolab Services Pty Ltd, NATA Accreditation No. 2901, Report numbers: 52919 and 52919-A.

Chain of custody documentation was signed and dated by Envirolab Services laboratory stating that all samples were received cool, in good order and in suitable containers. Compliance of holding times was met for all analyses undertaken by the above laboratory.

A summary of the field QA/QC samples are specified in the following table:

Field QA/QC	Sample Details
Intra-laboratory duplicates	*Soil Samples:* Samples BH13 (0.0-0.2) and BH21 (0.1-0.2) were re-analysed to provide intra-laboratory duplicate results.

The laboratory analysis results for the intra-laboratory duplicate sample above are presented in Table D.

The following field staff completed the activities associated with this project:

- Rob Muller – Environmental Scientist – soil sampling and field testing activities; and
- Geoff Fletcher –Environmental Engineer – soil sampling, field testing and site inspections.

An assessment of the DQIs adopted for this investigation is summarised in the following table. A brief explanation of the individual DQI is presented in Appendix D.

Data Quality Indicator (DQI)	Comments
Precision	Field and Laboratory Consideration: • EIS sampling protocols outlined in Appendix D was complied with during the investigation; • Intra-laboratory duplicates were analysed. Laboratory Duplicate RPD Results: Laboratory duplicate RPD results for the soil samples were generally within the acceptance criteria adopted by Envirolab laboratory. Some RPDs for PAHs (phenanthrene, fluoranthene, pyrene, benzo(a)pyrene) were outside the acceptance criteria, however this may be attributed to heterogenous distribution of PAHs through the soil matrix and the relatively low concentrations detected, (close to the PQL), and does not affect the interpretation of the data. Matrix Duplicate RPD Results: Matrix duplicate RPD results were generally within the acceptance criteria adopted by Envirolab laboratory. Intra-laboratory RPD Results: The intra-laboratory RPD values for the soil sample indicated that field precision was generally acceptable. Some RPDs for PAHs (phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, indeno(123-cd)pyrene, benzo(ghi)perylene) were outside the acceptance criteria. This may be attributed to heterogeneous distribution of PAHs through the soil matrix, and the relatively low concentrations detected (below the SAC), and therefore the interpretation of the data is not affected.

Accuracy	Field and Laboratory Consideration: • EIS sampling protocols outlined in Appendix D were complied with during the investigation; and • Analysis of laboratory blanks, matrix spike, surrogate spikes and laboratory control sample (LCS). Matrix and surrogate spikes and LCS Results: Matrix & surrogate spikes and LCS recovery concentrations were within the acceptable limits of 60-140% for organics and 70-130% for inorganics. Laboratory Blank Results: All laboratory blanks were found to be free of analyte concentrations above the PQLs.
Representativeness	Field and Laboratory Consideration: • All critical samples were analysed; • Samples were collected to reflect the characteristics of fill and natural soils; • Sample collection, handling, storage and preservation were considered appropriate; and • No laboratory artefacts were detected. All lab blanks were found to be free of analyte concentrations above the PQLs.
Completeness	Field and Laboratory Consideration: • All critical locations sampled; • EIS sampling protocols outlined in Appendix D were complied with during the investigation; • Samples were obtained by experienced staff with appropriate qualifications; • Documentation (including site notes, borehole logs and COC etc) was correctly maintained; • All of the laboratory data was used for the assessment; • Samples obtained were analysed for the site specific contaminants of concern where applicable; • Appropriate analytical methods used by the laboratory; and • Sampling holding times were complied with.
Comparability	Field and Laboratory Consideration: • Same sampling procedures and handling techniques were used; • Samples were obtained by experienced staff with appropriate qualifications; • Samples were collected in appropriate containers; • No significant influence on sampling from climatic or sampling conditions were reported; and • Samples were analysed by Envirolab.

10 CONCLUSION AND RECOMMENDATIONS

The additional environmental site assessment undertaken for the proposed residential development at 35-39 Dumaresq and 32-34 McIntyre Streets, Gordon, NSW, was designed to:

- assess the soil contamination conditions at the site in relation to the proposed development of the site for residential land use;
- attempt to assess the extent of the elevated benzo(a)pyrene and lead hotspots encountered during the initial assessment (Phase 1 report);
- undertake further assessment for the presence of asbestos.

10.1 Summary of Soil Laboratory Results

Soil samples obtained for the investigation were analysed for the contaminants of concern identified in Section 5.2.

Elevated concentrations of contaminants were encountered in the fill soil samples analysed for the investigation. The soil contamination data is shown on Figure 2. Lead contamination appeared to be confined to the north-western portion of the site, while PAH/benzo(a)pyrene contamination appeared to be confined to the southern portion of the site. A summary of the elevated results encountered in the fill soils are presented in the table below:

Summary of Contamination Data in Fill Soil (mg/kg)								
Contaminant	PPIL*	HIL+	No. of Samples Analysed	No. of Results above the PPIL	No. of Results above the HIL	Maximum Value	Mean Value	95% UCL
Lead	600	300	13	0	4	340	184	230.3
Total PAHs	NSL	20	8	NA	2	216.8	33.7	93.45
B(a)P	NSL	1	8	NA	2	17	2.63	16.23

Guideline Levels:
* PPILs: Provisional Phyto-toxicity Investigation Levels (PPILs);
+ HILs: Health Investigation Levels for 'Residential with accessible soils'.

Explanation:
PAHs – polycyclic aromatic hydrocarbons
B(a)P - benzo(a)pyrene
NSL - No Set Limit
NC – No Calculated
NA – Not Applicable

The upper level 95% confidence limit on mean value (95% UCL) was calculated on the lead, total PAH and benzo(a)pyrene results of the fill samples from both the Phase 1 investigation and the additional investigation. The 95% UCL lead result was less than the SAC, while the 95% UCL for both total PAHs and benzo(a)pyrene was higher than the SAC. The source of the PAHs and heavy metal contamination in the fill is considered to be associated with the ash and slag material encountered in the fill material matrix during the investigation.

10.1.1 Provisional Phyto-toxicity Investigation Levels (PPILs)

During the Phase 1 investigation elevated concentrations of copper and zinc above the PPIL criteria was encountered in the one of the fill samples. During the additional investigation for lead, concentrations of lead remained below PPILs. PPILs have not been established for PAHs.

10.1.2 Asbestos Screening

During the Phase 1 investigation, bound chrysotile asbestos was detected in the BH6(0-0.1m) fill sample. During the additional investigation six fill soil samples, from BH13, BH14, BH15, BH17, BH18 and BH21 were analysed for asbestos. Asbestos was not detected above the reporting limit in the samples analysed for the investigation and no respirable fibres were detected at concentrations above the reporting limit in the samples analysed.

10.2 Waste Classification

10.2.1 Fill Soils

The investigation has shown that the fill material encountered at the site contains inclusions of ash. Significant amounts of waste ash and gravely slag were available in the late nineteenth and early twentieth century as a result of the use of coal for

industrial and domestic heating purposes. Widespread use of ash waste (either as ash or mixed with other soil and waste materials) as fill material was common in the suburbs of Sydney at this time.

The *General Approvals of Immobilisation* published in the NSW Government Gazette on 16 July 1999[15] includes an immobilisation approval for ash contaminated materials (approval number 1999/05). GAI 1999 states that ash contaminated materials *"...can be classified according to their leachable concentration (TCLP) values alone."*, however, disposal restrictions indicate that the ash contaminated material can only be disposed of to a landfill with a leachate monitoring system. Treatment of this waste stream is not considered to be an economical option.

Laboratory analysis of the fill soils in the southern section of the site has indicated that for the purposes of off-site disposal the fill soils are classified as 'General Solid Waste – non-putrescible' according to the Waste Classification Guidelines 2009 and the GAI 1999.

The fill material on the portion of the site where asbestos was detected (BH6 – in the central eastern portion of the site) is classified as 'General Solid Waste (non-putrescible) containing asbestos' according to the criteria outlined in Waste Classification Guidelines 2009. Due to the asbestos encountered in the fill material, the fill material is not considered suitable for reuse on site and should be disposed of to a suitably licensed NSW DECCW (EPA) landfill only.

The fill material on the remainder of the site is classified as 'General Solid Waste (non-putrescible)' according to the criteria outlined in Waste Classification Guidelines 2009.

10.2.2 Natural Soil and Bedrock

Following removal of the fill material and successful validation results (see Section 17) the underlying natural soil and bedrock can be excavated and disposed of as Virgin Excavated Natural Material (VENM).

10.3 Suitability of Site for Proposed Development

Based on the scope of work undertaken for the Phase 1 investigation and the additional assessment, EIS consider that the site can be made suitable for the proposed residential development provided that the following recommendations are implemented:

- Remedial works are undertaken to remove contaminated fill material from the site. A Remedial Action Plan (RAP) for these works constitutes the remainder of this report;
- A Hazardous Building Material Survey is undertaken of all existing site buildings prior to demolition; and
- During demolition and excavation works, the site should be inspected by experienced environmental personnel to assess any unexpected conditions or subsurface facilities that may be discovered between investigation locations. This should facilitate appropriate adjustment of the works programme and schedule in relation to the changed site conditions.

10.4 Regulatory Requirement

The requirement to report to the DECCW (EPA) under Section 60 and *Guidelines on the Duty to Report Contamination*[16] under the CLM Amendment Act 2008 should be assessed once the results of the remedial works have been reviewed.

Please note that in the event the recommendations for additional work are not undertaken, there may be justification to report to the DECCW. EIS can be contacted for further advice regarding notification.

[15] *General Approvals of Immobilisation, Approval Numbers 05 and 07*, NSW Government Gazette, 1999 (GAI 1999)

[16] *Guidelines on the Duty to Report Contamination*, NSW Government Legislation, 2008 (Duty to Report Contamination 2008)

11 REMEDIATION ACTION PLAN – OBJECTIVES AND SCOPE OF WORK

11.1 Objectives

The objectives of the RAP are to:

- Identify the areas of contaminated material that exceed the site assessment criteria;
- Outline the procedures to be implemented in order to remediate and/or manage the risks posed by the soil contaminants encountered at the site;
- Prepare a validation plan to be implemented on completion of remedial works;
- Prepare a contingency plan to be implemented in the event of validation failure or unexpected findings; and
- Outline site management procedures to be implemented during remedial works.

11.2 Scope of Work

The scope of work undertaken included:

1. Review of the Phase 1 report and the results of the additional investigation; and
2. Preparation of the RAP report presenting a remediation strategy for the site.

12 EXTENT OF CONTAMINATION

12.1 Soil Contaminants of Concern

The contaminants of concern at the subject site identified during the previous investigations include lead, PAHs including total PAHs and benzo(a)pyrene, and asbestos.

As can be seen in Figure 2, lead contamination at the site appears to be confined to the north-western portion of the site, PAH contamination appears to be confined to the southern portion of the site and asbestos contamination appears to be confined to a single location in the vicinity of BH6.

Although the statistical calculations for the lead results indicate that this is not a significant issue of concern EIS note that most of the lead impacted soil will be removed as part of the basement excavation. EIS recommend that the remaining areas of lead impacted fill soil are also removed from the areas adjacent to the basement excavation during earthworks. The reasons for this are:

1. All of the lead impacted soil will be removed from the site, therefore any future issues that may arise from lead in soil are avoided; and
2. The fill material is relatively shallow and the excavation works can be easily combined with the basement excavation.

12.2 Contaminant Laydown and Transport Mechanisms

The lead and PAH compounds associated with ash contaminated fill material are generally considered to be bound tightly in a relatively insoluble matrix. Significant migration of heavy metals and PAHs from this material is unlikely. The TCLP results (Table C) indicate that hazardous quantities of lead and benzo(a)pyrene are unlikely to leach from the soil matrix.

12.3 Potential Receptors

The main potential contamination receptors are therefore considered to include:

- Site visitors, site occupants, workers and adjacent property owners, who may come into contact with contaminated soil and/or be exposed to contaminated dust arising from construction activity; and
- Future site occupants.

13 EXTENT OF REMEDIATION

13.1 Known Extent

The extent of the site remediation is summarised in the table below. Reference should also be made to the attached Figure 3 for each area location.

Remediation Area	Contaminant of Concern	Extent of Contamination	Rational for Selecting the Extent of Remediation Area
Area A	Lead	Area A covers approximately 1500m^2. The contamination in Area A is expected to be limited to the fill soils which are estimated to extend to depths of approximately 0.4m below the existing site levels. The natural soil below this depth is not considered to be impacted in this area.	The remediation area has been selected by ensuring that all boreholes in which lead was detected at concentrations exceeding the SAC are covered by the remediation area, extending to the approximate location of the nearest borehole where the lead concentration did not exceed the SAC.

Remediation Area	Contaminant of Concern	Extent of Contamination	Rational for Selecting the Extent of Remediation Area
Area B	PAHs including benzo(a)pyrene	Area B covers approximately 500m^2. The contamination in Area B is expected to be limited to the fill soils which are estimated to extend to a depth of approximately 0.4m below the existing site levels.	The remediation area has been selected by ensuring that all boreholes in which total PAHs or benzo(a)pyrene were detected at concentrations exceeding the SAC are covered by the remediation area, extending approximately halfway to the location of the nearest borehole where the PAH concentration did not exceed the SAC.
Area C	Asbestos	Area C covers approximately 25m^2. The contamination in Area C is expected to be limited to the fill soils which are estimated to extend to a depth of approximately 0.4m below the existing site levels.	The remediation area has been selected to centre on BH6, the only location on-site at which asbestos was detected, and extend around this location to a total excavation size of approximately 5m x 5m.

It should be borne in mind that the minimum waste classification for any fill soil is 'General Solid Waste'. Therefore from a practical point of view the excavation of the lead and PAH impacted fill can be combined with the excavation of the remainder of the fill material for the basement excavation.

Apart from the asbestos impacted area around BH6 any other fill material that has to be excavated can disposed off-site can be disposed of as 'General Solid Waste'. The fill material from the vicinity of BH6 should be disposed of as 'General Solid Waste containing asbestos'.

13.2 Unknown Extent

The proposed remediation works are based on point source data that has been spatially interpreted between previous sampling points. Therefore, the precise extent of the remediation works will not be defined until successful validation data has been obtained.

In particular, the following aspects of the remediation works are considered to be unknown:

- Depth of fill material across entire site;

- Extent of contaminated fill material, partially as a result of limitations in the data set due to some areas of the site being inaccessible because of the presence of buildings and pavement.

14 SOIL REMEDIATION OPTIONS

The NSW DECCW (EPA) follows the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* (1992[17]) published hierarchy for the remediation of contaminated sites. The preferred order for soil remediation and management is as follows:

1. On-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated material so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;
3. Removal of contaminated material to an approved site or facility, followed where necessary by replacement with clean material; and
4. Consolidation and isolation of the soil on-site by containment within a properly designed barrier.

The *Guidelines for the NSW Site Auditor Scheme, 2nd Edition* (2006[18]) provide the following additional requirements to be taken into consideration:

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

The soil remediation options available for consideration are outlined in the following table:

[17] Australian and Zealand Environment and Conservation Council (ANZECC) and National Health and Medical Research Council (NHMRC) *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* 1992 (ANZECC/NHMRC 1992)

[18] *Guidelines for the NSW Site Auditor Scheme, 2nd ed.*, NSW DEC, 2006 (Site Auditor Guidelines 2006)

REMEDIATION OPTION	COMMENTS	SUITABILITY
Option 1 On-site treatment of contaminated soil	On-site treatment provides a mechanism to reuse the processed material and in some instances, to avoid the need for large scale earthworks. Some of the treatment options include: Bio-remediation: Addition of oxygen and nutrient compounds to accelerate the natural process of organic compound decay within the environment. Soils require excavation and stockpiling prior to treatment. Not suitable for all contaminants. Soil Washing: Soil is stripped of contaminants via a leaching process and the concentrated contaminated liquid product retained for disposal or additional treatment. Air Sparging and Extraction: Air is forced through the contaminated soil to volatilise organic contaminants. The air is then extracted and captured for treatment leaving reduced contaminant concentrations within the sub-strata. Thermal Desorption: Contaminated soils are heated within an incinerator to volatilise or combust the contaminants. Contaminants are either broken down to water and carbon dioxide or alternatively trapped within an air filtration system. Licenses are necessary for specific individual waste streams due to the potential for air pollution and the formation of harmful by-products during the incineration process.	Not considered suitable for subject site
Option 2 Off-site treatment of contaminated soil	Contaminated soils are excavated, transported to an approved/ licensed treatment facility, treated to remove/stabilise the contaminants then returned to the subject site, transported to an alternative site or disposed to an approved landfill facility. This option provides for a relatively short program of on-site works, however there may be some delays if the material is to be returned to the site following treatment. The cost per tonne for transport to and from the site and for treatment is considered to be relatively high. The material would also have to be assessed in terms of suitability for reuse as part of the proposed development works.	Not considered suitable for subject site

REMEDIATION OPTION	COMMENTS	SUITABILITY
Option 3 Removal of contaminated material to an appropriate facility and reinstatement with clean material	Contaminated soils would be classified in accordance with NSW DECCW (EPA) guidelines for waste disposal, excavated and disposed of off-site to a NSW DECCW (EPA) licensed landfill. The material would have to meet the requirements for landfill disposal and gate fees (which may be significant) would apply in addition to transport costs.	Considered suitable and is the preferred option for Areas A, B and C.
Option 4 Consolidation and isolation of impacted soil by cap and containment	This would include the placement of an impermeable barrier such as concrete, or a warning barrier and non-contaminated soil material, over the existing ground surface to isolate the contaminated material and thereby reduce the health risk to future site users. This action may also reduce the transport of contamination via surface water movement, dust generation and potentially groundwater infiltration, however, environmental issues would need to be evaluated. Such an option should only be considered where other preferred approaches from the NSW DECCW hierarchy are not applicable. The capping and/or containment must be appropriate for the specific contaminants of concern. An ongoing environmental management plan (EMP) would be required and site identification documentation, possibly including the S.149 council planning certificate and/or the land title, would be modified to note the presence of the contamination. This may impact upon development approval conditions and limit the future potential land value.	Not considered suitable for subject site

15 RATIONALE FOR THE SELECTION OF REMEDIATION STRATEGY

The most viable option for remediation of Areas A, B and C is excavation of the contaminated material followed by off-site disposal to an appropriate facility (Option 3). This option is considered most appropriate as the various on-site and off-site treatment technologies are generally considered unsuitable for lead and PAH contamination. PAHs and lead associated with ash and slag material are considered to be relatively intractable and consequently there are no reliable or cost effective treatment processes available, particularly for relatively small quantities of contaminated soil. Large sections of Areas A and B will also be excavated for the proposed basements.

16 REMEDIATION DETAILS

Prior to commencement of remediation works, the site management and occupational health and safety plans presented within this report should be reviewed and implemented.

16.1 Waste Classification for Excavated Soils

A summary of the waste classification details for the site soils is presented in the following table:

Area	Waste Classification	Additional Testing Required/Recommended
Areas A and B	Fill soils: General solid waste (non-putrescible)	No (provided that nothing unexpected, such as asbestos, is encountered between the EIS sampling locations).
Area C	Fill soils: General solid waste (non-putrescible) containing asbestos	No (provided that nothing unexpected is encountered between the EIS sampling locations).

16.2 Inspection Requirements

During excavation of the fill material, environmental personnel should be available to make site visits as required to inspect unexpected conditions and manage any issues associated with removal of the fill material. Following excavation of Areas A, B and C, validation inspections should be undertaken and samples obtained as described in the validation plan.

16.3 Asbestos Management

Prior to site workers and demolition of the buildings an asbestos consultant should be engaged to prepare an asbestos management plan for the excavation around BH6. This could be combined with the hazaradous building material survey of the existing houses prior to demolition.

16.4 Documentation

The remediation contractor must retain all documentation associated with the remediation (e.g. landfill dockets, liquid waste disposal dockets etc). Copies of these documents must be forwarded to EIS on completion of the remediation for inclusion in the final validation report.

17 VALIDATION PLAN

17.1 Overview

Validation is necessary to demonstrate that remedial measures described in this RAP have been successful and that the site is suitable for the intended land use. The validation plan provides the following information:

- Procedures and protocols that will be adopted for the site validation;
- Outline the validation assessment criteria (VAC) that will be adopted for the assessment;
- Establish the data quality objectives (DQOs) and data quality indicators (DQIs); and
- Provide details on the sampling program adopted for the assessment.

The validation program will be staged to facilitate the remediation works.

17.2 Soil Sampling Program

17.2.1 Sampling Rational

Soil validation samples will be obtained from the remediation areas as outlined in the following table:

Remediation Area	Sampling Frequency	Sampling Method	Laboratory Analytical Schedule
Area A	Soil samples for the validation assessment will be obtained from the base and walls of the excavation as follows: Excavation Base: 1 sample per 100m^2 (10m grid spacing) Excavation Walls: 1 sample per 25m^2. Samples should be obtained from both fill and natural soils exposed along the walls.	Samples will be obtained using hand equipment or directly from the excavator bucket (based on the depth of excavation).	Samples will be analysed for lead
Area B	Soil samples for the validation assessment will be obtained from the base and walls of the excavation as follows: Excavation Base: 1 sample per 100m^2 (10m grid spacing) Excavation Walls: 1 sample per 25m^2. Samples should be obtained from both fill and natural soils exposed along the walls	Samples will be obtained using hand equipment or directly from the excavator bucket (based on the depth of excavation).	Samples will be analysed for a suite of PAHs including benzo(a)pyrene.
Area C	Soil samples for the validation assessment will be obtained from the base and walls of the excavation as follows: Excavation Base: 1 sample. Excavation Walls: 1 sample per wall.	Samples will be obtained using hand equipment or directly from the excavator bucket (based on the depth of excavation).	Samples will be analysed for asbestos.

In the event that elevated concentrations of contaminants are encountered above the VAC in the validation samples, the excavation will be extended and the validation process repeated for the additional area of excavation.

Where remedial excavations extend to the site boundaries and validation sampling indicates that contamination is likely to extend beneath adjacent properties, validation should be completed to the extent practical and the client advised of findings. If

contamination is thought to extend beneath neighbouring properties the site owner should inform adjacent property owners that contamination may be present.

17.2.2 Validation Soil Assessment Criteria (VSAC)

The soil investigation levels adopted for the validation assessment are derived from the Site Auditor Guidelines 2006 and NEPM 1999.

EIS has adopted the 'residential' (Column A) exposure setting for the validation assessment and the appropriate soil criteria are listed in the table below:

Contaminant	VSAC - HILs Column A (mg/kg)	PPILs (mg/kg)
Heavy Metals		
Lead	300	600
PAHs		
Total PAHs	20	-
Benzo(a)pyrene	1	-
Other		
Asbestos	NDLR [a]	-

Note:
[a] Not Detected at Limit of Reporting (NDLR)

17.2.3 Waste Classification Assessment Criteria

For the purpose of off-site disposal, the classification of soil into 'General Solid Waste (non-putrescible)', 'Restricted Solid Waste (non-putrescible)' and 'Hazardous Waste (non-putrescible)' categories is defined by chemical contaminant criteria outlined in the Waste Classification Guidelines 2009. The contaminant criteria are summarised in Table A-2.

17.2.4 Evaluation of Soil Analysis Data & Contaminant Threshold Concentrations

Assessment of the soil analytical data using the soil contaminant threshold concentrations has been undertaken in accordance with the methodology outlined in the NEPM 1999 Schedule 7(a) and the statistical analysis methods outlined in the *NSW EPA (now DECCW) Contaminated Sites Sampling Design Guidelines* (1995[19]).

The following criteria have been adopted for assessment of the analytical data:

[19] *Contaminated Sites Sampling Design Guidelines,* NSW EPA, 1995 (EPA Sampling Design Guidelines 1995)

- For a site to be considered suitable for the proposed land use, the 95% Upper Confidence Limit (UCL) value of the arithmetic mean concentration of each contaminant should be less than the applicable contaminant threshold concentration;
- The relevance of localised elevated values must also be considered and should not be obscured by consideration only of the arithmetic mean of the results. The results must also meet the following criteria:
  - the standard deviation of the results must be less than 50% of the VSAC; and
  - no single value exceeds 250% of the relevant VSAC.
- Where the concentration of each contaminant is less than the applicable contaminant threshold concentration (VSAC) in all samples, UCL calculations may not be required and the suitability of the site for the proposed use may be assessed based solely on individual analytical results.

Where contamination results exceed the VSAC, the remediation and validation process should be continued until statistical analysis of the data meets the VSAC.

17.3 Data Quality Objectives

The DQOs for the validation assessment will be developed with reference to the seven steps previously outlined in Section 6.2:

1. State the problem
2. Identify the decision
3. Identify inputs into the decision
4. Study Boundaries
5. Develop a Decision Rule
6. Specify Limits on Decision Errors
7. Optimise the Design for Obtaining data

Field investigations will be undertaken generally in accordance with EIS sampling protocols outlined in Appendix C.

17.4 Data Quality Indicators

The validation, as part of the DQOs, involves the technical review of the data using defined QA Assessment Criteria. The success of the DQIs is based on assessment of the data set as a whole and not on individual acceptance or exceedance within the data set.

The laboratory QA criteria will include a review of surrogate recovery, repeat analysis, duplicates, matrix spikes and method blanks.

Field QA/QC will include collection and analysis of the following for the contaminants of concern:

- approximately 5% of field soil and groundwater samples as inter-laboratory duplicates;
- approximately 10% of field soil and groundwater samples as intra-laboratory duplicates;
- field blank samples, rinsate samples of field equipment, and
- soil/water trip spike sample.

Success of field DQIs will be based on the following criteria:

- Relative percentage differences (RPDs) will be calculated for the inter-laboratory and intra-laboratory duplicates. The RPD is calculated as the absolute value of the difference between the initial and repeat result divided by the average value, expressed as a percentage. The following acceptance criteria will be used to assess the RPD results:
  - For results that are greater than 10 times the Practical Quantitation Limit (PQL) RPDs less than 50% will be considered acceptable.
  - For results that are between 5 and 10 times PQL RPDs less than 75% will be considered acceptable.
  - For results that are less than 5 times the PQL RPDs less than 100% will be considered acceptable.
- Acceptable concentrations in blank samples.

17.5 Importation of Virgin Excavated Natural Material (VENM)

In order to reduce the quantity of imported backfill it may be possible to sequence the site excavation works to use the natural soil to be excavated for the proposed development works following a successful validation assessment. In the event that additional backfill material is necessary, selected material previously documented as being VENM may be imported onto the site.

The Waste Classification Guidelines 2009 define VENM as natural material (such as clay, gravel, sand, soil or rock fines):

- that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities;
- that does not contain sulfidic ores or other waste; and

- includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the *NSW Government Gazette*.

The following procedures should be adopted for all imported material:

- An inspection of the source site to confirm and document that:
  - Historical and current use of the site has not resulted in contamination of the site;
  - Potential acid sulfate soil materials are not present at the site;
  - The appearance of material excavated from the site is consistent with natural material, i.e. relatively homogenous and without any debris (any fill material should have been removed prior to the inspection);
  - The physical characteristics of the material to be imported, i.e. soil/rock description, colour, etc. This should be confirmed by photographic documentation;
- Source sites should be inspected by an experienced consultant and any relevant reports should be reviewed, prior to acceptance of any material onto the site;
- All material imported as VENM should be accompanied by analytical data showing that the material has been analysed and meets the criteria specified in the table below; and
- Geotechnical advice should be sought regarding compaction so that all backfilled areas are suitable for the proposed use.

Based on the site inspection and review of any relevant documentation there are likely to be two potential scenarios for selecting an appropriate sampling density:

1. The risk of the VENM being impacted by contamination is considered to be low. In this case a minimum of three samples of the VENM should be sampled and analysed from across the site; or
2. The risk of the VENM being impacted by contamination is considered to be medium to high. In this case the material should be should be sampled at a density of one sample per 100m^3 (Service Station Guidelines 1994).

In the absence of any published criteria for assessing VENM, EIS have adopted the criteria outlined in the following table. Please note that screening for additional contaminants may be required based on the site history of the source site.

Proposed Acceptance Criteria (mg/kg)		
Contaminant	**Acceptance criteria**	**Guideline**
Arsenic (total)	1-50	a
Cadmium	1	a
Chromium (Total)	5-1000	a

Proposed Acceptance Criteria (mg/kg)		
Contaminant	**Acceptance criteria**	**Guideline**
Copper	2-100	a
Lead	2-200	a
Mercury (inorganic)	0.03	a
Nickel	5-500	a
Zinc	10-300	a
Benzo[a]pyrene	0.005	b
Polycyclic Aromatic hydrocarbons	0.005	b
Organochlorine pesticides	0.1	b
Benzene	0.2	b
Toluene	0.5	b
Ethylbenzene	0.5	b
Total xylenes	1	b
Petroleum hydrocarbons C_6-C_9	20	b
Petroleum hydrocarbons C_{10}-C_{36}	250	b
Asbestos	absent	-
Acid Sulfate Soils (ASS)	absent	-
Referenced Guidelines: a) NEPM 1999, background levels b) Laboratory PQL		

18 CONTINGENCY PLAN

A review of the proposed remediation works has indicated that there are a number of potential risks that may affect the success of the remediation. These risks are detailed in the following sections along with the contingencies to be implemented.

18.1 Unexpected Finds

There is a possibility that additional hazards exist at the site. The extent of the contamination has been interpreted from point source data and a documented process of reviewing historical site activities. However, ground conditions may vary between sampling locations and additional hazards may arise as result.

Residual hazards that may exist at the site would generally be expected to be detectable through visual or olfactory means. At this site, these types of hazards may include: fragments of fibre cement possibly containing asbestos, demolition waste or ash and slag contaminated soils.

The procedure to be followed in the event of an unexpected find is presented below:

- In the event of an unexpected find, all work in the immediate vicinity should cease and the client should be contacted immediately;
- Temporary barricades should be erected to isolate the area from access to the public and works;
- In the event potential asbestos material is encountered, a qualified occupational hygienist and/or asbestos consultant should be contacted;
- The client should engage a qualified environmental consultant to attend the site and assess the extent of remediation that may be required;
- In the event remediation is required, the procedures outlined within this report should be adopted where appropriate, alternatively an additional remediation action plan (RAP) should be prepared;
- An additional sampling and analytical rationale should be established by the consultant and should be implemented with reference to the relevant guideline documents; and
- Appropriate validation sampling should be undertaken and the results should be included in the validation report.

18.2 Continual Validation Failure

Where validation sampling indicates that the contaminated material extends further than anticipated, there are two options:

- Re-excavate and re-sample until the validation sample results meet the VAC; or
- Revise the remedial strategy to include the cap and contain approach. This will require the implementation of an Environmental Management Plan (EMP).

18.3 General

Where waste classification assessment of any stockpiled material indicates that contaminant concentrations exceed the 'restricted solid waste' criteria (i.e. the material is classified 'hazardous waste') listed in the Waste Classification Guidelines 2009 further assessment and stabilisation of contaminants may be required prior to off-site disposal of the contaminated material.

Off-site disposal of stabilised contaminated soil will require additional testing and NSW DECCW and landfill approvals. The presence of material classified as 'hazardous waste' may result in significant delays and additional cost to the project.

19 SITE MANAGEMENT

19.1 Interim Site Management

No special site management plans are considered necessary prior to remediation taking place, apart from the maintenance of the existing fences to prevent access to the site and potentially, construction of new fences following demolition of the existing buildings. Entrances to the site should be locked/padlocked to prevent unauthorised access, tipping or dumping on the site prior to, and, during the site works.

19.2 Project Contacts

The contact names and phone numbers of key project personnel from the Contractor, and offsite emergency services phone numbers are shown below. Emergency procedures and contact telephone numbers shall be displayed in a prominent position at the site entrance gate and within the main site working areas. These contacts will also facilitate registration of complaint acceptance points. The primary point for complaint acceptance will be the project manager.

Position	Name	Phone
Remediation Contractor – Site Manager	TBA	To be advised
Project Manager	TBA	To be advised
Site Contamination Consultant	Environmental Investigation Services	9888 5000
DECCW (Environmental Protection Authority)	Pollution Line	131 555
Emergency Services	Ambulance Police Fire Department	000
General Hospital	Royal North Shore Hospital	9926 7111

TBA: to be appointed.

19.3 Security

Prior to the commencement of site works, fencing should be installed as required to secure the work areas. Warning signs should be erected, including: 'hard hat only area', 'visitors must report to the site manager' and 'keep out'. All excavations should be clearly marked with coloured tape to reduce the risk to site personnel from injury by falling into open excavations.

19.4 Timing and Sequencing of Remediation Works

In the event of unexpected delays following commencement of the proposed remediation works, builder's plastic or a similar material should be employed to cover the exposed contaminated material to minimise the production of dust, on-site worker's exposure and/or run-off.

In general, all remedial works should be completed prior to the commencement of site construction and excavation works for the proposed development. In the event that remedial works and construction/excavation works are undertaken concurrently to assist with site access, all areas of contaminated material should be clearly marked and covered with builder's plastic, or similar materials, to reduce the generation of dust, run-off and exposure to site workers and occupants.

19.5 Site Soil and Water Management Plan

The earthworks contractor should prepare a detailed soil and water management plan prior to the commencement of site works. The NSW Government/Landcom Blue Book *"Managing Urban Stormwater – Soil and Construction"* 2004 (4th Ed)[20] (Blue Book) presents the general requirements to be included in soil and water management plans. Silt fences should be used to control the surface water runoff at all appropriate locations of the site.

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

19.6 Noise and Vibration Control Plan

Australian Standard AS2460 (2002[21]) outlines guidelines for the minimisation of noise on construction sites and these should be followed by site personnel at all times. Noise and vibration abatement measures should also be completed in accordance with any specific requirements as stated in the applicable Development Consent.

Noise producing machinery and equipment should only be operated between the hours approved by Council (refer to DA consent documents).

---

[20] NSW Government/Landcom Blue Book *"Managing Urban Stormwater – Soil and Construction"* 2004 (4th Ed)

[21] Australian Standard (2002) AS2460[21] Acoustics - Measurement of the reverberation time in rooms

All practicable measures should be taken to reduce the generation of noise and vibration to within acceptable limits. In the event that short-term noisy operations are necessary, and where these are likely to affect residences, notifications should be provided to the relevant authorities and the residents by the Project Manager / Site Foreman, specifying the expected duration of the noisy works.

19.7 Dust Control Plan

All practicable measures should be taken to reduce dust emanating from the site. Factors that contribute to dust production are:

- Wind over a cleared surface;
- Wind over stockpiled material; and
- Movement of machinery in unpaved areas.

Visible dust should not be present at the site boundary. Measures to minimise the potential for dust generation include:

- Use of water sprays on unsealed or exposed soil surfaces;
- Covering of stockpiled materials and excavation faces (particularly during periods of site inactivity and/or during windy conditions) or alternatively the erection of hessian fences around stockpiled soil or large exposed areas of soil;
- Establishment of dust screens consisting of a 2m high shade cloth or similar material secured to a chain wire fence;
- Maintenance of dust control measures to keep the facilities in good operating condition;
- Concrete surfaces brushed or washed to remove dust;
- Stopping work during strong winds;
- Loading or unloading of dry soil as close as possible to stockpiles to prevent spreading of loose material around the site; and
- The expanse of cleared land should be kept to a minimum to achieve a clean and economical working environment.

If stockpiles are to remain on-site or an excavation remains open for a period of longer than 3 days, dust monitoring should be undertaken at the site. If excessive dust is generated all site activities should cease until either wind conditions are more acceptable or a revised method of excavation/remediation is developed.

Dust is also produced during the transfer of material to and from the site. All material should be covered during transport and should be properly disposed of on delivery. No material is to be left in an exposed, un-monitored condition.

All plant, including trucks transporting material, should be brushed or washed down before leaving the site to limit dust and sediment movement off-site. In the event of prolonged rain and lack of paved areas all vehicles should be washed down prior to exit from the site, and any soil or dirt on the wheels of the vehicles removed. Water used to clean the vehicles should be collected and tested prior to appropriate disposal under the NSW DECCW Waste Classification Guidelines.

19.8 Asbestos

Following clearance of vegetation from around BH6 the area should be inspected by an appropriately qualified asbestos consultant. The asbestos consultant can then make an assessment of the requirement for an asbestos management plan or air monitoring during earthworks.

19.9 Dewatering of Excavations

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.

19.10 Odour Control Plan

All activities undertaken at the site should be completed in a manner that minimises emissions of smoke, fumes and vapour into the atmosphere and any odours arising from the works or stockpiled material should be controlled. Control measures may include:

- Maintenance of construction equipment so that exhaust emissions comply with the Clean Air Regulations issued under the *Protection of the Environment Operations Act* (1997[22]);
- Demolition materials and other combustible waste should not be burnt on site;
- The spraying of a solution of Biosolve™ or other appropriate product if required to suppress any odours that may be generate by excavated materials; and
- Use of protective covers (e.g. HDPE).

All practicable measures should be taken to reduce fugitive emissions emanating from the site so that associated odours do not constitute a nuisance and that the ambient air quality is not adversely impacted.

[22] *Protection of Environment Operations Act,* NSW Government, 1997 (POEO Act 1997)

19.11 Health and Safety Plan

A specific occupational health and safety plan should be prepared by the contractor for all work to be undertaken at the site in accordance with the occupational health and safety and construction safety regulations of NSW WorkCover. The OH&S plan should be provided to the auditor (if appointed) and approved prior to commencement of remedial works.

As a minimum requirement, personnel must wear appropriate protective clothing, including long sleeve shirts, long trousers and steel cap boots. Gloves should be worn when working on remediation activities.

Washroom and lunchroom facilities should also be provided to allow workers to remove potential contamination from their hands and clothing prior to eating or drinking.

In the event of asbestos remediation works, additional personal protective equipment (PPE) will be required as outlined by a qualified occupational hygienist and/or asbestos consultant.

19.12 Hours of Operation

Hours of operation should be between those approved by Council (refer to DA consent documents). Reference should also be made to any specific conditions imposed by the relevant consent authority.

20 REGULATORY COMPLIANCE

20.1 Remediation Category

Remediation works can fall under two categories as outlined in SEPP55. Category 1 remediation works are those undertaken in the following areas specified under Clause 9 of SEPP55:

- A designated development;
- Carried out on land declared to be a critical habitat;
- Development for which another SEPP or REP requires a development consent; or
- Carried out in an area or zone classified as:
  - Coastal Protection
  - Conservation or heritage conservation
  - Habitat protection, or habitat or wildlife corridor
  - Environmental protection;
  - Escarpment, escarpment protection or preservation;
  - Floodway or wetland;
  - Nature reserve, scenic area or scenic protection; etc

- Work that is not carried out in accordance with the site management provisions contained in the consent authority Development Control Plan (DCP)/Local Environmental Plan (LEP) etc.

Category 1 remediation works must not be carried out without the consent of the consent authority. The RAP needs to be assessed and determined either as part of the existing DA or as a new and separate DA. Category 1 remediation work is identified as advertised development work unless the remediation work is a designated development or a state significant development (Part 6 of EPAA Regulation 1994).

Should council consider that the proposed remediation work does not meet any of the conditions for Category 1 remediation works specified in Clause 9 of SEPP55, the remediation work will fall into Category 2. No development consent is necessary for Category 2 remediation, however Council should be given 30 days notice before the commencement of work.

20.1.1 Site Remediation Category

The proposed remediation work does not meet any of the conditions for Category 1 remediation work specified above and therefore falls into Category 2 remediation work. No development consent is necessary for Category 2 remediation, however Council should be given 30 days notice before the commencement of work.

20.2 Disposal of Waste

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. EIS accepts no liability whatsoever for the unlawful disposal of any waste from any site.

20.3 Dewatering of Excavations

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.

20.4 Duty to Report under CLM ACT

After successful implementation of the RAP and validation plan, the site contamination is unlikely to meet the Notification Triggers specified in the *Guidelines on the Duty to Report Contamination*[23] under the CLM Amendment Act 2008.

Please note that in the event remediation of the site as outlined in this RAP is not undertaken, there may be justification to report the contamination to DECCW. EIS can be contacted for further advice regarding notification.

21 LIMITATIONS

The boreholes drilled for the investigation have enabled an assessment to be made of the existence of significant, large quantities of contaminated soils. EIS adopts no responsibility whatsoever for any problems such as underground storage tanks, buried items or contaminated material that may be encountered between sampling locations at the site. The proposed construction activities at the site should be planned on this basis, and any unexpected problem areas that are encountered between boreholes should be immediately inspected by experienced environmental personnel.

The conclusions developed in this report are based on site conditions which existed at the time of the site assessment and the scope of work outlined previously in this report. They are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, and visual observations of the site and vicinity, together with the interpretation of available historical information and documents reviewed as described in this report.

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 previously in this report.

Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated.

EIS has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination.

---

[23] *Guidelines on the Duty to Report Contamination*, NSW Government Legislation, 2008 (Duty to Report Contamination 2008)

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 scope of work undertaken was designed to assess widespread asbestos contamination in soil. EIS adopts no responsibility for small scale or buried asbestos features at the site which may be encountered during earthworks or construction works at the site.

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.

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.

Changes in the proposed or current site use may result in remediation or further investigation being required at the site.

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. Copyright of the report is the property of EIS. EIS has used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report.

Should you require any further information regarding the above, please do not hesitate to contact us.

Yours faithfully

For and on behalf of
ENVIRONMENTAL INVESTIGATION SERVICES

Rob Muller
Environmental Scientist

Adrian Kingswell
Senior Associate

ABBREVIATIONS

AAS	Atomic Absorption Spectrometry
AGST	Above Ground Storage Tank
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment Conservation Council
ASS	Acid Sulfate Soil
B(a)P	Benzo(a)pyrene
BH	Borehole
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
COC	Chain of Custody documentation
CLM	Contaminated Land Management
DECCW	Department of Environment, Climate Change and Water (formerly EPA)
DNR	NSW Department of Natural Resources (now split between DWE and DECCW)
DWE	NSW Department of Water and Energy
DP	Deposited Plan
DQO	Data Quality Objective
EC	Electrical Conductivity
EPA NSW	Environment Protection Authority, New South Wales (now part of DECCW)
GC-ECD	Gas Chromatograph-Electron Capture Detector
GC-FID	Gas Chromatograph-Flame Ionisation Detector
GC-MS	Gas Chromatograph-Mass Spectrometer
HIL	Health Based Investigation Level
HM	Heavy Metals
ICP-AES	Inductively Couple Plasma – Atomic Emission Spectra
NATA	National Association of Testing Authorities, Australia
NEPC	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
OCPs	Organochlorine Pesticides
OPPs	Organophosphorous Pesticides
OHS (OH&S)	Occupational Health and Safety
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photo-ionisation Detector
PPIL	Provisional Phyto-toxicity Investigation Levels
PQL	Practical Quantitation Limit
P&T	Purge & Trap
RAP	Remedial Action Plan
QA/QC	Quality Assurance and Quality Control
RPD	Relative Percentage Difference
SEPP	State Environmental Planning Policy
sPOCAS	suspension Peroxide Oxidation Combined Acidity and Sulfate
SPT	Standard Penetration Test
SWL	Standing Water Level
TCLP	Toxicity Characteristic Leaching Procedure
TP	Test Pit
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
UCL	Upper Confidence Limit
UST	Underground Storage Tank
VOC	Volatile Organic Compounds

IMPORTANT INFORMATION ABOUT THE SITE ASSESSMENT REPORT

These notes have been prepared by EIS to assist with the assessment and interpretation of this report.

An Environmental Assessment 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 are modified;
- the proposed development levels are altered, e.g. 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 Assessment 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.

Environmental Site Assessment Limitations

Although information provided by an environmental 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 Environmental Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an environmental 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 Environmental 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 test 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 A-1
ENVIRONMENTAL AND HEALTH-BASED SOIL INVESTIGATION LEVELS (mg/kg)

Substances	Health Investigation Levels (HILs)[1]				Provisional Phyto-toxicity Investigation Levels (PPILs)[1]	NSW EPA Guidelines for Assessing Service Station Sites[2]	Back-ground Ranges[1]
	A	D	E	F			
	'Standard' residential with garden/ accessible soil (home-grown produce contributing less than 10% of vegetable and fruit intake; no poultry); includes children's day-care centres, kindergartens, preschools and primary schools	Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats	Parks, recreational open space and playing fields: includes secondary schools	Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites			
METALS/METALLOIDS							
Arsenic (total)	100	400	200	500	20		1-50
Barium					300		100-3000
Beryllium	20	80	40	100			
Cadmium	20	80	40	100	3		1
Chromium(III)	12%	48%	24%	60%	400		
Chromium(VI)	100	400	200	500	1		
Chromium (total)							5-1000
Cobalt	100	400	200	500			1-40
Copper	1000	4000	2000	5000	100		2-100
Lead	300	1200	600	1500	600		2-200
Manganese	1500	6000	3000	7500	500		850
Methyl mercury	10	40	20	50			
Mercury (inorganic)	15	60	30	75	1		0.03
Nickel	600	2400	600	3000	60		5-500
Vanadium					50		20-500
Zinc	7000	28000	14000	35000	200		10-300
ORGANICS							
Aldrin + Dieldrin	10	40	20	50			
Chlordane	50	200	100	250			
DDT + DDD + DDE	200	800	400	1000			
Heptachlor	10	40	20	50			
Polycyclic aromatic hydrocarbons (PAHs)	20	80	40	100			
Benzo(a)pyrene	1	4	2	5			
Phenol	8500	34000	17000	42500			
PCBs (total)	10	40	20	50			
Petroleum Hydrocarbon Components (constituents):							
>C16 - C35 Aromatics	90	360	180	450			
>C16 - C35 Aliphatics	5600	22400	11200	28000			
>C35 Aliphatics	56000	224000	112000	280000			
C6-C9						65	
C10-C40						1000	
Benzene						1	
Toluene						1.4	
Ethyl Benzene						3.1	
Total Xylenes						14	
OTHER							
Boron	3000	12000	6000	15000			
Cyanides (complexed)	500	2000	1000	2500			
Cyanides (free)	250	1000	500	1250			
Phosphorus					2000		
Sulfur					600		
Sulfate					2000		

NOTE: Reference should be made to the following guidelines for further details (as referenced in the above table):

1 National Environment Protection (Assessment of Site Contamination) Measure - 1999, National Environment Protection Council. Human exposure settings based on land use have been established for HILs and details are outlined in Taylor and Langley 1998.

2 NSW DECCW (formerly EPA) Guidelines for Assessing Service Station Sites - 1994.

TABLE A - 2
CHEMICAL CONTAMINANT CRITERIA FOR WASTE CLASSIFICATION
Waste Classification Guidelines. Part 1: Classifying Waste DECC (now DECCW) NSW July 2009

GENERAL SOLID WASTE	RESTRICTED SOLID WASTE	HAZARDOUS WASTE
IF SCC ≤ CT1, TCLP NOT NEEDED TO CLASSIFY AS GENERAL SOLID WASTE	IF SCC ≤ CT2, TCLP NOT NEEDED TO CLASSIFY AS RESTRICTED SOLID WASTE	IF SCC > CT2, TCLP NOT NEEDED TO CLASSIFY AS HAZARDOUS WASTE
IF TCLP ≤ TCLP1 AND SCC ≤ SCC1 TREAT AS GENERAL SOLID WASTE	IF TCLP ≤ TCLP2 AND SCC ≤ SCC2 TREAT AS RESTRICTED SOLID WASTE	IF TCLP > TCLP2 AND/OR SCC > SCC2 TREAT AS HAZARDOUS WASTE

	GENERAL SOLID WASTE			RESTRICTED SOLID WASTE		
CONTAMINANT	CT1 (mg/kg)	TCLP1 (mg/L)	SCC1 (mg/kg)	CT2 (mg/kg)	TCLP2 (mg/L)	SCC2 (mg/kg)
Arsenic	100	5	500	400	20	2,000
Beryllium	20	1.0	100	80	4	400
Cadmium	20	1.0	100	80	4	400
Chromium VI	100	5	1,900	400	20	7,600
Cyanide (total)	320	16	5,900	1280	64	23,600
Cyanide (Amenable)	70	3.5	300	280	14	1,200
Fluoride	3,000	150	10,000	12,000	600	40,000
Lead	100	5	1,500	400	20	6,000
Mercury	4	0.2	50	16	0.8	200
Molybdenum	100	5	1,000	400	20	4,000
Nickel	40	2	1,050	160	8	4,200
Selenium	20	1	50	80	4	200
Silver	100	5.0	180	400	20	720
Benzene	10	0.5	18	40	2	72
Toluene	288	14.4	518	1,152	57.6	2,073
Ethylbenzene	600	30	1,080	2,400	120	4,320
Total xylenes	1,000	50	1,800	4,000	200	7,200
Total petroleum hydrocarbons (C6-C9)	-	-	650	-	-	2,600
Total petroleum hydrocarbons (C10-C36) (C10-C14, C15-C28, C29-C36)	-	-	10,000	-	-	40,000
Benzo(a)pyrene	0.8	0.04	10	3.2	0.16	23
Polycyclic aromatic hydrocarbons (Total)	-	-	200	-	-	800
Polychlorinated biphenyls	-	-	<50	-	-	<50
Phenol (nonhalogenated)	288	14.4	518	1,152	57.6	2,073
Scheduled chemicals	-	-	<50	-	-	<50

NOTE:
SCC – Specific Contaminant Concentration
CT – Contaminant Threshold
TCLP – Toxicity Characteristics Leaching Procedure

TABLE B
SUMMARY OF LABORATORY TEST DATA
SOIL CHARACTERISATION ASSESSMENT
All data in mg/kg unless stated otherwise

ANALYTE				PAHs		PID	ASBESTOS
			Lead	Total PAHs	B(a)P	VALUES	FIBRES
PQL - Envirolab Services			1	-	0.05		
Site Assessment Criteria ^			300 *	20 *	1 *		
Provisional Phyto-toxicity Investigation Levels			600 **	NSL	NSL		
General Solid Waste CT1+			100	NSL	0.8		
General Solid Waste SCC1+			1500	200	10		
Location	Depth in metres	DESCRIPTION					
BH10	0.1-0.2	Fill - silty clay	NA	**69.2**	**9.1**	0.0	NA
BH11	0-0.1	Fill - silty clay	NA	**216.8**	**17**	0.0	NA
BH12	0-0.2	Fill - silty sandy clay	NA	LPQL	LPQL	0.0	NA
BH13	0-0.2	Fill - silty clay	180	11.6	0.8	0.0	No asbestos detected
BH14	0-0.2	Fill - silty clay	30	LPQL	LPQL	0.0	No asbestos detected
BH15	0.1-0.2	Fill - silty clay	84	LPQL	LPQL	0.0	No asbestos detected
BH16	0-0.2	Fill - silty sandy clay	120	NA	NA	0.0	NA
BH17	0-0.1	Fill - silty clay	160	0.7	0.1	0.0	No asbestos detected
BH18	0-0.1	Fill - silty clay	NA	NA	NA	0.0	No asbestos detected
BH19	0.1-0.2	Fill - silty clay	**300**	NA	NA	0.0	NA
BH20	0.2-0.3	Fill - silty clay	**330**	NA	NA	0.0	NA
BH21	0.1-0.2	Fill - silty clay	280	1.9	0.2	0.0	No asbestos detected
BH22	0.2-0.3	Fill - silty clay	55	NA	NA	0.0	NA
BH23	0.1-0.2	Fill - silty clay	37	NA	NA	0.0	NA
BH24	0-0.1	Fill - silty clay	**320**	NA	NA	0.0	NA
BH25	0.1-0.2	Fill - silty clay	160	NA	NA	0.0	NA
BH26	0-0.1	Fill - silty clay	**340**	NA	NA	0.0	NA
Total no. of samples analysed			13	8	8	16	6
Maximum Value			340	216.8	17	0	NC
Mean Value			184	33.7	2.63	0	NC
Standard Deviation			116.9	80.8	6.34	0	NC
Coefficient of Variation			0.6	2.4	2.41	NC	NC
Distribution +			Gamma	Gamma	Unknown	NC	NC
Upper Level 95% or 99% Confidence Limit on Mean Value (95% or 99% UCL) +			230.3	93.45	16.23	NC	NC

EXPLANATION:

^ Site Assessment Criteria: Guideline concentrations adopted for the investigation as outlined below:
* National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC Guidelines) Health Investigation Levels (HIL) - Column A, Residential with accessible soils
** Provisional Phyto-toxicity Investigation Levels (PPILs)
# NSW DECC (EPA) Guidelines for Assessing Service Station Sites - 1994
^^ In the absence of Australian guidelines, the laboratory PQL has been adopted as the site assessment criteria
+ Waste Classification Guidelines – Part 1: Classifying Waste (2009)

Concentration above the Site Assessment Criteria

ABBREVIATIONS:

PAHs: Polycyclic Aromatic Hydrocarbons
B(a)P: Benzo(a)Pyrene
PQL: Practical Quantitation Limit
LPQL: Less than PQL
NA: Not Analysed
NC: Not Calculated
PID: Photoionisation Detector
NSL: No Set Limit

NOTE: + Statistical analysis has been calculate using ProUCL version 4.1 (USEPA). Statistical analyses has only been undertaken for those contaminants that exceeded the health based site assessment criteria

TABLE C
SUMMARY OF LABORATORY TEST DATA
TOXICITY CHARACTERISTICS LEACHING PROCEDURE (TCLP)
All data in mg/L unless stated otherwise

ANALYTE		Lead	B(a)P
PQL - Envirolab		0.03	0.001
TCLP1 - General Solid Waste *		5	0.04
TCLP2 - Restricted Solid Waste *		20	0.16
TCLP3 - Hazardous Waste *		>20	>0.16
SAMPLE	Depth in metres		
BH10	0.1-0.2	NA	LPQL
BH11	0.0-0.1	NA	LPQL
BH16	0.0-0.2	LPQL	NA
BH17	0.0-0.1	0.03	NA
BH19	0.1-0.2	0.2	NA
BH20	0.2-0.3	0.09	NA
BH21	0.1-0.2	0.1	NA
BH24	0.0-0.1	0.1	NA
BH25	0.1-0.2	0.04	NA
BH26	0.0-0.1	0.3	NA
Total no. of samples		8	2
Maximum Value		0.3	LPQL

EXPLANATION:
* NSW DECC (EPA) Waste Classification Guidelines - Part 1: Classifying Waste - April 2009

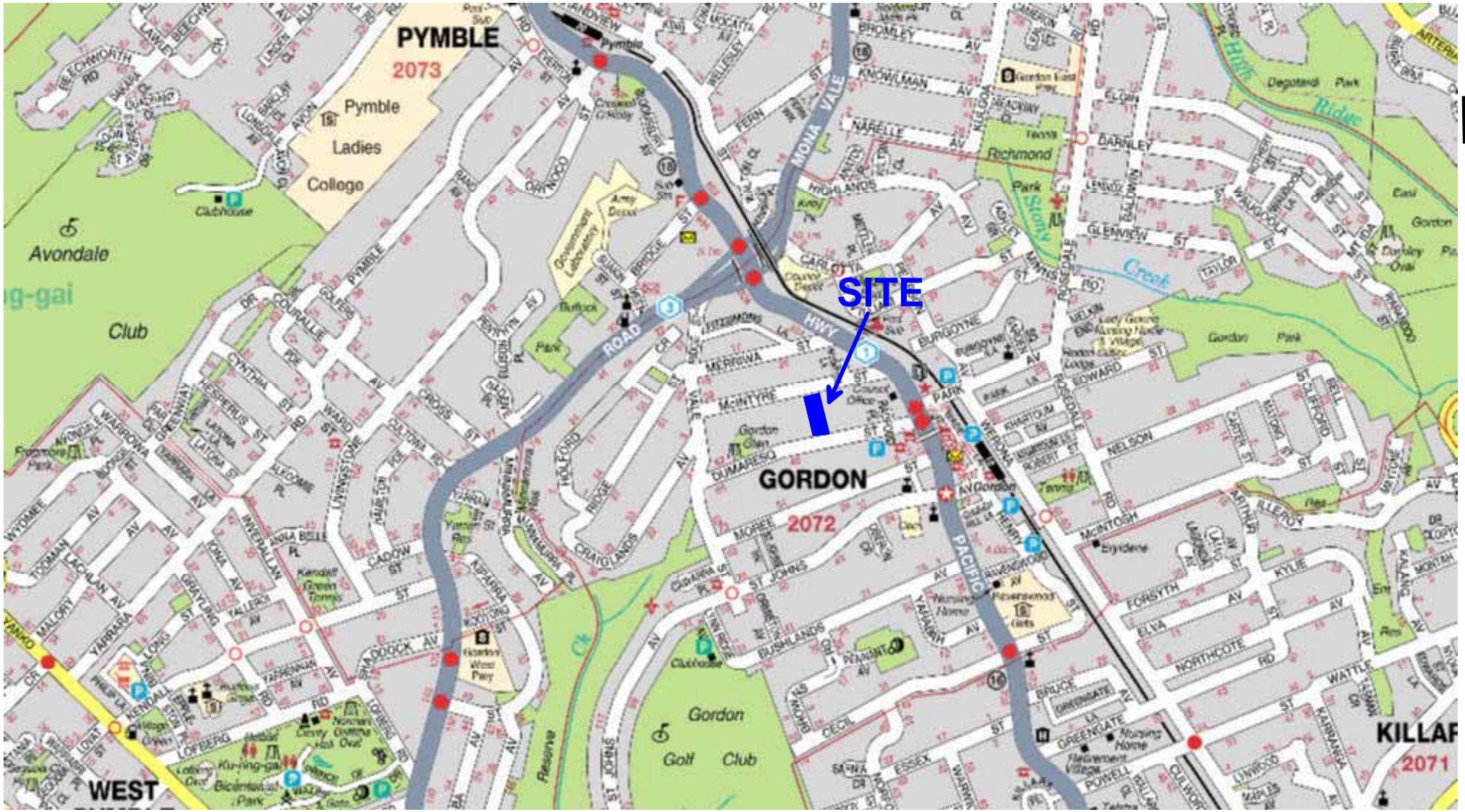
Concentration above the General Solid Waste guideline level — **VALUE**
Concentration above the Restricted Solid Waste guideline level — ***VALUE***

ABBREVIATIONS:
PQL: Practical Quantitation Limit
LPQL: Less than PQL
B(a)P: Benzo(a)Pyrene

TABLE D
SOIL INTRA-LABORATORY DUPLICATE RESULTS
QA/QC - RELATIVE PERCENTAGE DIFFERENCES

	SAMPLE ID	BH13 (0.0-0.2)				BH21 (0.1-0.2)			
	ANALYSIS	INITIAL (mg/kg)	REPEAT (mg/kg)	MEAN (mg/kg)	RPD %	INITIAL (mg/kg)	REPEAT (mg/kg)	MEAN (mg/kg)	RPD %
Intra-laboratory duplicates	Lead	180	240	210	29	280	250	265	11
	Naphthalene	LPQL	LPQL	NC	NC	LPQL	LPQL	NC	NC
Sample IDs: BH13 (0.0-0.2)	Acenaphthylene	0.2	LPQL	NC	NC	LPQL	LPQL	NC	NC
and BH21 (0.1-0.2)	Acenaphthene	LPQL	LPQL	NC	NC	LPQL	LPQL	NC	NC
	Fluorene	0.2	LPQL	NC	NC	LPQL	LPQL	NC	NC
Envirolab reports:	Phenanthrene	1.9	0.4	1.15	130	0.2	0.2	0.2	0
52919 and 52919A	Anthracene	0.3	LPQL	NC	NC	LPQL	LPQL	NC	NC
	Fluoranthene	2.3	0.6	1.45	117	0.4	0.4	0.4	0
	Pyrene	2	0.5	1.25	120	0.3	0.3	0.3	0
	Benzo(a)anthracene	0.7	0.2	0.45	111	0.1	0.1	0.1	0
	Chrysene	0.7	0.3	0.5	80	0.2	0.2	0.2	0
	Benzo(b)&(k)fluorant	1.2	0.4	0.8	100	0.3	0.2	0.25	40
	Benzo(a)pyrene	0.8	0.3	0.55	91	0.2	0.1	0.15	67
	Indeno(123-cd)pyrene	0.6	0.1	0.35	143	0.1	LPQL	NC	NC
	Dibenzo(ah)anthracene	0.1	LPQL	NC	NC	LPQL	LPQL	NC	NC
	Benzo(ghi)perylene	0.6	0.1	0.35	143	0.1	LPQL	NC	NC

ABBREVIATIONS:
PQL: Practical Quantitation Limit
LPQL: Less than PQL
NC: Not Calculated



Recreated from UBD on disc (version 5.0)
Map Ref: 174 L7 (Sydney) (not to scale)

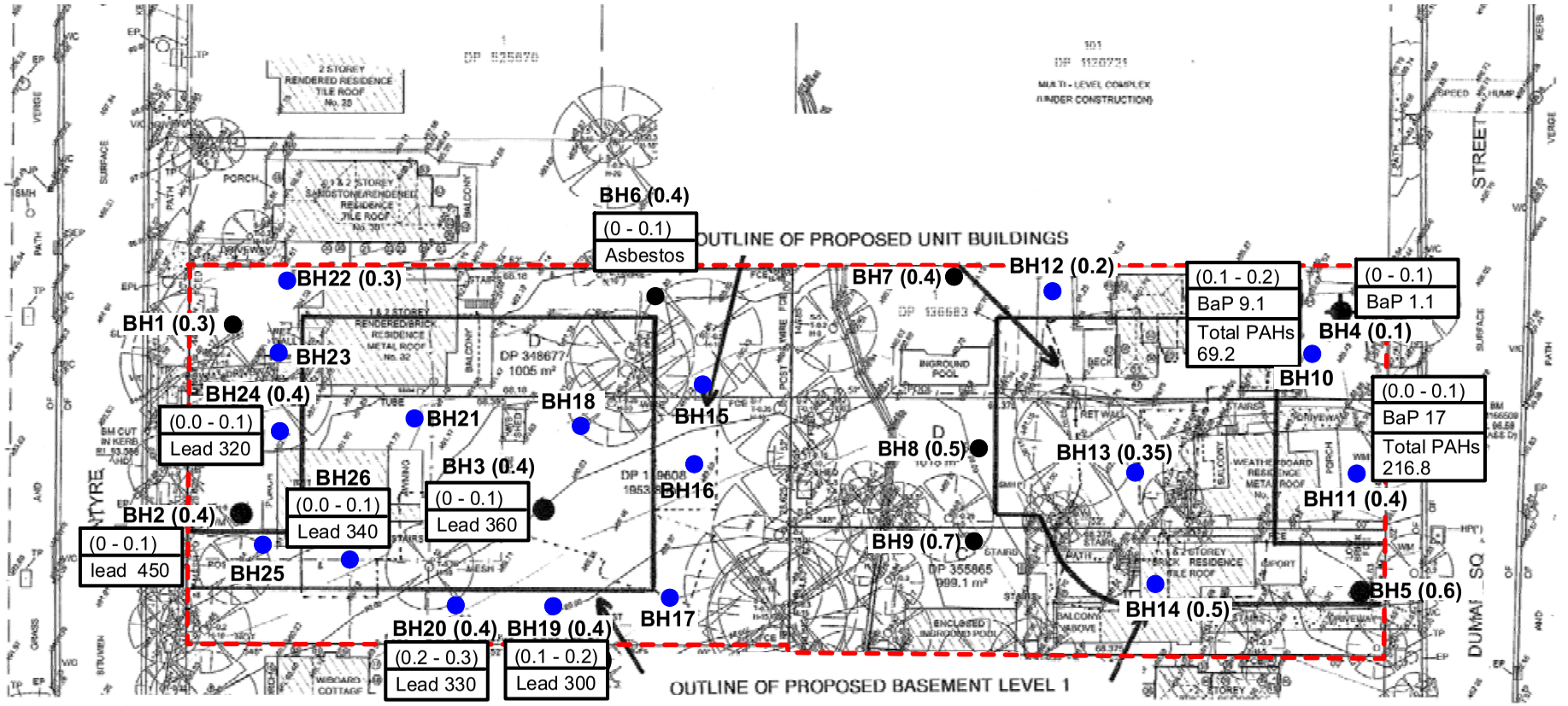
Note: Reference should be made to the text for a full understanding of this plan

SITE LOCATION PLAN

35-39 Dumaresq and
32-34 McIntyre Street, Gordon

ENVIRONMENTAL INVESTIGATION SERVICES

Job No: E24170Krpt2
Figure: 1



Approximate Scale (m)

0 5 10 15 20 25

Note: Reference should be made to the text for a full understanding of this plan. Contamination data shown on this plan are only those contaminants above the residential with accessible soils (including primary schools) (Column A) Health Investigation Levels (HILs) presented in NEPM (1999).

LEGEND:

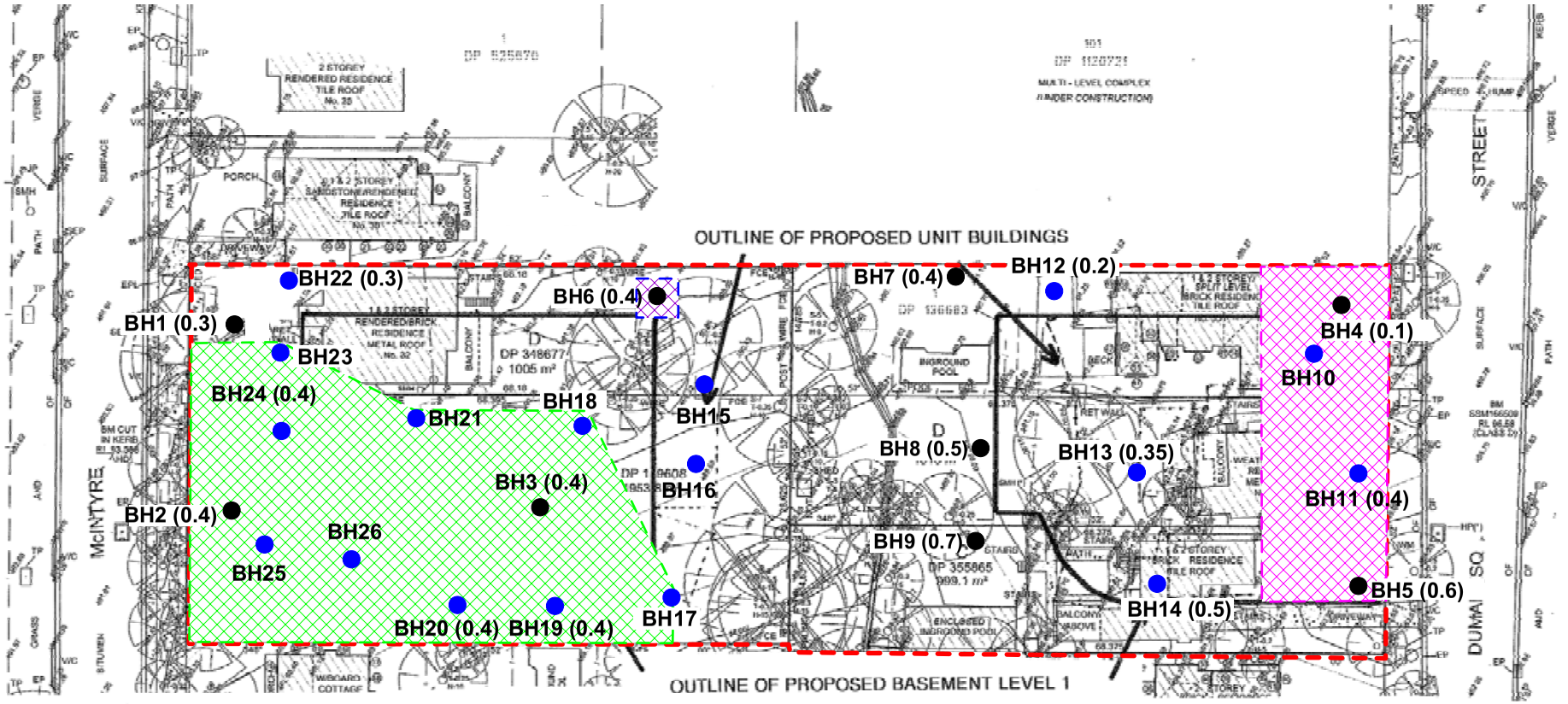
- **BH1 (0.5)** — **PHASE 1 (PREVIOUS) BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL IF KNOWN (in metres)**
- **BH1 (0.5)** — **ADDITIONAL INVESTIGATION BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL IF KNOWN (in metres)**
- **SITE BOUNDARIES**
- (0 - 0.2) / BaP 1.1 — **SAMPLE DEPTH (m) CONTAMINANT AND CONCENTRATION (mg/kg)**

BOREHOLE LOCATION PLAN AND CONTAMINATION DATA

35-39 Dumaresq and
32-34 McIntyre Street, Gordon

ENVIRONMENTAL INVESTIGATION SERVICES

Report No: E24170K rpt2
Figure: 2



LEGEND:

- BH1 (0.5) — PHASE 1 (PREVIOUS) BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL IF KNOWN (in metres)
- BH1 (0.5) — ADDITIONAL INVESTIGATION BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL IF KNOWN (in metres)
- SITE BOUNDARIES
- AREA A - LEAD IMPACTED AREA
- AREA B - PAH IMPACTED AREA
- AREA C - ASBESTOS IMPACTED AREA

Approximate Scale (m)

0 5 10 15 20 25

Note: Reference should be made to the text for a full understanding of this plan. Contamination data shown on this plan are only those contaminants above the residential with accessible soils (including primary schools) (Column A) Health Investigation Levels (HILs) presented in NEPM (1999).

REMEDIATION AREAS

35-39 Dumaresq and
32-34 McIntyre Street, Gordon

EIS
ENVIRONMENTAL INVESTIGATION SERVICES

Report No: E24170K rpt2
Figure: 3