ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

SM ENGINEERING AND CONSTRUCTIONS PTY LTD

ON

CONCEPTUAL REMEDIATION ACTION PLAN

FOR

PROPOSED MIXED USE COMMERCIAL/RESIDENTIAL DEVELOPMENT

AT

36-44 JOHN STREET, LIDCOMBE, NSW

1 MAY 2013 **REF: E26515KBrpt-RAP**

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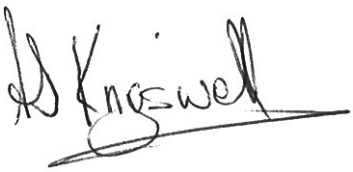

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EXECUTIVE SUMMARY

SM Engineering and Constructions Pty Ltd (the 'client') commissioned Environmental Investigation Services (EIS) to prepare a Conceptual Remediation Action Plan (RAP) for the proposed mixed use commercial/residential development at 36-44 John Street, Lidcombe, NSW ('the site').

The site is identified as Lot 5A in DP979289, Lot 1 in DP1002517, Lot 1 in DP235940 and Lot 1 in DP511612. The site location is shown on the attached Figure 1 and the site boundaries/proposed development area is shown on Figure 2.

The conceptual RAP was undertaken generally in accordance with an EIS proposal (Ref: EP7104K) of 26 April 2013 and written acceptance from the client of 26 April 2013.

This conceptual RAP has been prepared based on the information presented in the CSTS Combined Phase 1 and Phase 2 Contamination Assessment report (Ref: Job No: SCD 1531, Report No: ENVAA, Ref 44 dated 31 August 2012) prepared for the proposed development at the site. EIS assume that the information presented in the CSTS 2012 report is accurate. No further investigation has been undertaken by EIS to verify the accuracy of the information presented in the CSTS 2012 report. This report should be read in conjunction with the CSTS 2012 report.

This report documents the procedures to be undertaken to remediate and/or manage contamination issues identified in the CSTS 2012 report. This conceptual RAP should be revised and updated upon addressing the data gaps outlined in **Section 2.2.**

EIS understand that the proposed development includes demolition of the existing buildings and construction of a nine storey mixed used commercial/residential development over three levels of basement car parking. The proposed basement will extend over the majority of the site as shown on the attached Figure 2. Excavation for the basement is anticipated to extend to depths ranging from approximately 9m to 10m.

EIS have been proposed with the CSTS 2012 report prepared for the proposed development. A summary of the information relevant to this report is presented in **Section 2.** This report should be read in conjunction with the CSTS 2012 report.

The scope of work included:

- A review of previous investigation reports prepared for the site;
- Prepare site specific Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) for the validation works;
- Design of a validation sampling and laboratory analysis program; and
- Preparation of the conceptual RAP report.

Findings of the CSTS 2012 Investigation:

CSTS concluded that none of the results exceeded the HIL-D guideline concentrations and therefore the site was considered suitable for "Residential developments with limited soil access opportunities". EIS also note that the hydrocarbon results were all less than the concentrations specified in the GASSS. CSTS were of the opinion that the site did not pose an unacceptable risk to human health.

CSTS concluded that a number of results were above the PPILs and that these concentrations may have an adverse impact on plant growth in any landscaped sections of the site.

A preliminary waste classification was undertaken using the available data (EIS note the no TCLP analysis was undertaken). The waste classification concluded that the majority of

material could be disposed of as General Solid Waste but that some of the fill material would be classified as Restricted or Hazardous Waste based on this data.

The report recommended further assessment of the material (including TCLP analysis) at the time of excavation in order to assign an accurate waste classification to the material.

Data Gaps Identified by EIS:

EIS have identified the following data gaps in the CSTS 2012 report:

- The Borehole logs do not distinguish between fill and natural soils. This could have a major impact on the disposal costs of excavated soil. During excavation it will be very important to distinguish between fill and natural soil as the cost of disposal of fill material are significant. Detailed borehole logs showing the boundary between the fill and natural soil will be required;
- The waste classification of the soil has not been finalised. We note that some soil is currently classified as Restricted Solid Waste (very expensive to dispose of). Further analysis may reduce this classification to General Solid Waste;
- There has been no soil assessment beneath the buildings;
- The existing site buildings appear to have been constructed around the 1970's and can contain hazardous building material. A hazmat survey should be undertaken by a suitably qualified consultant prior to the commencement of demolition works; and
- There has been no assessment of the groundwater. We note that there will be three basement levels and therefore groundwater may be encountered.

Known Extent of Remediation:

Elevated concentrations of contaminants above the HILs and GASSS were not identified during the CSTS 2012 investigation. Concentrations above the PPILs were encountered in some samples analysed by CSTS 2012. These concentrations are not considered to be significant as the proposed development includes excavation for 3 levels of basement which extends to the site boundaries. The basement excavation will remove the majority of the contaminants above the PPILs.

Unknown Extent of Remediation;

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:

- The CSTS 2012 investigation was limited to accessible areas of the site and did not include sampling beneath the existing buildings;
- The Borehole logs included in the CSTS 2012 report do not distinguish between fill and natural soils;
- Hazardous building material may have been used in the existing buildings located on site; and
- There has been no assessment of the groundwater.

Remediation Strategy Adopted for the Site:

Elevated concentrations of contaminants above the HILs and GASSS were not identified during the CSTS 2012 investigation. Concentrations above the PPILs were encountered in some samples analysed by CSTS in 2012. These concentrations are not considered to be significant as the proposed development includes excavation for 3 levels of basement which extends to the site boundaries. The basement excavation will remove the majority of the contaminants above the PPILs. The most appropriate remediation option for this situation is Option 3. Reference should be made to **Sections 8 and 9** for further details.

The RAP also includes a contingency plan in **Section 11** and a site management plan in **Section 12**.

Conclusion:

EIS are of the opinion that the site can be made suitable for the proposed mixed use commercial/residential development provided the following items are addressed:

- An additional investigation to address the data gaps outlined in **Section 2.2**;
- Prepare a final RAP based on the findings of the additional investigation; and
- Prepare a validation report after the completion of remedial works.

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

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1 INTRODUCTION

SM Engineering and Constructions Pty Ltd (the 'client') commissioned Environmental Investigation Services (EIS)[1] to prepare a Conceptual Remediation Action Plan (RAP) for the proposed mixed use commercial/residential development at 36-44 John Street, Lidcombe, NSW ('the site').

The site is identified as Lot 5A in DP979289, Lot 1 in DP1002517, Lot 1 in DP235940 and Lot 1 in DP511612. The site location is shown on the attached Figure 1 and the site boundaries/proposed development area is shown on Figure 2.

The RAP was undertaken generally in accordance with an EIS proposal (Ref: EP7104K) of 26 April 2013 and written acceptance from the client of 26 April 2013.

This conceptual RAP has been prepared based on the information presented in the CSTS Combined Phase 1 and Phase 2 Contamination Assessment report (Ref: Job No: SCD 1531, Report No: ENVAA, Ref 44 dated 31 August 2012[2]) prepared for the proposed development at the site. EIS assume that the information presented in the CSTS 2012 report is accurate. No further investigation has been undertaken by EIS to verify the accuracy of the information presented in the CSTS 2012 report. This report should be read in conjunction with the CSTS 2012 report.

This report documents the procedures to be undertaken to remediate and/or manage contamination issues identified in the CSTS 2012 report. This conceptual RAP should be revised and updated upon addressing the data gaps outlined in **Section 2.2.**

1.1 Proposed Development Details

Proposed development plans provided for the preparation of this conceptual RAP are attached in Appendix A.

Based on the review of the plans, EIS understand that the proposed development includes demolition of the existing buildings and construction of a nine storey mixed used commercial/residential development over three levels of basement car parking. The proposed basement will extend over the majority of the site as shown on the attached Figure 2. Excavation for the basement is anticipated to extend to depths ranging from approximately 9m to 10m.

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

[2] CSTS, 2012, *Report To SM Engineering & Constructions Pty Ltd on Combined Phase I & II Contamination Assessment for High Density Mixed Residential & Commercial Development*, Job No: SCD 1531, Report No.: ENVAA, Ref 44 dated 31 August 2012 (Referred to as CSTS 2012 Report)

1.2 Previous Investigation Reports and Documents

EIS have been proposed with the CSTS 2012 report prepared for the proposed development. A summary of the information relevant to this report is presented in **Section 2.** This report should be read in conjunction with the CSTS 2012 report.

1.3 Objectives

The objectives of the RAP are to:

- Summarise the contamination issues at the site;
- Identify major data gaps in the previous report;
- Outline additional site works to address the data gaps;
- Identify remediation and management measures to minimise potential risks posed by the contamination to human health or the environment;
- Outline remediation and management procedures for the site;
- Prepare a validation plan to be implemented in conjunction with the remediation work;
- 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 remediation work.

1.4 Scope of Work

The scope of work included:

- A review of previous investigation reports prepared for the site;
- Prepare site specific Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) for the validation works;
- Design of a validation sampling and laboratory analysis program; and
- Preparation of the conceptual RAP report.

The conceptual RAP was prepared with reference to regulations/guidelines outlined in the table below. Individual guidelines applicable for this report are also referenced within the text as applicable.

Table 1-: Guidelines

Guidelines/Regulations/Documents
Contaminated Land Management Amendment Act (2008[3])
State Environmental Planning Policy No.55 – Remediation of Land (1998[4])
NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (1997[5])
Guidelines on the Duty to Report Contamination[6]
Guidelines for the NSW Site Auditor Scheme, 2nd Edition (2006[7])
National Environmental Protection (Assessment of Site Contamination) Measure (1999[8]).
Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (1992[9])
NSW DECCW Guidelines for the Assessment and Management of Groundwater Contamination (2007)[10]
NSW EPA Contaminated Sites Sampling Design Guidelines (1995[11])
NSW DECCW Waste Classification Guidelines - Part 1: Classifying Waste (2009[12])
Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation (2008[13])
NSW EPA Contaminated Sites: Guidelines for Assessing Service Station Sites (1994[14])
Working with Asbestos Guide (2008[15])
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000[16])

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

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

[5] *Guidelines for Consultants Reporting on Contaminated Sites,* NSW EPA, 1997 (Reporting Guidelines 1997)

[6] *Guidelines on the Duty to Report Contamination*, NSW EPA, Draft 2011 (Duty to Report Contamination 2011)

[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] 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)

[10] *Guidelines for the Assessment and Management of Groundwater Contamination,* NSW DECCW, 2007 (Groundwater Contamination Guidelines 2007)

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

[12] *Waste Classification Guidelines, Part 1: Classifying Waste,* NSW DECCW, 2009 (Waste Classification Guidelines 2009)

[13] *Protection of Environment Operation (Underground Petroleum Storage Systems) Regulation*, NSW Government, 2008 (UPSS Regulation 2008)

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

[15] *Working with Asbestos Guide,* NSW WorkCover, 2008 (WorkCover Working with Asbestos Guide 2008)

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

2 BACKGROUND

A summary of the CSTS 2012 report provided to EIS is presented below.

2.1 Combined Phase I & II Assessment (CSTS 2012)

2.1.1 Objectives

The objectives of the Combined Phase I & II Assessment were:

- To assess soil contamination at the site;
- To assess the potential for off-site migration of any potential contamination on the site;
- To assess the risk posed by any contamination at the site to the environment and human health; and
- To assess whether the site is suitable for the proposed use.

2.1.2 Scope of Work

The scope of work undertaken to meet the above objectives included:

- A review of historical information associated with the site;
- A review of regional geology and topography of the site;
- A walkover inspection of the site;
- Sampling and analysis of representative soil samples;
- Assessment of the soil results against various site assessment criteria (SAC); and
- Preparation of a report based on the findings of the investigation.

2.1.3 Site History

The limited site history undertaken for the site appeared to indicate that prior to 1965 the site use was principally residential. The current site configuration appeared to have been established by around 1972. At the time of the CSTS investigation the site was occupied by a supermarket in the north east section, a solicitor in the east of the site and mixed residential/commercial properties in the south-east of the site. The west section of the site was used for vehicle storage.

2.1.4 Site Assessment Criteria (SAC)

The soil results were assessed against the following guidelines:

- The Health Based Investigation Levels (HILs) for 'Residential Developments with Limited Soil Access Opportunities (HIL-D)' specified in NEPM 1999;
- NSW EPA Contaminated Sites: Guidelines for Assessing Service Station Sites (GASSS) (1994);

- The Provisional Phytotoxicity Investigation Levels (PPILs) specified in the NSW DEC Site Auditor Guidelines 2006; and
- NSW DECCW Waste Classification Guidelines - Part 1: Classifying Waste (2009).

2.1.5 Sampling Density

Samples were obtained from a total of nine boreholes across a site area of approximately 2,800m^2. The sampling points appeared to be restricted to accessible areas of the site as shown on the attached plan in Appendix B.

2.1.6 Summary of Laboratory Results

Two samples were analysed from each borehole, although EIS note that no distinction was made between the fill and natural soil samples.

The samples were analysed for the following: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons (TPH), monocyclic aromatic hydrocarbons (BTEX), organochlorine (OC) and organophosphate (OP) pesticides, polychlorinated biphenyls (PCBs) and asbestos. The laboratory results are summarised below:

Contaminant	No of samples analysed	Max Concentration (mg/kg)	No of results greater than HIL-D	No. of results above GASSS	No. of results above PPIL
Arsenic	18	17	0	NA	0
Cadmium	18	1.5	0	NA	0
Chromium	18	24	0	NA	0
Copper	18	920	0	NA	1
Lead	18	620	0	NA	2
Mercury	18	0.8	0	NA	0
Nickel	18	35	0	NA	0
Zinc	18	1,100	0	NA	4
PAH	18	29	0	NA	NA
BaP	18	2.7	0	NA	NA
TPH	18	LPQL	0	0	NA
BTEX	18	LPQL	0	0	NA
OC pesticides	18	LPQL	0	NA	NA
OP pesticides	18	LPQL	0	NA	NA
PCBs	18	LPQL	0	NA	NA
Asbestos	18	Not detected	-	-	-

Note:
LPQL: Less than Practical Quantitation Limit
NA: Not Applicable

Five lead concentrations and one benz(a)pyrene concentration exceeded the relevant CT1 criterion specified in the Waste Classification Guidelines. Two of these lead concentrations also exceeded the CT2 criterion.

2.1.7 Summary of QA/QC

Field QA/QC samples included one rinsate sample, one trip blank, one trip spike, one blind (intra-laboratory) duplicate sample and one split (inter-laboratory) duplicate sample. The field QA/QC was generally satisfactory; however some of the metal duplicate results exceeded the generally acceptable RPD (relative percent difference) value of 50%. These exceedances were attributed to sample heterogeneity.

The primary laboratory was Envirolab services Pty Ltd. CSTS stated that they checked the laboratory QA/QC results and found them acceptable.

2.1.8 Conclusions of Report

CSTS concluded that none of the results exceeded the HIL-D guideline concentrations and therefore the site was considered suitable for "Residential developments with limited soil access opportunities". EIS also note that the hydrocarbon results were all less than the concentrations specified in the GASSS. CSTS were of the opinion that the site did not pose an unacceptable risk to human health.

CSTS concluded that a number of results were above the PPILs and that these concentrations may have an adverse impact on plant growth in any landscaped sections of the site.

A preliminary waste classification was undertaken using the available data (EIS note the no TCLP analysis was undertaken). The waste classification concluded that the majority of material could be disposed of as General Solid Waste but that some of the fill material would be classified as Restricted or Hazardous Waste based on this data.

2.1.9 Recommendations of Report

The report recommended further assessment of the material (including TCLP analysis) at the time of excavation in order to assign an accurate waste classification to the material.

2.2 Data Gaps Identified by EIS

EIS have identified the following data gaps in the CSTS 2012 report:

- The Borehole logs do not distinguish between fill and natural soils. This could have a major impact on the disposal costs of excavated soil. During excavation it

will be very important to distinguish between fill and natural soil as the cost of disposal of fill material are significant. Detailed borehole logs showing the boundary between the fill and natural soil will be required;

- The waste classification of the soil has not been finalised. We note that some soil is currently classified as Restricted Solid Waste (very expensive to dispose of). Further analysis may reduce this classification to General Solid Waste;
- There has been no soil assessment beneath the buildings;
- The existing site buildings appear to have been constructed around the 1970's and can contain hazardous building material. A hazmat survey should be undertaken by a suitably qualified consultant prior to the commencement of demolition works; and
- There has been no assessment of the groundwater. We note that there will be three basement levels and therefore groundwater may be encountered.

3 SITE INFORMATION AND PHYSICAL SETTING

3.1 Site Identification

Table 3-: Site Identification Information

Site Address:	36-44 John Street, Lidcombe
Lot & Deposited Plan:	Lot 5A in DP979289, Lot 1 in DP1002517, Lot 1 in DP235940 and Lot 1 in DP511612
Current Land Use:	Mixed Commercial/residential
Proposed Land Use:	Mixed Commercial/residential
Local Government Authority:	Auburn
Current Zoning:	B4- mixed use- Auburn LEP 2100
Site Area (m^2):	2,800
RL (AHD in m) (approx.):	23 – 24
Geographical Location (MGA) (approx.):	N: 6251516 E: 319122
Site Location Plan:	Figure 1
Proposed Basement Layout Plan:	Figure 2
CSTS 2012 Sampling Plan:	Appendix B

3.2 Site Location and Setting

The site is located in a predominantly residential/retail area of Lidcombe and is bounded by residences to the west, by John Street to the east, by Ann Street to the north and by Board Street to the south. Lidcombe Primary School is located to the east of John Street and the site. Lidcombe Railway Station is located approximately 300m to the south-east of the site. Wyatt Park is located approximately 300m to the north-west of the site.

3.3 Topography

The site appears to be located in a relatively flat topographic setting with localised falls to the west. The site itself is relatively flat with minor falls to the west.

3.4 Site Inspection

An inspection of the site and immediate surrounds was outside the scope of this conceptual RAP. The information presented in this section is based on the observations made during the CSTS 2012 investigation and an interpretation of aerial photos available on Google and Six Maps.

EIS understand that the site is predominantly occupied by four buildings which generally occupy the central and east sections of the site. The buildings appear to be used for commercial/retail purposes with frontages onto John Street to the east. The

rear of the properties appears to have been surfaced with concrete pavement and occupied by parked cars. A brick shed was located on the south-west corner of the site. A few smaller sheds also appear in the rear of the main buildings.

The CSTS 2012 report indicates that the building located on the north-east section of the site was used as a grocer. The building on the south-east section of the site was used for mixed retail/residential purposes. The west portion of the site was occupied by a paved hardstand area used for parking.

3.5 Surrounding Land Use

The immediate surrounds included the following landuses:

- North – Beyond Ann Street was high rise residential;
- South – Beyond Board Street was mixed use retail/residential;
- East – Beyond John Street was predominantly residential; and
- West – Residential.

3.6 Regional Geology

The regional geological map of Sydney (1983[17]) indicates the site to be underlain by Ashfield Shale of the Wianamatta Group, which typically consists of black to dark grey shale and laminite.

3.7 Hydrogeology

A search of the groundwater bore summary records available on the NSW Office of Water[18] website was undertaken for the preparation of this report. The search was limited to registered bores located within approximately 1km of the site. The search indicated the existence of one bore (GW111940) which was registered for Monitoring purposes. The bore was located approximately 600m to the south of the site. The bore was drilled to a depth of approximately 6.1m and standing water level (SWL) was noted at a depth of approximately 2.71m.

The stratigraphy of the site is expected to consist of 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 for abstraction purposes in the immediate vicinity of the site. A perched aquifer located in the shallow subsurface is not considered to be a resource due to high salinity, poor water quality and low yield.

[17] *1:100,000 Geological Map of Sydney (Series 9130),* Department of Mineral Resources (1983)

[18] http://www.waterinfo.nsw.gov.au/gw/, visited on 30/4/13

3.8 Surface Water Flows

Based on the site and surrounding topography, surface water flows would be expected to enter the street stormwater system flowing toward the west or north-west of the site.

4 SITE CHARACTERISATION

4.1 Data Gaps

The data gaps identified in the CSTS 2012 report is outlined in **Section 2.2**.

4.2 Summary of Soil Contamination

The CSTS 2012 report concluded that none of the results exceeded the HIL-D guideline concentrations and therefore the site was considered suitable for "Residential developments with limited soil access opportunities". EIS also note that the hydrocarbon results reported in the CSTS 2012 report were all less than the concentrations specified in the GASSS. CSTS were of the opinion that the site did not pose an unacceptable risk to human health.

The CSTS 2012 report concluded that a number of results were above the PPILs and that these concentrations may have an adverse impact on plant growth in any landscaped sections of the site.

A preliminary waste classification was undertaken using the available data (EIS note the no TCLP analysis was undertaken). The waste classification concluded that the majority of material could be disposed of as General Solid Waste but that some of the fill material would be classified as Restricted or Hazardous Waste based on this data.

4.3 Contamination Fate and Transport

The fate and transport of potential contaminants that may be encountered in areas which have not been investigated are summarised in the following table:

Table 4-: Fate and Transport of PCC

PCC	Fate and Transport
Non-volatile contaminants including metals, heavy fraction PAHs, OCPs, OPPs, PCBs and asbestos	With the exception of asbestos, non-volatile contaminants are predominantly confined to the soil and groundwater medium. The mobility of these contaminants varies depending on: the nature and type of contaminant present (e.g. leachability, viscosity etc); soil type/porosity; surface water infiltration; groundwater levels; and the rate of groundwater movement. At this site, the potential for surface water infiltration is very limited which would reduce the migration potential for certain contaminants. The presence of paved surfaces in the surrounding areas can also limit the migration potential for non-volatile contaminants. Non-volatile contaminants associated with ash and slag waste (some heavy metals, heavy fraction PAHs, and sometimes heavy fraction TPHs) are bound within a relatively insoluble matrix. Slag and ash is usually formed as

PCC	Fate and Transport
	a by-product of combustion at high temperatures which 'locks in' the contaminants within the matrix. The potential for migration of asbestos fibres would increase following disturbance of asbestos contaminated soils. This is likely to occur during demolition and excavation works. A number of studies have found that soils effectively filter out asbestos fibres and retain them within the soil matrix. The studies concluded that there is no significant migration of asbestos fibres, either through soil or groundwater. The transport of airborne asbestos is associated with disturbance of the material and therefore would be expected during demolition and excavation works.
Volatile contaminants including TPH, BTEX, VOCs and light fraction PAHs	Volatile contaminants are usually more mobile when compared to the non-volatile compounds. The potential for migration of volatile contaminants such as light fraction PAHs and TPH is relatively high in sandy soil with a high water table. These contaminants break down rapidly as a result of microbial activity and availability of nutrients including nitrogen, oxygen etc. The mobile contaminants would be expected to move down to the rock surface or groundwater table and migrate down gradient from the source. The mobility would depend on a range of factors such as: soil type/porosity; surface water infiltration; groundwater levels; porosity, confining layers within the aquifer, solubility in groundwater etc.

4.4 Sensitive Receptors and Exposure Pathways

The potential receptors and exposure pathways identified at the site are presented in the following table:

Table 4-: Potential Receptors and Exposure Pathways

Receptor	Pathway
Human Receptors: • Site occupants; • Site visitors; • Contractors and workers; • Future site occupants; and • Off-site occupants.	• Exposure by direct contact via dermal, ingestion and inhalation; • Inhalation of airborne asbestos fibres; and • Abstraction and use of contaminated groundwater.
Environmental Receptors: • The stormwater system located around the site; and • Any other sensitive receptor included in the Section 149 certificates for the site.	• Exposure by direct contact with plants and animals; and • Extraction and use of contaminated water for agricultural and/or landscaping.

5 EXTENT OF REMEDIATION

5.1 Known Extent

Elevated concentrations of contaminants above the HILs and GASSS were not identified during the CSTS 2012 investigation. Concentrations above the PPILs were encountered in some samples analysed by CSTS 2012. These concentrations are not considered to be significant as the proposed development includes excavation for 3 levels of basement which extends to the site boundaries. The basement excavation will remove the majority of the contaminants above the PPILs.

5.2 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:

- The CSTS 2012 investigation was limited to accessible areas of the site and did not include sampling beneath the existing buildings;
- The Borehole logs included in the CSTS 2012 report do not distinguish between fill and natural soils;
- Hazardous building material may have been used in the existing buildings located on site; and
- There has been no assessment of the groundwater.

6 REMEDIATION OPTIONS

6.1 Soil Remediation Options

The NSW EPA follows the ANZECC/NHMRC 1992 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 Site Auditor Guidelines 2006 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 for consideration are outlined in the following table:

Table 6-: Soil Remediation Options

Remediation Option	Details
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.

Remediation Option	Details
	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.
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.
Option 3 Removal of contaminated material to an appropriate facility and reinstatement with clean material	Contaminated soils would be classified in accordance with NSW EPA guidelines for waste disposal, excavated and disposed of off-site to a NSW EPA licensed landfill. The material would have to meet the requirements for landfill disposal. Landfill gate fees (which may be significant) would apply in addition to transport costs.
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 EPA 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.

6.2 Groundwater Remediation Options

The preferred order for the remediation and management of contaminated groundwater presented in the Groundwater Contamination Guidelines 2007 is outlined below:

1. Clean-up so that the natural background water quality is restored;
2. Clean-up to protect the environmental, human and ecological health; and
3. Clean-up to the extent practicable.

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

Table 6-: Groundwater Remediation Options

Remediation Option	Details
Option 1 In-situ treatment of contaminated groundwater	Some of the in-situ treatment options include: Bio-remediation: Addition of oxygen and nutrient compounds to accelerate the natural process of organic compound decay within the environment. Chemical oxidation: Addition of chemical compounds to oxidise the contaminants in groundwater into compounds that are less harmful to the environment Air Sparging and Extraction: Air is forced through the contaminated groundwater system to volatilise organic contaminants. The air is then extracted and captured for treatment leaving reduced contaminant concentrations within the sub-strata
Option 2 Ex-situ treatment of contaminated groundwater	Some of the ex-situ treatment options include: Washing: Groundwater is stripped of contaminants via a leaching process, with the concentrated contaminated liquid product retained for disposal or additional treatment Bioreactors: Groundwater is pumped into an above ground tank and treated with inorganic nutrients. Oxygen is introduced in to the tank by sparging. Hydrocarbons are broken down by naturally occurring bacteria Contaminated groundwater is transported to an approved/licensed treatment facility, treated to remove/stabilise the contaminants then returned to the subject site or transported to an alternative facility for disposal
Option 3 On-going management & monitoring	Measures to manage groundwater contamination may include: • Notifying appropriate government agencies, owners of subsurface facilities and any other appropriate parties of the presence of groundwater contamination; • Plume containment; • Active or passive cleanup of contaminated groundwater; • Ongoing monitoring of natural attenuation; • Implementing management or contingency plans to reduce risks; and • Restricting groundwater use in and down gradient of the contaminated plume.

7 VALIDATION 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 validation;
- Outline the validation assessment criteria (VAC);
- The data quality objectives (DQOs) and data quality indicators (DQIs) adopted for the validation; and
- Details on the sampling program adopted for the validation.

The validation will be staged to facilitate the remediation works. In some sections of the site where remediation would include the installation of a capping layer, an EMP will be prepared outlining the ongoing management and monitoring requirements.

7.1 Sampling Program

The sampling program for the validation is outlined in **Section 8**. This is the minimum requirement based on conditions known to exist at the site. Additional validation sampling may be required based on the findings of the additional investigation works and site observations made during remediation.

Site observations will also be used as a validation tool to assess the extent of site contamination. In particular visual indicators such as the presence of ash/slag material or coal tar will be used to assist the validation process.

Where 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.

8 REMEDIATION DETAILS (CONCEPTUAL)

Prior to commencement of remediation work, the site management and work health and safety (WHS) plans presented in **Sections 12** should be reviewed and implemented.

Prior to proceeding with the remedial works, written approval must be sought from Auburn Council.

Geotechnical advice should be sought regarding the requirements of any backfill material (including re-used natural soil from the site) for the proposed development.

8.1 Site Remediation

8.1.1 Rationale for Selection of Remedial Strategy

Elevated concentrations of contaminants above the HILs and GASSS were not identified during the CSTS 2012 investigation. Concentrations above the PPILs were encountered in some samples analysed by CSTS in 2012. These concentrations are not considered to be significant as the proposed development includes excavation for 3 levels of basement which extends to the site boundaries. The basement excavation will remove the majority of the contaminants above the PPILs. The most appropriate remediation option for this situation is Option 3.

8.1.2 Remediation Details

The specific remediation details for this area are described below:

- Prior to commencement of physical works, an additional investigation should be undertaken to address the data gaps identified in **Section 2.2**;
- The additional investigation should include a revised Waste Classification with TCLP analysis;
- On completion of the additional works, an application should be submitted to dispose of the material to a NSW EPA landfill licensed to receive the waste stream;
- Geotechnical advice should be sought regarding the stability of the adjacent structures and/or adjacent areas prior to commencing the excavation;
- The fill material should be excavated and either stockpiled over builders plastic in a quarantine area or alternatively loaded directly onto trucks for transport to landfill;
- Validation samples should be obtained from the walls and base of the excavation after removal of the fill material to demonstrate that the underlying natural soil/bedrock is VENM; and

- In the event validation is unsuccessful, re-excavate the areas that failed and re-validate. In the event of continual validation failures, reference should be made to the contingency plan presented in this RAP.

8.1.3 Validation Sampling

As a minimum the following samples will be obtained for the validation assessment:

Table 8-: Validation Sampling

Sampling Frequency	Sampling Method	Laboratory Analytical Schedule
Soil samples from the basement excavation will be obtained as follows: Excavation Base: 1 sample per 100m^2 (10m grid spacing) (minimum 9 samples) Excavation Walls: 1 sample per 30m^2 (20 lineal meters of 1.5m high). Sample should be obtained from both fill and natural soils exposed along the walls.	Sample will be obtained using hand equipment or directly from the excavator bucket (based on the depth of excavation).	Samples will be analysed for: heavy metals, PAHs and TPH/BTEX. In the event the additional investigation identifies other contaminants of concern, they should also be included in the schedule.

In the event that elevated concentrations of contaminants are encountered in the samples above the VAC outlined in **Section 9**, the excavation will be extended and the validation process repeated for the additional area of excavation.

8.2 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.

8.3 Documentation

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

8.4 Fill Volume Analysis

The Borehole logs included in the CSTS 2012 report do not distinguish between fill and natural soils. This could have a major impact on the disposal costs of excavated soil. During excavation it will be very important to distinguish between fill and natural soil as the cost of disposal of fill material are significant. Detailed borehole logs showing the boundary between the fill and natural soil will be required.

A fill volume analysis should be included as part of the final validation assessment report based on the findings of the additional investigation. The analysis should be compared to landfill dockets.

9 VALIDATION ASSESSMENT CRITERIA (VAC)

9.1 DQOs for the Validation Assessment

The DQO process includes a clear statement of the objectives of the study and a methodology for collecting enough data of sufficient quality to support the decisions of the study. The DQOs provide a systematic approach for undertaking the assessment and outlines the criteria against which the data can be assessed.

A methodology for establishing the DQOs is presented in the US EPA document *Data Quality Objectives Process for Hazardous Waste Site Investigations* (2000[19]). This methodology has been adopted by the NEPC in NEPM 1999, AS4482.1-2005[20] and the Site Auditor Guidelines 2006. The main steps involved in preparing the DQOs include:

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; and
7. Optimise the design for obtaining data.

The first six steps provide qualitative and quantitative statements which are used in the final step to develop a data collection plan. The data is then assessed against adopted performance criteria.

The soil analytical results will be compared with the VAC outlined in **Section 9.3**. Statistical analysis will be undertaken on the analytical results (if required) as outlined in the EPA Sampling Design Guidelines 1995. The following criteria will be adopted for the assessment:

- The 95% Upper Confidence Limit (UCL) value of the arithmetic mean concentration of each contaminant should be less than the VAC;
- The standard deviation (SD) of the results must be less than 50% of the VAC; and
- No single value exceeds 250% of the relevant VAC.

UCL calculations may not be required if all results are below the VAC. Further assessment or remediation will be required when the concentration of contaminants exceed the above criteria.

[19] *Data Quality Objectives Process for Hazardous Waste Site Investigations,* US EPA, *2000* (US EPA 2000)
[20] *Guide to the Investigation and Sampling of sites with Potentially Contaminated Soil,* Standards Australia, 2005 (AS 2005)

The groundwater analytical results will be compared to the Groundwater Investigation Levels (GILs) as outlined in **Section 9.4**. The results will be assessed as either above or below the GILs.

9.2 DQIs for Analytical Data

The analytical data will be assessed against the following DQIs: precision, accuracy, representativeness, completeness and comparability. Definitions of the individual DQIs are presented in Appendix C. The table below outlines the steps that will be taken to address the DQIs:

Table 9-: DQIs

Indicator	Methods
Completeness	Data and documentation completeness will be achieved by: • Preparation of a validation sampling and analysis plan as outlined in **Section 8**; • Preparation of chain of custody (COC) records; • Review the laboratory sample receipt information; • Use of National Association of Testing Authorities (NATA) registered laboratories for all analysis; • Visual and PID screening of samples during the investigation; and • Laboratory analysis to target PCC.
Comparability	Data comparability will be achieved by: • Maintaining consistency in sampling techniques; • Use of appropriate preservation, storage and transport methods; and • Use of consistent analysis techniques and reporting standards by the laboratories.
Representativeness	Data representativeness will be achieved by: • Appropriate coverage of sample locations in the remediation areas as outlined in **Section 8**; and • Representative coverage of analysis for PCC.
Precision	Precision will be achieved by: • Calculating the relative percentage difference (RPD) of duplicate samples; • The following acceptance criteria will be used to assess the RPD results: ➢ results > 10 times the practical quantitation limit (PQL), RPDs < 50% are acceptable; ➢ results between 5 and 10 times PQL, RPDs < 75% are acceptable; ➢ results > 5 times PQL, RPDs < 100% are acceptable; and • An explanation is provided if RPD results are outside the acceptance

Indicator	Methods
	criteria. As a conservative measure, the higher value is adopted when the value exceeds the VAC.
Accuracy	Accuracy will be achieved by: • Use of trained and qualified field staff; • Appropriate industry standard sampling equipment and decontamination procedures; • Sampling and screening equipment will be factory calibrated on a regular basis. Calibration will be checked internally prior to use; • Sampling and equipment decontamination; • Collection and analysis of field Quality Assurance (QA) and Quality Control (QC) samples for PCC; • As a minimum, the field QA/QC analysis will include: ➢ 5% of samples as inter-laboratory duplicates; ➢ 10% of samples as intra-laboratory duplicates; ➢ 1 trip blank sample per batch; ➢ 1 rinsate sample of field equipment per day of sampling, and ➢ 1 trip spike sample per batch of volatiles; • Acceptable concentrations in trip blanks, trip spikes and rinsate samples. Non-compliance to be documented in the report; • Appropriate sample preservation, handing, holding time and COC procedure; • Review of the primary laboratory QA/QC data including: RPDs, surrogate recovery, repeat analysis, blanks, laboratory control samples (LCS) and matrix spikes; • The following acceptance criteria will be used to assess the primary laboratory QA/QC results. Non-compliance to be documented: ➢ <u>RPDs</u>: o results that are < 5 times the PQL, any RPD is acceptable; and o results > 5 times the PQL, RPDs between 0-50% are acceptable; ➢ <u>LCS recovery and matrix spikes</u>: o 70-130% recovery acceptable for metals and inorganics; o 60-140% recovery acceptable for organics; and o 10-140% recovery acceptable for VOCs; ➢ <u>Trip spike and Surrogate spike recovery</u>: o 60-140% recovery acceptable for general organics; and o 10-140% recovery acceptable for VOCs; ➢ <u>Blanks</u>: All less than PQL (ALTPQL); and • Reporting to industry standards.

9.3 Soil VAC

The VAC for soil contaminants are derived from NEPM 1999 and the Site Auditor Guidelines 2006.

9.3.1 Health Investigation Levels (HILs)

The NEPM 1999 includes Health Based Investigation Levels (HILs) for a range of contaminants based on the risk of exposure, duration of exposure, toxicity and land use (availability). The HILs are divided into four categories outlined in the following table:

Table 9-: HILs Categories

Category/Column	Land Use
Column A	'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.
Column D	Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats.
Column E	Parks, recreational open space and playing fields: includes secondary schools.
Column F	Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites.

Where the proposed land use includes more than one land use category (for example a mixed-use development including residential/retail/commercial land uses) the exposure setting of the most 'sensitive' land use should be adopted for the site.

9.3.2 Petroleum Hydrocarbons in Soil

Threshold concentrations for petroleum hydrocarbon including total TPH and BTEX compounds have been adopted from the Service Station Guidelines 1994 referenced in the Site Auditor Guidelines 2006. Heavy fraction petroleum hydrocarbon aliphatic/aromatic component threshold concentrations have been adopted from NEPM 1999 (as applicable).

Soil samples are initially analysed for total recoverable hydrocarbons (TRH) without a preliminary silica gel clean-up of the sample. Consequently the TRH result may include other compounds such as phthalates, humic acids, fatty acids and sterols (if present).

Silica gel clean-up should remove these other compounds and result in a more accurate result for petroleum hydrocarbons. If undertaken these results have been referred to as TPH_{sgel} within this report.

9.3.3 Provisional Phyto-toxicity Investigation Levels (PPILs)

PPILs are included in the validation assessment where the proposed land use includes landscaped areas or garden accessible soils. Contaminants above the PPIL threshold may cause phytotoxicity in some plant species. The PPILs are listed in the Site Auditor Guidelines 2006 and are identical to the Ecological Investigation Levels (EILs) specified in NEPM 1999.

9.3.4 Asbestos in Soil

The NEPM 1999 do not provide numeric guidelines for the assessment of asbestos in soil. The draft NEPM[21] guidelines have essentially adopted the Western Australian Asbestos Guidelines 2009[22] which prescribe a site investigative model and asbestos clean-up goals. These guidelines however, have not yet been adopted in NSW and as such are generally only used on a site specific basis.

The general criterion currently used for the assessment of asbestos in soil is the presence/absence of asbestos in soil in accordance with AS4964-2004[23]. If asbestos is found to be present, the status of the asbestos material (friable or bonded/non-friable) is further considered due to the implications associated with site remediation and/or management.

The WorkCover publication *Working with Asbestos Guide* (2008[24]) recommends that the status of the asbestos material in soil should be assessed by an occupational hygienist. More recently, the 2011 WHS Regulation[25] and associated Safe Work Australia code of practice, *How to Safely Remove Asbestos*[26] (endorsed by WorkCover NSW) states that the assessment of asbestos contaminated soil is to be undertaken by a licenced asbestos assessor or competent person. WorkCover NSW has not currently

[21] *Draft National Environmental Protection (Assessment of Site Contamination) Measure,* as varied, National Environment Protection Council (NEPC), 2011 (Draft NEPM 2011)

[22] *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, WA Department of health, Perth, Australia, May 2009 (Western Australian Asbestos Guidelines 2009)

[23] Australian Standard 4964, *Method for the Qualitative Identification of Asbestos in Bulk Samples*, Australian Standards, 2004

[24] *Working with Asbestos Guide,* NSW WorkCover, 2008 (WorkCover Working with Asbestos Guide 2008)

[25] *Work Health and Safety Regulation*, NSW Government 2011

[26] *National Code of Practice How to Safely Remove Asbestos*, Safe Work Australia 2011

issued any licences for asbestos assessors. Correspondence with WorkCover indicates that the licence program is currently being implemented in accordance with the Safe Work Australia Guide for Applicants for Asbestos Assessor Licences[27]. The ACT Planning and Land Authority currently issues licences for asbestos assessor Class A and Class B.

At present, the assessment of asbestos contamination in soil is undertaken in accordance with the NEPM guidelines, the adoption of the draft NEPM is considered only on a site specific basis. Assessment of the contaminant levels and status of asbestos contaminated soil is undertaken by a combination of: site assessment by experienced environmental consultants and ACT accredited asbestos assessors; and soil screening by NATA endorsed laboratories using AS4964-2004.

9.3.5 Soil Assessment Criteria

The soil assessment criteria adopted for the validation assessment is presented in the following table:

Table 9-: Soil VAC

Analyte	Column D[1] (mg/kg)	PPILs[2] (mg/kg)
Metals		
Arsenic (total)	400	20
Cadmium	80	3
Chromium (III)	48%	400
Copper	4000	100
Lead	1200	600
Mercury (inorganic)	60	1
Nickel	2400	60
Zinc	28000	200
Petroleum Hydrocarbons		
TPH (C_6-C_9)	65 [a]	Na
TPH (C_{10}-C_{36})	1000 [a]	Na
Benzene	1 [a]	Na
Toluene	1.4 [a]	Na
Ethylbenzene	3.1 [a]	Na
Total Xylenes	14 [a]	Na
PAHs		
Total PAHs	80	Na
Benzo(a)pyrene	4	Na

[27] *Guide for Applicants for Asbestos Removal and Asbestos Assessor Licences and Notifications*, Safe Work Australia 2012

Analyte	Column D[1] (mg/kg)	PPILs[2] (mg/kg)
Pesticides		
Aldrin + Dieldrin	40	Na
Chlordane	200	Na
DDT+ DDD + DDE	800	Na
Heptachlor	40	Na
Total OPPs	0.1[b]	Na
Others		
PCBs (Total)	40	Na
Asbestos	NDLR [c]	Na

Note:

1 – HILs outlined in NEPM 1999

2 – PPILs outlined in the Site Auditor Guidelines 2006

a - Service Station Guidelines 1994

b- Due to the absence of locally endorsed guideline criteria, the laboratory PQL has been adopted

c - Not Detected at Limit of Reporting (NDLR)

Na – Not Applicable

The PPILs will be used to assess any areas not excavated and used for landscaping purposes.

9.3.6 Waste Classification Criteria for Off-Site Disposal

Additional material excavated for the validation assessment may require a waste classification for off-site disposal in accordance with the Waste Classification Guidelines 2009.

Soils are classed into the following categories based on the chemical contaminant criteria outlined in the guidelines (refer to Table A):

Table 9-: Waste Categories

Category	Description
General Solid Waste (non-putrescible) (GSW)	• If SCC ≤ CT1 then TCLP not need to classify the soil as GSW • If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as GSW
Restricted Solid Waste (non-putrescible) (RSW)	• If SCC ≤ CT2 then TCLP not need to classify the soil as RSW • If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as RSW
Hazardous Waste (HW)	• If SCC > CT2 then TCLP not need to classify the soil as HW • If TCLP > TCLP2 and/or SCC > SCC2 then treat as HW
Virgin Excavated Natural Material (VENM)	Natural material (such as clay, gravel, sand, soil or rock fines) that meet the following: • 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.

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

9.4 Groundwater Investigation Levels (GILs) for Validation Assessment

The appropriate settings for current and potential uses of groundwater should be identified for establishing the GILs. The guidelines applicable for the validation assessment are outlined in the following table:

Table 9-: GILs Applicable for the Validation Assessment

Guideline	Applicability
ANZECC 2000	Includes a framework for developing guidelines for aquifer assessment. The guidelines provide water quality parameters for aquatic ecosystems (fresh and marine waters), industrial, agricultural and irrigation uses. The closest receiving water body in the vicinity of the site is the stormwater system. Surface water runoff into stormwater is predominantly fresh water. Hence the fresh water trigger values will be adopted for the assessment. The NSW EPA promotes the use of trigger values for the protection of 95% of aquatic ecosystems except where the contaminants have the potential to bio-accumulate, in which case the 99% trigger values are recommended. The 95% trigger values will be adopted for the validation assessment. Where necessary, the low reliability trigger values may be quoted.
NHMRC 2011	Includes the Australian Drinking Water Guidelines used to assess drinking water quality. The groundwater bore search did not indicate the presence of bores registered for domestic use in the vicinity of the site. The abstraction and use of groundwater for drinking purposes is unlikely to occur at or around the site. Therefore these guidelines have not been adopted.
Dutch Guidelines 2000[28]	In the absence of locally endorsed guidelines for petroleum hydrocarbon in groundwater, the 'intervention value' concentration for mineral oil specified in the Dutch Guidelines will be adopted as the GIL for TPH (C_{10}-C_{36} fractions only). It is noted that these guidelines have not been endorsed by NSW EPA and are used only as a preliminary screening tool.
USEPA	In the absence of locally endorsed guidelines for individual PAHs and VOCs in groundwater, the USEPA Region 9 PRGs for 'Tap Water' will be adopted as the GILs for individual PAHs and VOCs. It is noted that these guidelines have not been endorsed by NSW EPA and are used only as a preliminary screening tool.

9.4.1 Hardness Modified Trigger Values (HMTVs)

Water hardness can affect the bioavailability of metals/metalloids in fresh water. Consequently, Section 3.4.3.2 of the ANZECC 2000 guidelines includes algorithms to derive hardness modified trigger values (HMTVs) for metals/metalloid concentrations in

[28] *Circular on Target Values and Intervention Values for Soil Remediation,* Ministry of Housing, Spatial Planning and Environment, 2000 (Dutch Guidelines 2000)

fresh water. The HMTVs will be adopted as the GILs where applicable as outlined in the following section.

9.4.2 GILs for Individual Analytes

The GILs for individual analytes are outlined in the following table:

Table 9-: GILs for Individual Analytes

	GIL - ANZECC 2000 [1] Fresh Waters	GIL - US EPA[5]
Heavy Metals		
Arsenic (As III)	24	
Cadmium	0.2	
Chromium (III)	3.3[a]	
Chromium (VI)	1	
Copper	1.4	
Lead	3.4	
Mercury (inorganic)	0.6	
Nickel	11	
Zinc	8	
Petroleum Hydrocarbons (TPH Compounds)		
Hydrocarbons C6-C9	nsl	
Hydrocarbons C10-C14	nsl	
Hydrocarbons C15-C28	nsl	
Hydrocarbons C29-C36	nsl	
Total Hydrocarbons C10-C36	600[b]	
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)		
Benzene	950[a]	
Toluene	180[a]	
Ethylbenzene	80[a]	
m + p-xylene	75[m]	
o-xylene	350[a]	
Total xylenes	nsl	
Polycyclic Aromatic Hydrocarbons (PAHs)		
Naphthalene	16[a]	0.14
Acenaphthylene	nsl	nsl
Acenaphthene	nsl	400
Fluorene	nsl	220
Phenanthrene	0.6[c]	nsl
Anthracene	0.01[c]	1300
Fluoranthene	1[c]	630
Pyrene	nsl	87

	GIL - ANZECC 2000 [1] Fresh Waters	GIL - US EPA[5]
Benzo(a)anthracene	nsl	0.029
Chrysene	nsl	2.9
Benzo(b,k)fluoranthene	nsl	0.029[r]
Benzo(a)pyrene	0.1[c]	0.003
Indeno(1,2,3-c,d)pyrene	nsl	0.029
Dibenzo(a,h)anthracene	nsl	0.003
Benzo(g,h,i)perylene	nsl	nsl
Total PAHs	nsl	nsl

Note:

1 - ANZECC Australian Water Quality Guidelines for Fresh Waters, 2000 - Trigger Values for protection of 95% of species

5 - In the absence of Australian guidelines, the USEPA (2010) Region 9 Screening Levels for tapwater have been adopted as a preliminary screening tool

a - In the absence of a high reliability guideline concentration, the moderate or low reliability guideline concentration has been quoted

c - 99% trigger values adopted due to the potential for bioaccumulation effects

m - Guideline value adopted for m-Xylene. We note that the m-Xylene guideline value is 75ug/L and the p-Xylene guideline value is 200ug/L. However these two isomers cannot be distinguished analytically. Therefore EIS have adopted the more conservative guideline value

r - The more conservative value for Benzo(b)fluoranthene has been adopted

9.4.3 Groundwater Management Plan (GMP)

In the event remediation of contaminants in groundwater is not achieved with the remediation option adopted for the site, a groundwater management plan (GMP) should be prepared and implemented. The GMP should address the following issues as a minimum:

- Options for the ongoing long-term treatment of groundwater;
- Outline the management goals for groundwater; and
- Risk to site occupants of contamination remaining on-site.

10 IMPORTATION OF MATERIAL

10.1 Material Imported for Landscaping

The proposed development may require suitable material (topsoil, nutrient rich soil, etc.) to be imported onto the site for landscaping purposes. In our experience, this type of material generally does not meet the definition of virgin excavated natural material (VENM) as outlined in the Waste Classification Guidelines 2009.

In order to minimise the risk of importing potentially contaminated material onto the site, the following measures should be adopted:

- Documentation should be obtained from the supplier indicating that the material is suitable for landscaping purposes at the site;
- An inspection of the source material should be undertaken prior to importation onto the site. As a minimum, the material should be sampled at a ratio of 3 samples per 100m^3 of material to be imported. The samples should be analysed for: heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc); TPH/BTEX, PAHs, OCP/OPP/PCBs; and asbestos. A suitable QA/QC procedure should be adopted in accordance with the DQIs outlined in **Section 9.2**;
- The analytical data should be assessed against the importation acceptance criteria detailed in the table below;
- Provided that the analysis results do not exceed the assessment criteria, the material can be imported onto the site and stockpiled away from the remediation area or any other stockpiles located on site; and
- Upon importation, the material should be inspected to confirm that the material is the same as what was initially sampled.

Table 10-: Acceptance Criteria for Material Imported for Landscaping

Contaminant	Acceptance Criteria (mg/kg)	Reference Guideline
Arsenic (total)	20	a
Cadmium	3	a
Chromium (Total)	400	a
Copper	100	a
Lead	600	a
Mercury (inorganic)	1	a
Nickel	60	a
Zinc	200	a
Benzo[a]pyrene	1	b
PAHs	20	b
OCPs	0.1	b
OPPs	0.1	b
PCBs	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	-

Notes:

a – PPILs in NEPM 1999

b – Laboratory PQL

10.2 Importation of Virgin Excavated Natural Material (VENM)

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, ie. 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 acceptance 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 recommended in the Service Station Guidelines 1994.

A suitable QA/QC procedure should be adopted in accordance with the DQIs outlined in **Section 9.2**.

EIS have adopted the following acceptance criteria for VENM. Please note that screening for additional contaminants may be required based on the site history of the source site.

Table 10-: Acceptance Criteria for VENM

Contaminant	Acceptance Criteria (mg/kg)	Source of Acceptance Criteria
Arsenic (total)	1-50	a
Cadmium	1	a
Chromium (Total)	5-1000	a
Copper	2-100	a
Lead	2-200	a
Mercury (inorganic)	0.03	a
Nickel	5-500	a
Zinc	10-300	a
Benzo[a]pyrene	0.05	b
Polycyclic Aromatic hydrocarbons	0.05-0.2	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	-
Aesthetics	No odour or discolouration	c

Notes:

a – Background Levels in NEPM 1999

b – Laboratory PQL

c – Site Auditors Guidelines 2006

11 CONTINGENCY PLAN

A review of the proposed remediation works has indicated that the greatest risk that may affect the success of the remediation is an unexpected find during earthworks.

11.1 Unexpected Finds

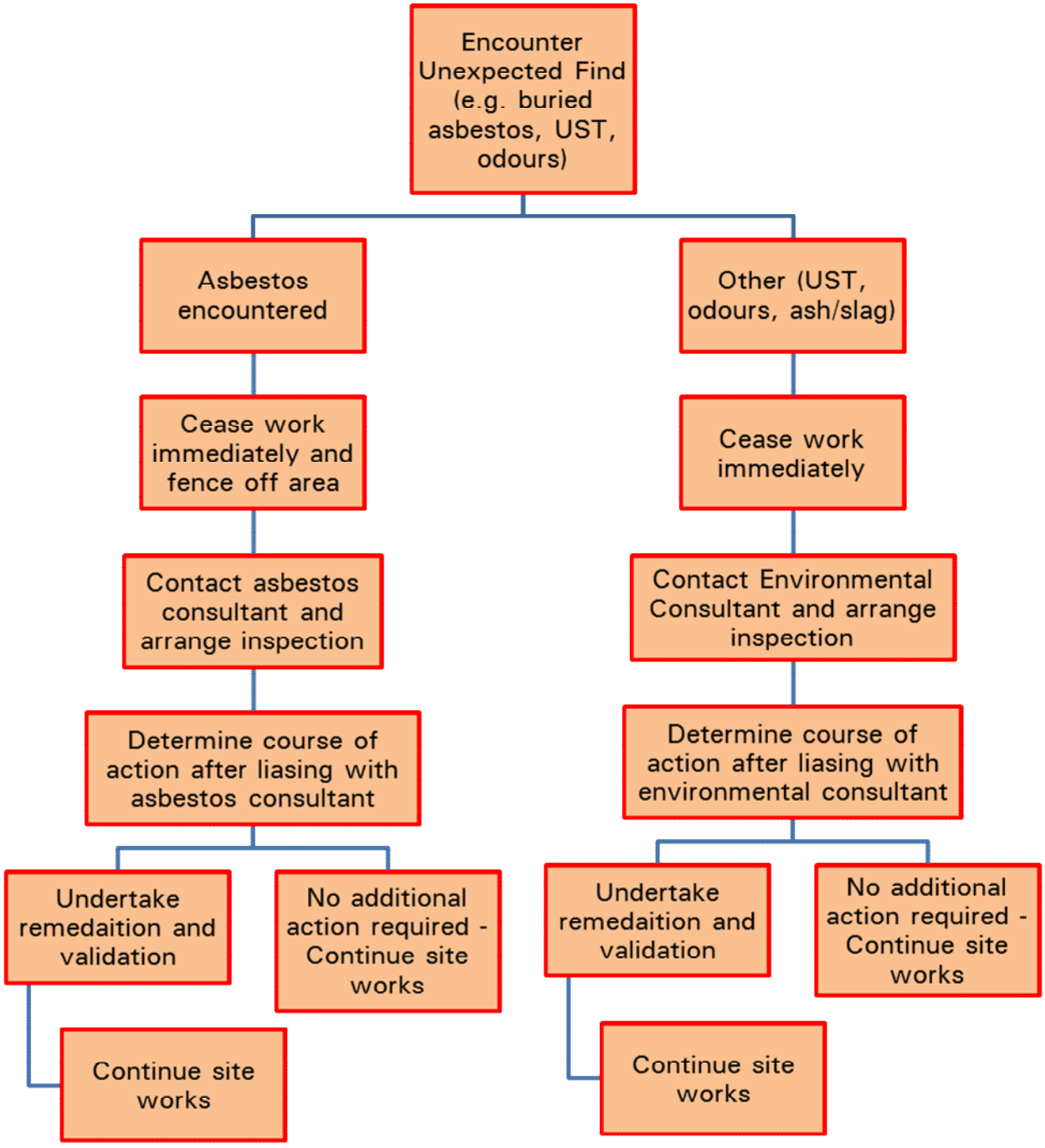
There is a possibility that additional hazards exist at the site. The extent of the contamination has been interpreted from point source data and a documented process of reviewing historical site activities. However, ground conditions may vary between sampling locations and additional hazards may arise 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: USTs, fragments of fibre cement (possibly containing asbestos), odourous or stained hydrocarbon impacted soils, 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.

The following flow chart can be provided to all site workers as a summary of the above unexpected finds protocol:


Encounter Unexpected Find (e.g. buried asbestos, UST, odours)
Asbestos encountered
Other (UST, odours, ash/slag)
Cease work immediately and fence off area
Cease work immediately
Contact asbestos consultant and arrange inspection
Contact Environmental Consultant and arrange inspection
Determine course of action after liasing with asbestos consultant
Determine course of action after liasing with environmental consultant
Undertake remedaition and validation
No additional action required - Continue site works
Undertake remedaition and validation
No additional action required - Continue site works
Continue site works
Continue site works

11.2 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).

11.3 Importation Failure for VENM or Landscaping Soil Materials

Where material to be imported onto the site does not meet the importation acceptance criteria detailed in **Section 10**, the only option is to not accept the material. Alternative material must be sourced that meets the importation requirements.

11.4 Demolition of Buildings Containing Hazardous Materials

In the unexpected event that any issues arise during removal of the hazardous building materials from the site, all work should cease and the environmental and hazardous building materials consultants should be contacted. As a minimum, the 'Unexpected Finds' procedure detailed in **Section 11.1** should be implemented along with any additional recommendations from the hazmat consultant.

11.5 Failure of Natural Attenuation of Groundwater Contaminants

Where natural attenuation of groundwater contamination is ineffective, the following actions may be considered:

- Addition of treatment compounds to the groundwater to speed up the bio-degradation process; or
- Revision of the groundwater remediation strategy to include active groundwater remediation (i.e. ex-situ treatment).

Alternative options for groundwater remediation/management should be considered, including:

- More intrusive remediation methods such as vacuum extraction; or
- Undertaking a health risk assessment and preparation of a groundwater management plan.

11.6 Long-term Site Management

If remediation is undertaken in accordance with this RAP no long term management of the site is considered necessary. However, if remediation cannot be completed, due to site constraints, and contamination is to remain on the site management may be required. This may include production of an environmental management plan (EMP) for

the site. Assessment of any long-term management strategies required should be undertaken following completion of remediation works at the site.

11.7 Disposal of Hazardous Waste

Material classed as 'Hazardous Waste' in accordance with the Waste Classification Guidelines 2009 may require further assessment and stabilisation prior to off-site disposal. Disposal approval may also be required from the NSW EPA and EPA licensed landfill facility.

The presence of 'Hazardous Waste' may result in significant delays and additional cost to the project.

11.8 Groundwater Seepage and Dewatering

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. Contaminated groundwater will require treatment prior to disposal.

12 SITE MANAGEMENT

12.1 Interim Site Management

Based on the existing information, 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.

12.2 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.

Table 12-: Project Contacts

Task	Company	Contact Details
Remediation Contractor – Site Manager	TBA	TBA
Project Manager	TBA	TBA
Site Contamination Consultant	Environmental Investigation Services	9888 5000
Geotechnical Consultant	TBA	TBA
Certifier	TBA	TBA
EPA	Pollution Line	131 555
Emergency Services	Ambulance Police Fire Department	000
General Hospital	Auburn Hospital	8759 3000

Note:

TBA: to be appointed.

12.3 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.

12.4 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.

12.5 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)[29] (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.

12.6 Noise and Vibration Control Plan

Australian Standard AS2460 (2002[30]) 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).

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.

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

[30] Australian Standard (2002) AS2460[30] Acoustics - Measurement of the reverberation time in rooms

12.7 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 Waste Classification Guidelines 2009.

12.8 Air Monitoring

Prior to the commencement of asbestos remediation works, air monitoring should be undertaken in the vicinity of the works and along the site parameters. A qualified occupational hygienist or asbestos consultant should be appointed to assess the extent of monitoring required at the site. Appropriate NSW WorkCover permits should be obtained for asbestos remediation works.

12.9 Dewatering of Excavations

A license application should be lodged to the NSW Office of Water in order to obtain a permit for temporary construction dewatering. Disposal approval will also be required from Auburn Council.

Based on previous EIS experience, Council typically requires that any groundwater being discharged needs to meet the ANZECC 2000 guidelines. If groundwater contamination is encountered during the additional investigation, some treatment is likely to be required. Turbid water will also need to be treated with flocculent prior to disposal.

12.10 Odour Control Plan

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

- Maintenance of construction equipment so that exhaust emissions comply with the Clean Air Regulations issued under the POEO Act1997[31];
- 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 generated 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.

Disturbance of hydrocarbon contaminated soils is likely to result in odorous conditions. The following odour management plan should be implemented to limit the exposure of site personnel and surrounding residents to unpleasant odours:

- Excavation and stockpiling of material should be scheduled during periods with low winds if possible;

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

- Biosolve or a similar product should be sprayed on material during excavation and following stockpiling to reduce odours;
- All complaints from workers and neighbours should be logged and a response provided. Work should be rescheduled as necessary to minimise odour problems;
- The site foreman should consider the following odour control measures as outlined in the National Environment Protection Measure (NEPM.), No. 9, *Draft Guideline on the Protection of Health and the Environment During the Assessment of Contamination (1999*[32]*):*
  - reduce the exposed surface of the odorous materials;
  - time excavation activities to reduce off-site nuisance (particularly during strong winds); and
  - cover exposed excavation faces overnight or during periods of low excavation activity.
- If continued complaints are received, alternative odour management strategies should be considered and implemented.

12.11 Health and Safety Plan

A site specific work health and safety (WHS) plan should be prepared by the contractor for all work to be undertaken at the site. The WHS plan should meet all the requirements outlined in NSW WorkCover WHS regulations.

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.

12.12 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the contractor should develop a waste management or recycling plan to minimise the amount of waste produced by the site. This should, as a minimum, include measures to recycle and re-use excavated material wherever possible.

[32] National Environment Protection Measure (NEPM.), No. 9, *Draft Guideline on the Protection of Health and the Environment During the Assessment of Contamination (1999)*

12.13 Incident Management Contingency

EIS or the environmental consultant engaged to undertake site validation works should be contacted if any unexpected conditions are encountered at the site. This should enable the scope of remedial/validation works to be adjusted as required. Similarly if any incident occurs on site, EIS should be advised to assess potential impacts on site contamination conditions and the remediation/validation timetable.

12.14 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/regulatory bodies.

12.15 Material Tracking

A Material Tracking Plan (MTP) should be prepared for the remedial site works:

- In the event that cap and contain is the selected remedial option to:
  - Monitor and check incoming materials to be used to cap the site;
  - Record the on-site location of imported materials with reference to the source site; and
- Check the appropriate disposal of contaminated fill material in the event that excavation and off-site disposal is the selected remedial option.

13 CONCLUSION AND REGULATORY COMPLIANCE

EIS are of the opinion that the site can be made suitable for the proposed mixed use commercial/residential development provided the following items are addressed:

- An additional investigation to address the data gaps outlined in **Section 2.2**;
- Prepare a final RAP based on the findings of the additional investigation; and
- Prepare a validation report after the completion of remedial works.

13.1 Remediation Category

Site remediation can fall under the following two categories outlined in SEPP55:

Table 13-: Remediation Category

Category	Details	Applicability
Category 1	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. Approval is required from the consent authority for Category 1 remediation work. 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).	EIS recommend the client to contact Council regarding the remediation category applicable for the site.

Category	Details	Applicability
Category 2	Remediation works which do not fall under the above category are classed as Category 2. Development consent is not required for Category 2 remediation works, however the consent authority should be given 30 days notice prior to commencement of works.	EIS recommend the client to contact Council regarding the remediation category applicable for the site..

13.2 Regulatory Requirements

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

Table 13-: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination 2008[33]	At this stage, EIS consider that there is no requirement to notify the NSW EPA of the site contamination. After successful implementation of the RAP and validation assessment, the site contamination is unlikely to meet the Notification Triggers.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner.
Water Management Act 2000[34]	The remediation of contaminated groundwater may require treatment. Relevant approval should be obtained from NSW EPA and NSW Office of Water (NOW) prior to the commencement of pumping and treatment.
Dewatering Approval	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.
Work Health and Safety Code of Practice 2011[35]	Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan.

[33] *Guidelines on the Duty to Report Contamination*, NSW Government Legislation, 2008 (Duty to Report Contamination 2008)
[34] NSW Government Water Management Act 2000
[35] Code of Practice – How to Manage and Control Asbestos in the Workplace, WHS Regulation 2011

14 LIMITATIONS

The report limitations are outlined below:

- EIS accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development/remediation works should be inspected by an environmental consultant as soon as possible;
- This report has been prepared based on site conditions which existed at the time of the previous investigations; scope of work and limitation outlined in the EIS proposal; and terms of contract between EIS and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- This report has been prepared in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated in the report;
- EIS has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- EIS have not and will not make any determination regarding finances associated with the site;
- Additional investigation/remediation work may be required in the event of changes to the proposed development or landuse. EIS should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa;
- 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 in this report is the property of EIS. EIS has used a degree of care, skill and diligence normally exercised by consulting professionals 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;

- If the client, or any person, provides a copy of this report to any third party, such third party must not rely on this report except with the express written consent of EIS; and
- Any third party who seeks to rely on this report without the express written consent of EIS does so entirely at their own risk and to the fullest extent permitted by law, EIS accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

LIST OF IN-TEXT TABLES:

IMPORTANT INFORMATION ABOUT THIS REPORT

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

The Report is Based on a Unique Set of Project Specific Factors:
This report has been prepared in response to specific project requirements as stated in the EIS proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- the proposed land use is altered;
- the defined subject site is increased or sub-divided;
- the proposed development details including size, configuration, location, orientation of the structures are modified;
- the proposed development levels are altered, eg addition of basement levels; or
- ownership of the site changes.

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

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

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

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

Assessment Limitations
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a

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

Misinterpretation of Site Assessments by Design Professionals

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

Logs Should not be Separated from the Assessment Report

Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problems, 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.

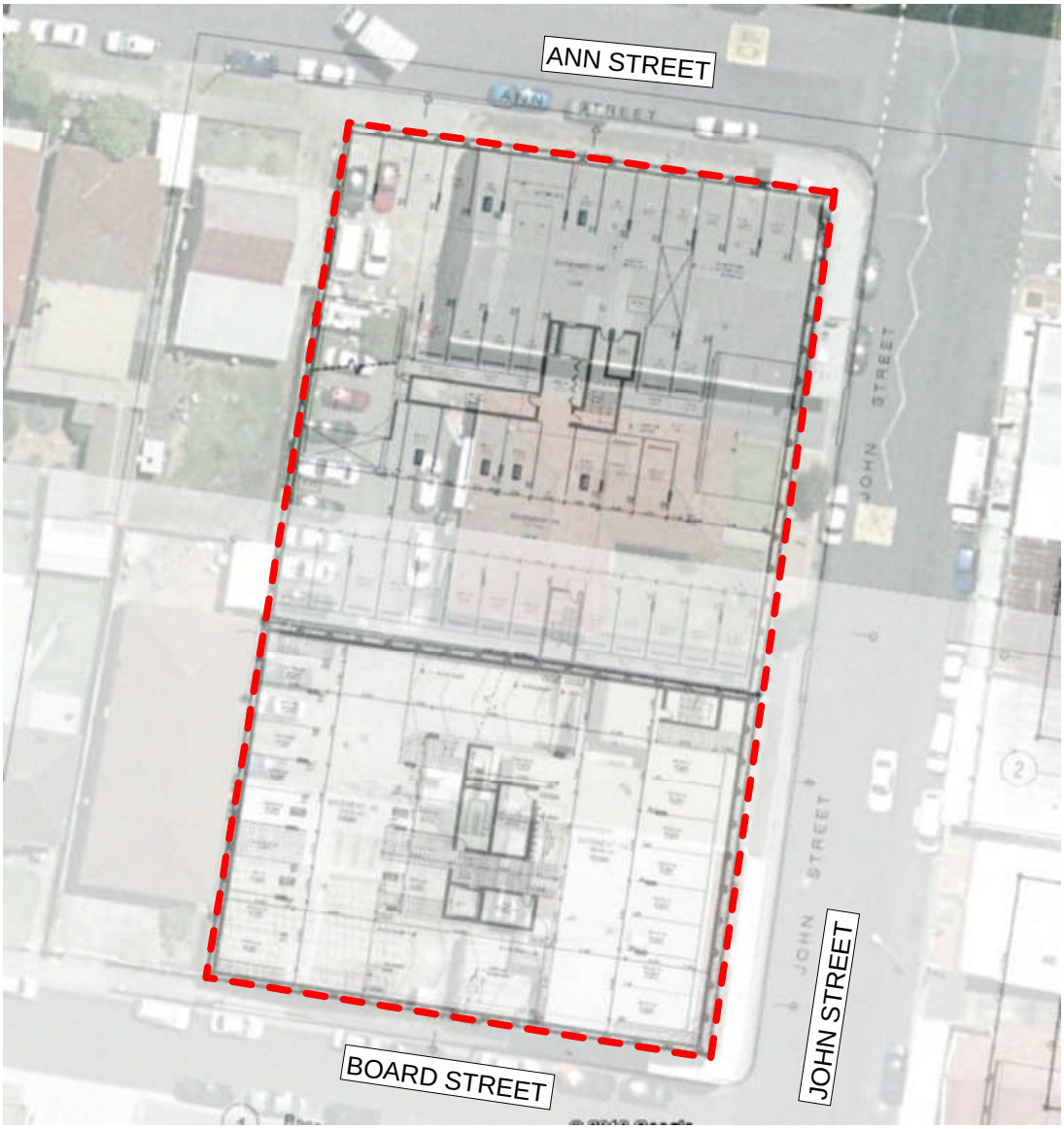
REPORT FIGURES

NOTES:
Figure 1 has been recreated from UBD on disc (version 5.0). Figure is not to scale.

UBD Map ref: 232 D7

Reference should be made to the report text for a full understanding of this plan.

ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: **E26515KB**	Title: **SITE LOCATION PLAN**
	Figure: **1**	Address: **36, 38, 40-42 and 44 JOHN STREET, LIDCOMBE, NSW 2141**



N

LEGEND:

Approximate site boundary

NOTES:
Figure 2 has been recreated from both Google Earth and the site basement plans

The borehole locations presented on this plan have been established from site measurements only and should not be construed as survey points.

Reference should be made to the report text for a full understanding of this plan.

Approximate Scale (in meters)

0 10 20 30 40

ENVIRONMENTAL INVESTIGATION SERVICES

Project Number:	Title:
E26515KB	**PROPOSED BASEMENT LAYOUT PLAN**
Figure:	Address:
2	**36-38, 40-42, 44 JOHN STREET, LIDCOMBE, NSW**

REPORT TABLES

TABLE A
CHEMICAL CONTAMINANT CRITERIA FOR WASTE CLASSIFICATION
Waste Classification Guidelines Part 1: Classifying Waste DECCW NSW July 2009
All data in mg/kg unless stated otherwise

CONTAMINANT	GENERAL SOLID WASTE			RESTRICTED SOLID WASTE		
	CT1 (mg/kg)	TCLP1 (mg/L)	SCC1 (mg/kg)	CT2 (mg/kg)	TCLP2 (mg/L)	SCC2 (mg/kg)
Heavy Metals						
Arsenic	100	5	500	400	20	2,000
Beryllium	20	1	100	80	4	400
Cadmium	20	1	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	180	400	20	720
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)						
Benzene	10	0.5	18	40	2	72
Toluene	288	14.4	518	1,152	57.6	2,073
Ethyl benzene	600	30	1,080	2,400	120	4,320
Total xylenes	1,000	50	1,800	4,000	200	7,200
Total Petroleum Hydrocarbons (TPHs)						
Light Fraction TPH (C6-C9)	nsl	nsl	650	nsl	nsl	2,600
Mid to Heavy Fraction TPH (C10-C36)	nsl	nsl	10,000	nsl	nsl	40,000
Polycyclic Aromatic Hydrocarbons (PAHs)						
Benzo(a)pyrene	0.8	0.04	10	3.2	0.16	23
Total PAHs	nsl	nsl	200	nsl	nsl	800
Others						
Polychlorinated biphenyls	nsl	nsl	<50	nsl	nsl	<50
Phenol (non-halogenated)	288	14.4	518	1,152	57.6	2,073
Scheduled chemicals	nsl	nsl	<50	nsl	nsl	<50

Explanation:

1). General Solid Waste (GSW):

- If SCC ≤ CT1 then TCLP not needed to classify the material as GSW
- If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as GSW

2). Restricted Solid Waste (RSW):

- If SCC ≤ CT2 then TCLP not needed to classify the material as RSW
- If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as RSW

3). Hazardous Waste (HW):

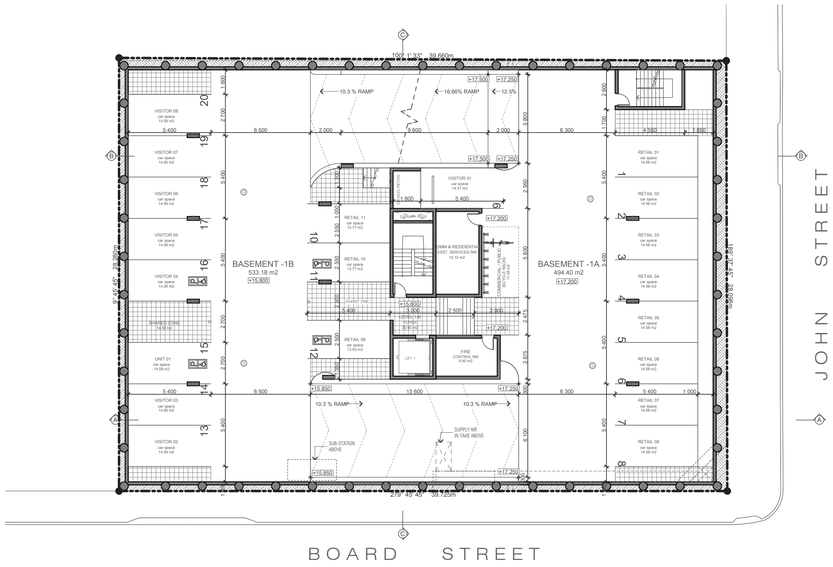
- If SCC > CT2 then TCLP not needed to classify the material as HW
- If TCLP > TCLP2 and/or SCC > SCC2 then treat as HW

Abbreviations:

SCC – Specific Contaminant Concentration
CT – Contaminant Threshold
TCLP – Toxicity Characteristics Leaching Procedure
nsl - No Set Limit
DECCW - NSW Department of Environment, Climate Change and Water (now EPA)

APPENDIX A

Proposed Development Plans



1 Basement Level -1 Plan - Visitor & Commercial
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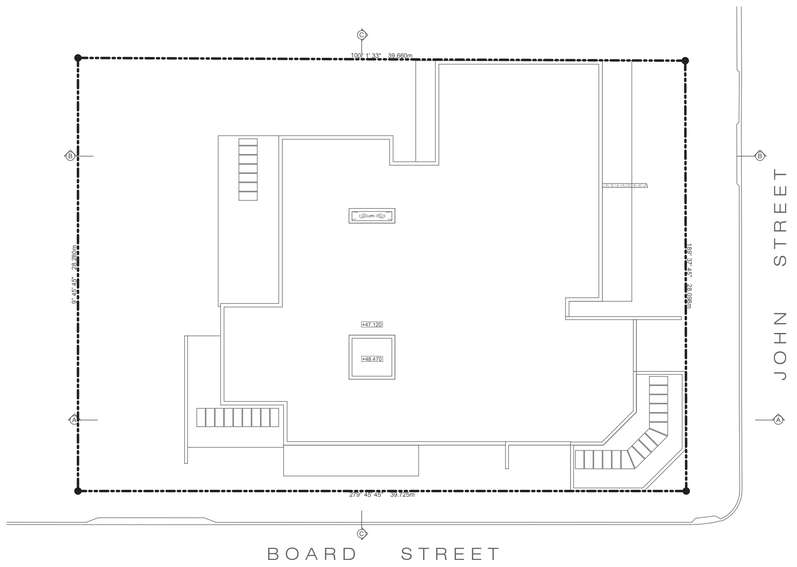
Scale 1:400 @ A3



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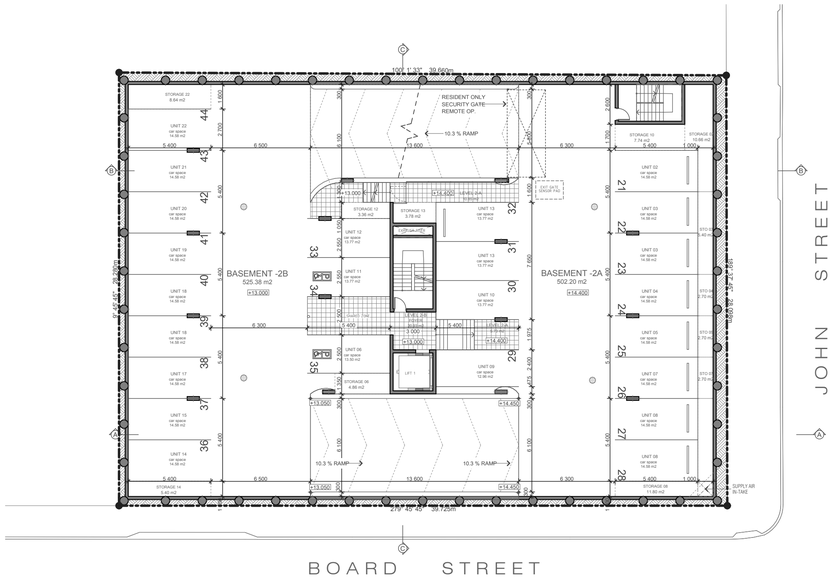
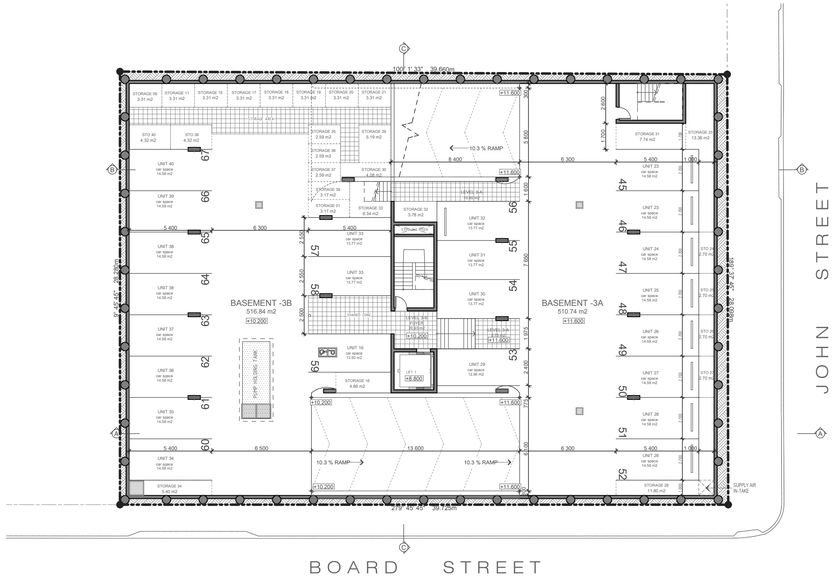
Scale 1:200 @ A3



2 Basement Level -2 Plan - Residential
Scale 1:200 @ A1
Scale 1:400 @ A3



3 Basement Level -3 Plan - Residential
Scale 1:200 @ A1
Scale 1:400 @ A3

PARKING	LEVEL -1	Commercial	11
		Residential	1
		Visitor	8
		Disabled	*(4)*
		Bicycles	8
	LEVEL -2	Residential	24
		Disabled	*(2)*
	LEVEL -3	Residential	23
		Disabled	*(1)*
TOTAL	67 spaces	Commercial	11
		Visitor	8
		Resident	48
		Disabled	*(7)*
		Bicycles	8
		Storage	40

SCALE 1:200 @ A1

DA-A	ISSUED FOR DEVELOPMENT APPLICATION	28/09/2012	YT	AHM
ISSUE	AMENDMENT	DRAWN	CHECKED	APPROVED

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Development Application

Original Design:
Zhinar Architects Pty Ltd

Client:
Sydney Building Constructions Pty Ltd
Mr M. Mehajer

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NORTH:

SHEET TITLE:
Basements & Roof Plan

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
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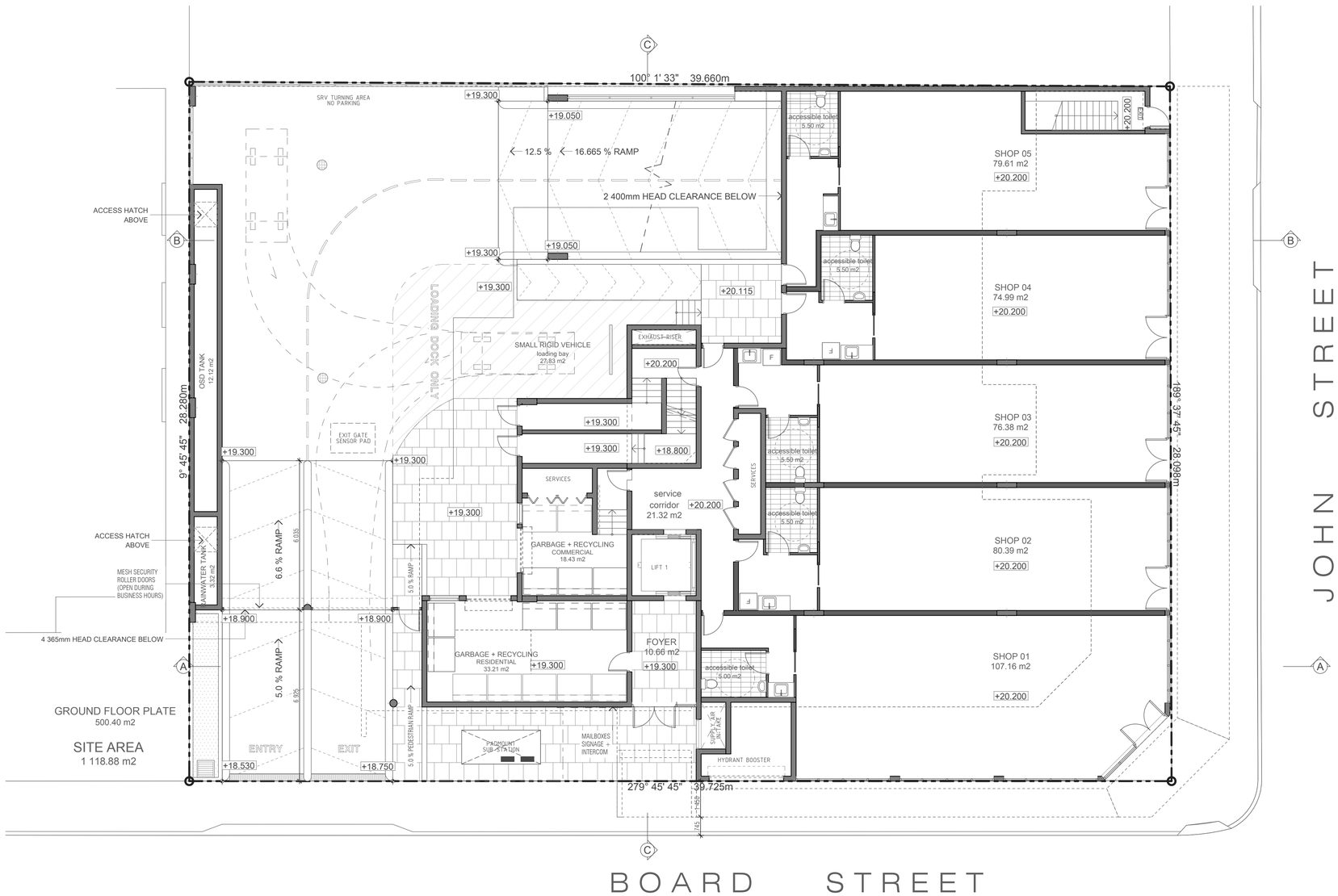
Mixed Use Development
36-38 John Street,
Lidcombe NSW 2145

JOB No.: 8012 DA - A:03

ISSUE: A



1 Ground Floor & Site Plan - 36-38 John Street, Lidcombe

Scale 1:100 @ A1
Scale 1:200 @ A3

ISSUE		DATE	DRAWN	CHECKED
DA-A	ISSUED FOR DEVELOPMENT APPLICATION	28/09/2012	YT	AHM
	AMENDMENT			

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Development Application

Original Design: Zhinar Architects Pty Ltd

Client: Sydney Building Constructions Pty Ltd
Mr M. Mehajer

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NORTH: N

SHEET TITLE: Ground Floor + Site Plan

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36-38 John Street,
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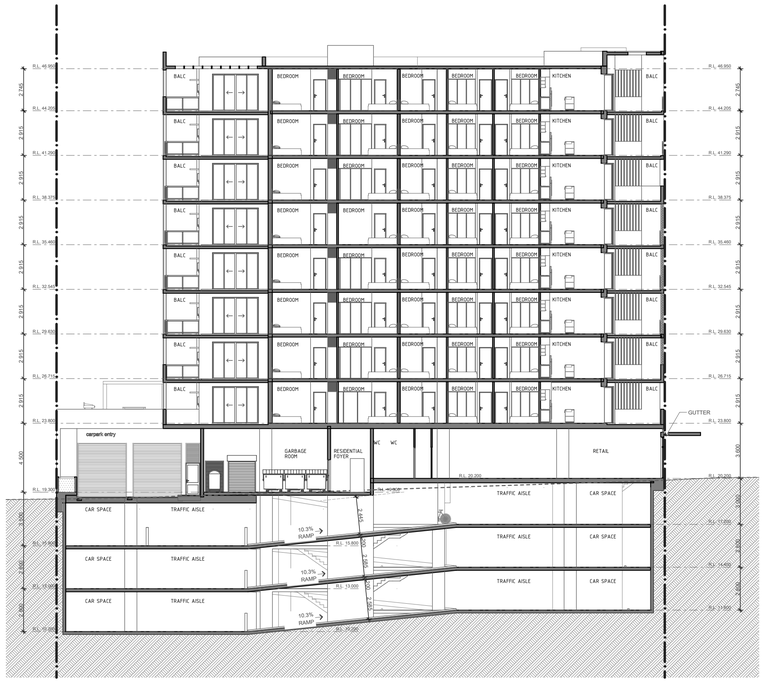
ISSUE: A



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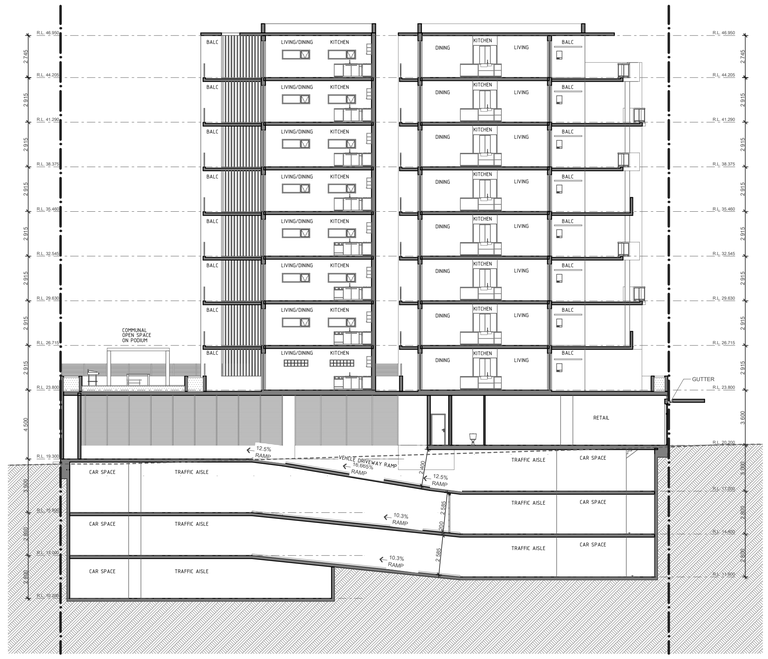

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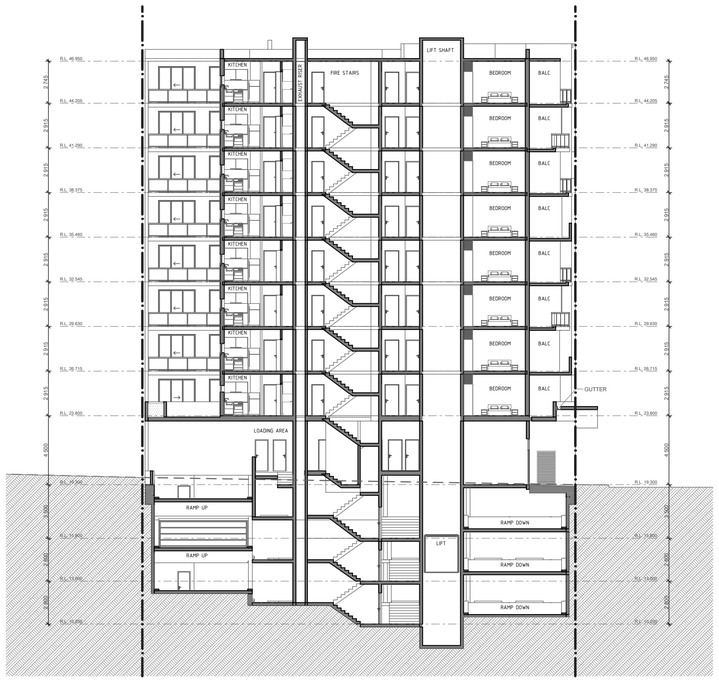

3 Section C-C
Scale 1:200 @ A1
Scale 1:400 @ A3

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
DA-A	ISSUED FOR DEVELOPMENT APPLICATION	28/09/2012	YT	AHM

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Development Application

Original Design:
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Client:
Sydney Building Constructions Pty Ltd
Mr M. Mehajer

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NORTH:

SHEET TITLE:
Sections

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
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				PLOT:

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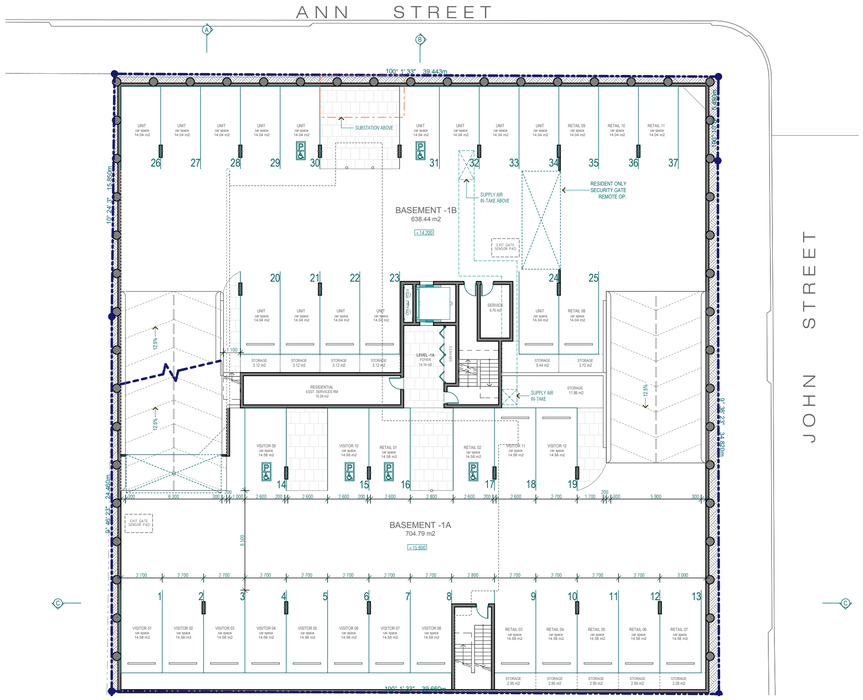
JOB No.: 8012 DA - A:08

ISSUE: A



1 Basement Level -1 Plan - Visitor & Commercial
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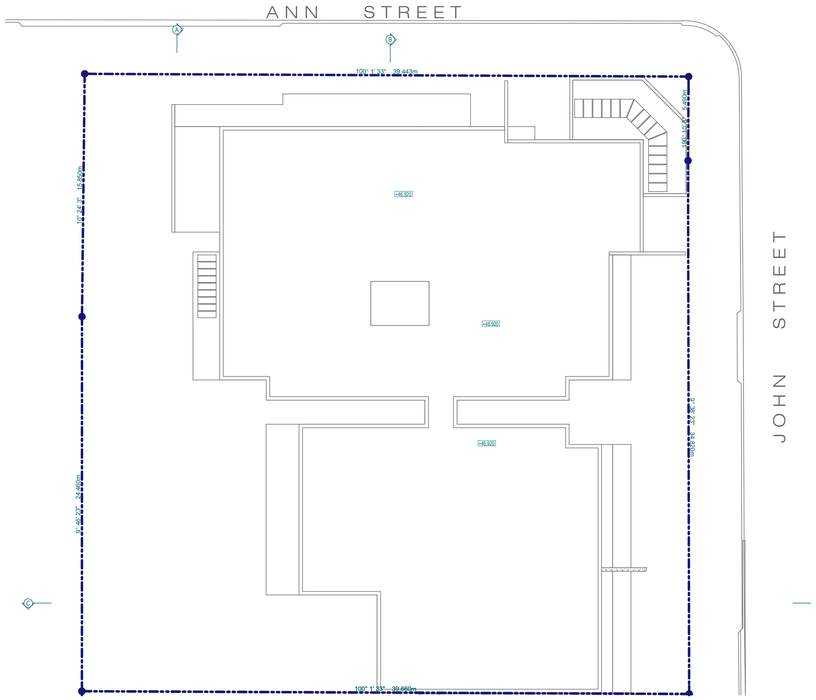
Scale 1:400 @ A3



2 Roof Plan
Scale 1:100 @ A1
Scale 1:200 @ A3

3 Basement Level -2 Plan - Residential
Scale 1:200 @ A1
Scale 1:400 @ A3

4 Basement Level -3 Plan - Residential
Scale 1:200 @ A1
Scale 1:400 @ A3

PARKING	LEVEL -1	Retail	11
		Visitor	12
		Residential	14
		Disabled	*(6)*
	LEVEL -2	Residential	39
		Disabled	*(4)*
	LEVEL -3	Residential	13
TOTAL	89 spaces	Retail	11
		Visitor	12
		Residential	66
		Disabled	*(10)*

SCALE 1:200 @ A1

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
DA-A	ISSUED FOR DEVELOPMENT APPLICATION.	27/11/2012	YT	AHM
DA-P.5	ISSUED FOR DA REVIEW	JUN 2012	YT	AHM

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Original Design:
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Client:
Sydney Building Constructions Pty Ltd
Mr M. Mehajer

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NORTH: N

SHEET TITLE:
Basement Levels, Roof Plan

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
AHM	YT	Jun 2012	AS NOTED	A1 SHEET

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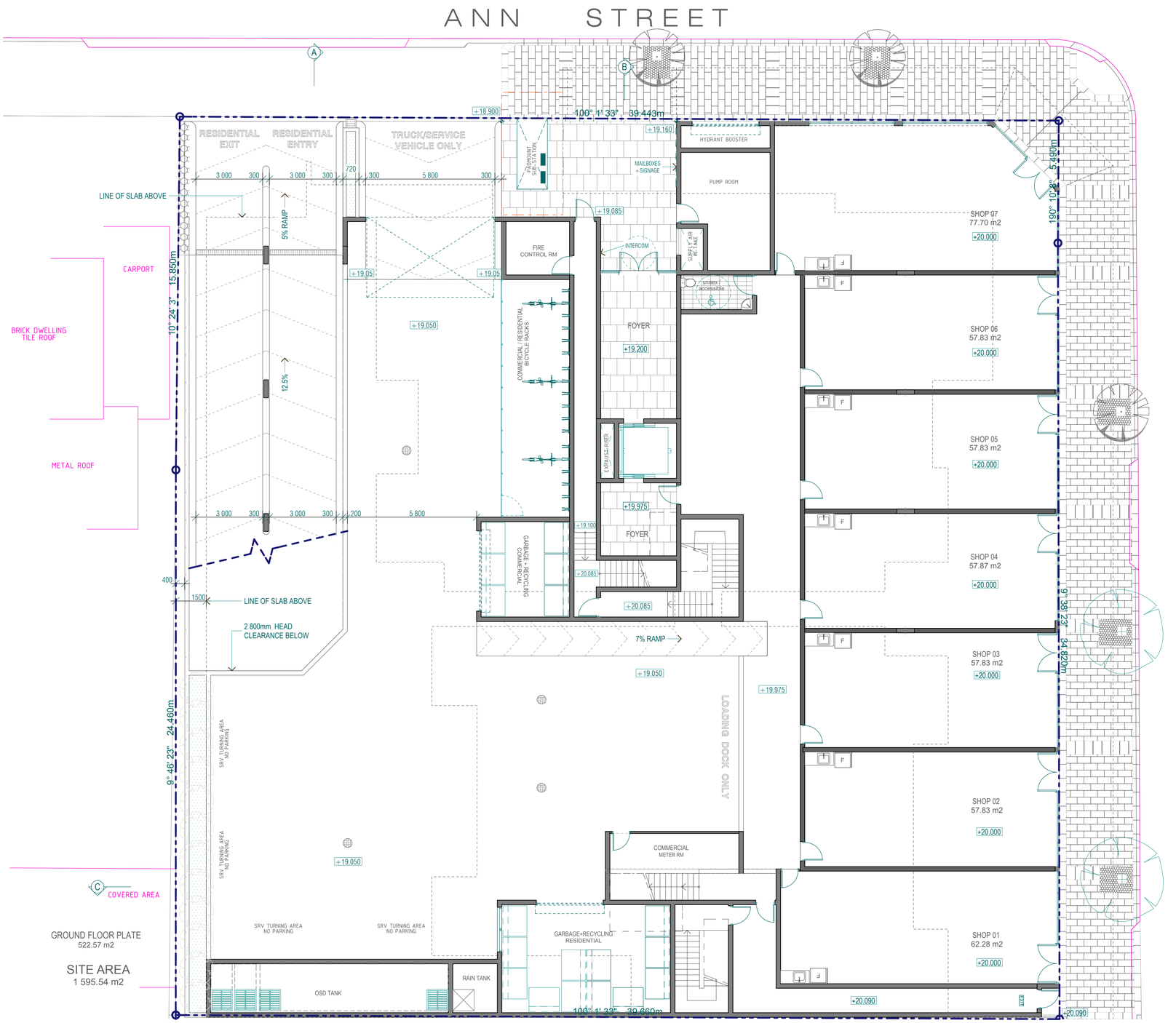
40-44 John Street,
Lidcombe NSW 2145

JOB No.: 8134 DA- A:03

ISSUE: A



1 Ground Floor & Site Plan - 40-44 John Street, Lidcombe

Scale 1:100 @ A1

Scale 1:200 @ A3

eco certificates .com.au
T: 1300 16 24 36
F: (02) 8007 0455
PO Box 3248 North Parramatta NSW 1750
info@ecocertificates.com.au

Assessor: Manuel Basiri
ABSA Accredited Assessor 20859
BDAV Accredited Assessor VIC/BDAV/12/146
MIEAust

NatHERS Building Thermal Modelling Performance Specifications

Development:

Certificate Number: 14620001

Date Issued: 29/10/2012

These are the specifications upon which the certified assessment is based. If details included in these specifications vary from other drawings or written specifications, these specifications shall take precedence. If only one specification option is detailed for a building element, that specification must apply to all instances of that element for the project. If alternate specifications are detailed for a building element, the location and extent of alternate specifications must be detailed below and / or clearly indicated on referenced documents.

Windows and Skylights

Description	Type	U Value	SHGC
All windows of units 3,5,6,7 and 8	Improved Aluminium frame double glazed clear	3.61	0.66
All windows of all other units	Improved Aluminium frame single glazed clear	5.91	0.73

Window and skylight U and SHGC values, if specified, are according to NFRC. Alternate products or specifications may be used if their U value is lower, and the SHGC value is less than 10% higher or lower, than the U and SHGC values of the product specified above.

External and Internal Walls

Description	Type	Insulation	Colour - Solar Abs
All external walls of all units	Cavity Brick	None	Medium SA 0.475 - 0.7
All internal walls of all units	Single Skin Brick	None	N/A

Floors, Ceilings and Roofs

Description	Construction	Insulation	Covering
Floor of all first floor units	Concrete slab	R1.0	Not Specified
Floor of all other units	Concrete slab	None	Not Specified

True North Orientation: 10
Terrain Category: Suburban and Open
Seals on Windows and Doors: Yes
Climate Zone: 56

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PO Box 3248 North Parramatta NSW 1750
info@ecocertificates.com.au

Assessor: Manuel Basiri
ABSA Accredited Assessor 20859
BDAV Accredited Assessor VIC/BDAV/12/146
MIEAust

NatHERS Building Thermal Modelling Performance Specifications

Development:

Certificate Number: 14620001

Date Issued: 29/10/2012

Unit Number	Heating	Cooling	Star Rating	Unit Number	Heating	Cooling	Star Rating
1	52	10	5.0	30	48	11	5.0
2	6	23	7.5	31	4	13	8.5
3	49	19	4.5	32	4	18	8.0
4	49	22	4.5	33	40	14	5.5
5	54	15	4.5	34	32	18	6.0
6	61	10	4.5	35	46	15	5.0
7	66	9	4.5	36	51	19	4.5
8	56	11	4.5	37	48	11	5.0
9	3	20	8.0	38	4	13	8.5
10	2	26	7.5	39	4	18	8.0
11	38	25	5.0	40	40	14	5.5
12	29	25	5.5	41	32	18	6.0
13	43	24	4.5	42	46	15	5.0
14	56	13	4.5	43	51	19	4.5
15	62	11	4.5	44	48	11	5.0
16	45	16	5.0	45	4	13	8.5
17	3	20	8.0	46	4	18	8.0
18	2	26	7.5	47	40	14	5.5
19	38	25	5.0	48	32	18	6.0
20	29	25	5.5	49	46	15	5.0
21	43	24	4.5	50	51	19	4.5
22	48	24	4.5	51	48	11	5.0
23	45	16	5.0	52	4	13	8.5
24	4	13	8.5	53	4	16	8.0
25	4	18	8.0	54	45	16	5.0
26	40	14	5.5	55	37	16	5.5
27	32	18	6.0	56	50	14	5.0
28	46	15	5.0	57	53	17	4.5
29	51	19	4.5	58	52	11	5.0

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
DA-A	ISSUED FOR DEVELOPMENT APPLICATION.	27/11/2012	YT	AHM
DA-P.5	ISSUED FOR DA REVIEW	JUN 2012	YT	AHM

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Development Application

Original Design: Zhinar Architects Pty Ltd

Client: Sydney Building Constructions Pty Ltd
Mr M. Mehajer

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NORTH: N

SHEET TITLE: Ground Floor + Site Plan

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40-44 John Street,
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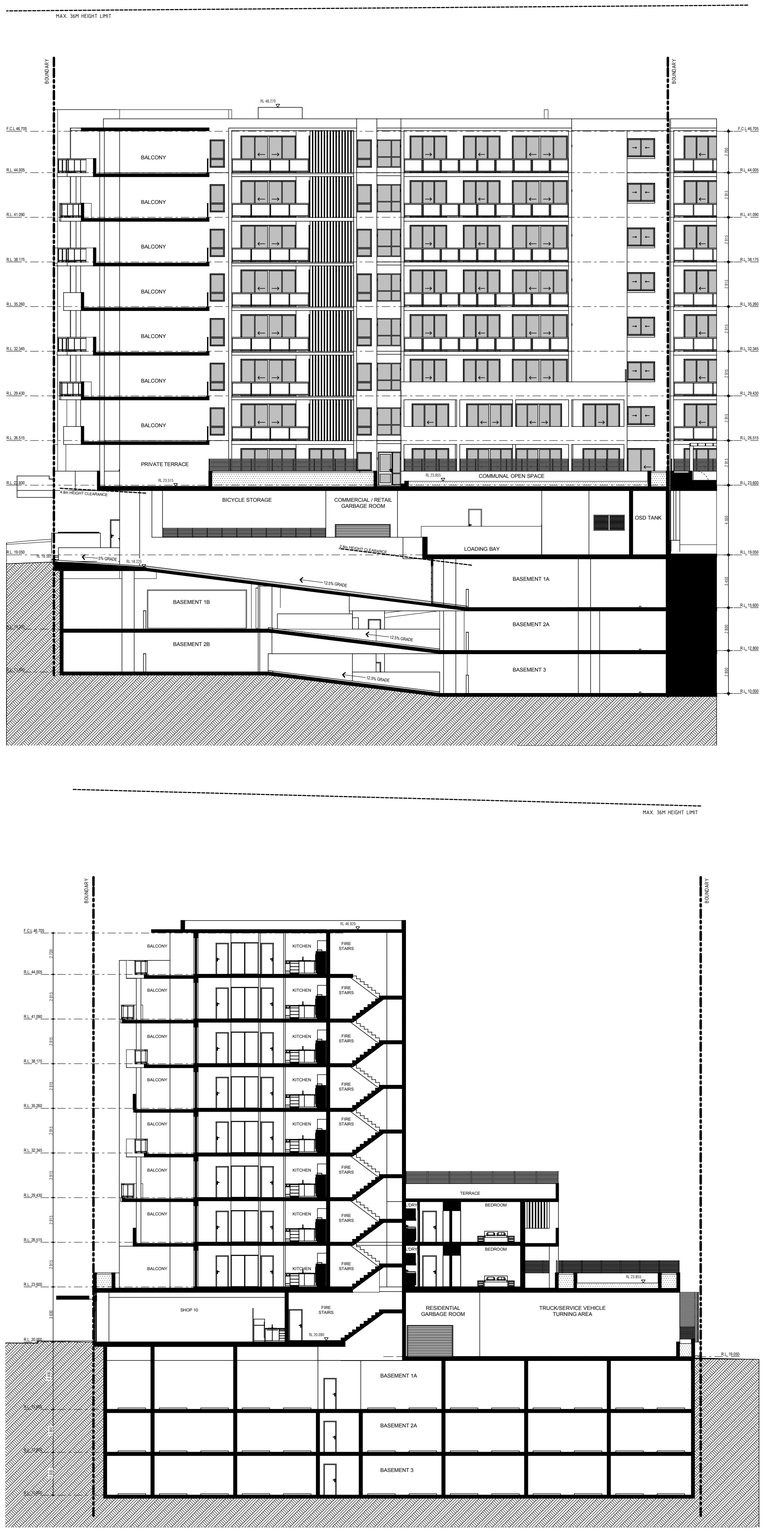
JOB No.: 8134 DA- A:04

ISSUE: A



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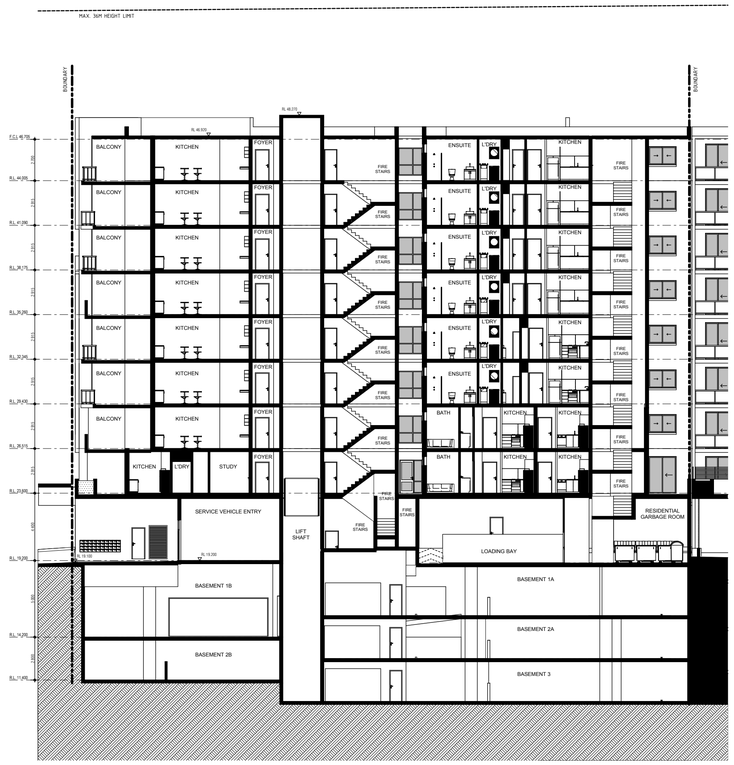

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Scale 1:400 @ A3

3 Section C-C
Scale 1:200 @ A1
Scale 1:400 @ A3

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
DA-A	ISSUED FOR DEVELOPMENT APPLICATION.	27/11/2012	YT	AHM
DA-P.5	ISSUED FOR DA REVIEW	JUN 2012	YT	AHM

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NORTH:

SHEET TITLE:
Sections

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JOB No.: 8134 DA- A:08

ISSUE: A

APPENDIX B

SAMPLING PLAN FROM CSTS 2012 REPORT

Compaction and Soil Testing Services Pty Ltd

CSTS

Notes: *This drawing has been produced using a base plan provided by others to which additional information e.g.: density test, DCP and Test Pit locations or notes have been added. Some or all the information shown on the plan may not be relevant at the time of producing this drawing.*

Drawn:	CR
Approved:	NG
Date:	22/08/2012
Scale:	Not to Scale

Site Plan
36-44 John Street, Lidcombe NSW

Drawing No:	SCD 1531 ENV AA - 15
Job No:	**SCD 1531**

APPENDIX C

Abbreviations, Sampling Protocols and QA/QC Definitions

ABBREVIATIONS

AEC	Area of Environmental Concern
AGST	Above Ground Storage Tank
AHD	Australian Height Datum
ALTPQL	All Less than PQL
ANZECC	Australian and New Zealand Environment Conservation Council
ASS	Acid Sulfate Soil
BA/DA	Building Approval and Development Application
B(a)P	Benzo(a)pyrene
BGL	Below Ground Level
BH	Borehole
BOM	Bureau of Meteorology
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
COC	Chain of Custody documentation
CLM	Contaminated Land Management
CMP	Construction Management Plan
CSM	Conceptual Site Model
CT	Contamination Threshold
DBYD	Dial Before You Dig
DEC	Department of Environment and Conservation (now part of EPA)
DECC	Department of Environment and Climate Change (now part of EPA)
DECCW	Department of Environment, Climate Change and Water (now part of EPA)
DWE	NSW Department of Water and Energy
DO	Dissolved Oxygen
DP	Deposited Plan
DQIs	Data Quality Indicators
DQOs	Data Quality Objective
EC	Electrical Conductivity
Eh	Redox Potential
EILs	Ecological Investigation Levels
ENM	Excavated Natural Material
EMP	Environmental Management Plan
ESA	Environmental Site Assessment
FR	Field Rinsate
GAI	General Approvals of Immobilisation
GILs	Groundwater Investigation Levels
GPS	Global Positioning System
Hazmat	Hazardous Materials Assessment
HILs	Health Based Investigation Level
HM	Heavy Metals
HMTVs	Hardness Modified Trigger Values
LNAPLs	Light Non-Aqueous Phase Liquids
NATA	National Association of Testing Authorities
NDLR	Not Detected at Limit of Reporting
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measure
NHMRC	National Health and Medical Research Council
NSW EPA	Environmental Protection Authority of NSW
MGA	Map Grid of Australia
OCPs	Organochlorine Pesticides
OEH	NSW Office of Environment and Heritage
OPPs	Organophosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbons

ABBREVIATIONS

PASS	Potential ASS
PCC	Potential Contaminants of Concern
PCBs	Polychlorinated Biphenyls
PID	Photo-ionisation Detector
POEO	Protection of Environmental Operations
PPIL	Provisional Phyto-toxicity Investigation Levels
PQL	Practical Quantitation Limit
RAP	Remediation Action Plan
RL	Reduced Level
QA/QC	Quality Assurance and Quality Control
RPD	Relative Percentage Difference
SAC	Site Assessment Criteria
SAQP	Sampling, Analysis and Quality Plan
SAS	Site Audit Statement
SCC	Specific Contamination Concentration
SD	Standard Deviation
SEPP	State Environmental Planning Policy
sPOCAS	suspension Peroxide Oxidation Combined Acidity and Sulfate
SPT	Standard Penetration Test
SVOCs	Semi-Volatile Organic Compounds
SWL	Standing Water Level
TB	Trip Blank
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TP	Test Pit
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
TS	Trip Spike
USEPA	United States Environmental Protection Agency
UCL	Upper Confidence Limit
UPSS	Underground Petroleum Storage Systems
UST	Underground Storage Tank
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
WC	Waste Classification
WHS	Workplace, Health and Safety

SOIL AND GROUNDWATER SAMPLING PROTOCOLS

These protocols specify the basic procedures to be used when sampling soils or groundwater for environmental site assessments undertaken by EIS. The purpose of these protocols is to provide standard methods for: sampling, decontamination procedures for sampling equipment, sample preservation, sample storage and sample handling. Deviations from these procedures must be recorded.

Soil Sampling

a) Prepare a test pit/borehole log.
b) Layout sampling equipment on clean plastic sheeting to prevent direct contact with ground surface. The work area should be at a distance from the drill/rig excavator such that the drill rig/excavator can operate in a safe manner.
c) Ensure all sampling equipment has been decontaminated prior to use.
d) Remove any surface debris from the immediate area of the sampling location.
e) Collect samples and place in glass jar with a Teflon seal. This should be undertaken as quickly as possibly to prevent the loss of volatiles. If possible, fill the glass jars completely.
f) Collect samples for asbestos analysis and place in a zip-lock plastic bag.
g) Label the jar and/or bag with the EIS job number, sample location (eg. BH1), sampling depth interval and date. If more than one sample container is used, this should also be indicated (eg. 2 = Sample jar 1 of 2 jars).
h) Photoionisation detector (PID) screening of volatile organic compounds (VOCs) should be undertaken on samples using the soil sample headspace method. Headspace measurements are taken following equilibration of the headspace gasses in partly filled zip-lock plastic bags. PID headspace data is recorded on the borehole/test pit log and the chain of custody forms.
i) Record the lithology of the sample and sample depth on the borehole/test pit log in accordance with AS1726-1993[36].
j) Store the sample in a sample container cooled with ice or chill packs. On completion of the sampling the sample container should be delivered to the lab immediately or stored in the refrigerator prior to delivery to the lab. All samples are preserved in accordance with AS 4482.1:2005, AS 4482.2:1999 and AS/NZS 5667.1:1998.
k) Check for the presence of groundwater after completion of each borehole using an electronic dip metre or water whistle. Boreholes should be left open until the end of fieldwork. All groundwater levels in the boreholes should be rechecked on the completion of the fieldwork.
l) Backfill the boreholes/test pits with the excavation cuttings or clean sand prior to leaving the site.

Decontamination Procedures for Soil Sampling Equipment

a) All of the equipment associated with the soil sampling procedure should be decontaminated between every sampling location.
b) The following equipment and materials are required for the decontamination procedure:
   - Phosphate free detergent (Decon 90)
   - Potable water
   - Stiff brushes
   - Plastic sheets
c) Ensure the decontamination materials are clean prior to proceeding with the decontamination.
d) Fill both buckets with clean potable water and add phosphate free detergent to one bucket.
e) In the bucket containing the detergent scrub the sampling equipment until all the material attached to the equipment has been removed.
f) Rinse sampling equipment in the bucket containing potable water.

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[36] *Geotechnical Site Investigations*, Standards Australia 1993 (AS1726-1993)

g) Place cleaned equipment on clean plastic sheets.

If all materials are not removed by this procedure, high-pressure water cleaning is recommended. If any equipment is not completely decontaminated by both these processes that equipment should not be used until it has been thoroughly cleaned.

Groundwater Sampling

Groundwater samples are more sensitive to contamination than soil samples and therefore adhesion to this protocol is particularly important to obtain reliable, reproducible results. The recommendations detailed in AS/NZS 5667.1:1998 are considered to form a minimum standard.

The basis of this protocol is to maintain the security of the borehole and obtain accurate and representative groundwater samples. The following procedure should be used for collection of groundwater samples from previously installed groundwater monitoring wells.

a) After monitoring well installation, at least three bore volumes should be pumped from the monitoring wells (well development) to remove any water introduced during the drilling process and/or the water that is disturbed during installation of the monitoring well. This should be completed prior to purging and sampling.

b) Groundwater monitoring wells should then be left to recharge for at least three days before purging and sampling. Prior to purging or sampling the condition of each well should observed and any anomalies recorded on the field data sheets. The following information should be noted: the condition of the well, noting any signs of damage, tampering or complete destruction; the condition and operation of the well lock; the condition of the protective casing and the cement footing (raised or cracked); and, the presence of water between protective casing and well.

c) Take the groundwater level from the collar of the piezometer/monitoring well using an electronic dip meter. The collar level should be taken (if required) during the site visit using a dumpy level and staff.

d) Purging and sampling of piezometers/monitoring wells is done on the same site visit when using micro-purge (or low flow) techniques. Layout and organize all equipment associated with groundwater sampling in a location where they will not interfere with the sampling procedure and will not pose a risk of contaminating samples. Equipment generally required includes:
   - Micropore filtration system or Stericup single-use filters (for heavy metals samples).
   - Filter paper for Micropore filtration system.
   - Bucket with volume increments.
   - Sample containers: teflon bottles with 1 ml nitric acid, 75mL glass vials with 1 mL hydrochloric acid, 1 L amber glass bottles.
   - Bucket with volume increments.
   - Flow cell.
   - pH/EC/Eh/T meters.
   - Plastic drums used for transportation of purged water.
   - Esky and ice.
   - Nitrile gloves.
   - Distilled water (for cleaning).
   - Electronic dip meter.
   - Micro-purge pump pack and pump head.
   - Air and water tubing for Micro-purge.
   - Groundwater sampling forms.

e) If single-use stericup filtration is not being used, clean the Micropore filtration system thoroughly with distilled water prior to use and between each sample. Filter paper should be changed between samples. 0.45um filter paper should be placed below the glass fibre filter paper in the filtration system.

f) Ensure all non-disposable sampling equipment is decontaminated or that new disposable equipment is available prior to any work commencing at a new location. The procedure for decontamination of groundwater equipment is outlined at the end of this section.

g) Disposable gloves should be used whenever samples are taken to protect the sampler and to assist in avoidance of contamination.
h) Groundwater samples are obtained from the monitoring wells using low flow/micro-purge sampling equipment to reduce the disturbance of the water column and loss of volatiles.
i) During pumping to purge the well, the pH, temperature, conductivity, dissolved oxygen, redox potential and groundwater levels are monitored (where possible) using calibrated field instruments to assess the development of steady state conditions. Steady state conditions are generally considered to have been achieved when the difference in the pH measurements was less than 0.2 units and the difference in conductivity was less than 10%.
j) All measurements are recorded on specific data sheets.
k) Once steady state conditions are considered to have been achieved, groundwater samples are obtained directly from the pump tubing and placed in appropriate glass bottles, BTEX vials or plastic bottles.
l) All samples are preserved in accordance with water sampling requirements detailed in the NEPM 1999 and placed in an insulated container with ice. Groundwater samples are preserved by immediate storage in an insulated sample container with ice in accordance with AS/NZS 5667.1:1998.
m) Record the sample on the appropriate log in accordance with AS1726:1993. At the end of each water sampling complete a chain of custody form.

Decontamination Procedures for Groundwater Sampling Equipment

a) All of the equipment associated with the groundwater sampling procedure (other than single-use items) should be decontaminated between every sampling location.
b) The following equipment and materials are required for the decontamination procedure:
   - Phosphate free detergent.
   - Potable water.
   - Distilled water
   - Plastic Sheets or bulk bags (plastic bags)
c) Fill one bucket with clean potable water and phosphate free detergent, and one bucket with distilled water.
d) Flush potable water and detergent through pump head. Wash sampling equipment and pump head using brushes in the bucket containing detergent until all materials attached to the equipment are removed.
e) Flush pump head with distilled water.
f) Change water and detergent solution after each sampling location.
g) Rinse sampling equipment in the bucket containing distilled water.
h) Place cleaned equipment on clean plastic sheets.
i) If all materials are not removed by this procedure that equipment should not be used until it has been thoroughly cleaned

QA/QC DEFINITIONS

The QA/QC terms used in this report are defined below. The definitions are in accordance with US EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (1994[37]) methods and those described in *Environmental Sampling and Analysis, A Practical Guide,* (H. Keith 1991[38]).

Practical Quantitation Limit (PQL), Limit of Reporting (LOR) and Estimated Quantitation Limit (EQL)

These terms all refer to the concentration above which results can be expressed with a minimum 95% confidence level. The laboratory reporting limits are generally set at ten times the standard deviation for the Method Detection limit (MDL) for each specific analyte. For the purposes of this report the LOR, PQL, and EQL are considered to be equivalent.

When assessing laboratory data it should be borne in mind that values at or near the PQL have two important limitations. *"The uncertainty of the measurement value can approach, and even equal, the reported value. Secondly, confirmation of the analytes reported is virtually impossible unless identification uses highly selective methods. These issues diminish when reliably measurable amounts of analytes are present. Accordingly, legal and regulatory actions should be limited to data at or above the reliable detection limit"* Keith 1991.

Precision

The degree to which data generated from repeated measurements differ from one another due to random errors. Precision is measured using the standard deviation or Relative Percent Difference (RPD). Acceptable targets for precision in this report will be less than 50% RPD for concentrations greater than ten times the PQL, less than 75% RPD for concentrations between five and ten times the PQL and less than 100% RPD for concentrations that are less than five times the PQL.

Accuracy

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter being measured. The assessment of accuracy for an analysis can be achieved through the analysis of known reference materials or assessed by the analysis of surrogates, field blanks, trip spikes and matrix spikes.

The proximity of an averaged result to the true value, where all random errors have been statistically removed. Accuracy is measured by percent recovery. Acceptable limits for accuracy generally lie between 70% to 130% recoveries. Certain laboratory methods may allow for values that lie outside these limits.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is primarily dependent upon the design and implementation of the sampling program. Representativeness of the data is partially ensured by the avoidance of contamination, adherence to sample handing and analysis protocols and use of proper chain-of-custody and documentation procedures.

Completeness

Completeness is a measure of the number of valid measurements in a data set compared to the total number of measurements made and overall performance against DQIs. The following information is assessed for completeness:

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[37] *SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* US EPA, 1994 (US EPA SW-846)

[38] *Environmental Sampling and Analysis, A Practical Guide*, Keith, H, 1991 (Keith 1991)

- Chain-of-custody forms;
- Sample receipt form;
- All sample results reported;
- All blank data reported;
- All laboratory duplicate and RPDs calculated;
- All surrogate spike data reported;
- All matrix spike and lab control spike (LCS) data reported and RPDs calculated;
- Spike recovery acceptable limits reported; and
- NATA stamp on reports.

Comparability

Comparability is the evaluation of the similarity of conditions (eg. sample depth, sample homogeneity) under which separate sets of data are produced. Data comparability checks include a bias assessment that may arise from the following sources:

- Collection and analysis of samples by different personnel;
- Use of different techniques;
- Collection and analysis by the same personnel using the same methods but at different times; and
- Spatial and temporal changes (due to environmental dynamics).

Blanks

The purpose of laboratory and field blanks is to check for artifacts and interferences that may arise during sampling and analysis.

Matrix Spikes

Samples are spiked with laboratory grade standards to detect interactive effects between the sample matrix and the analytes being measured. Matrix Spikes are reported as a percent recovery and are prepared for 1 in every 20 samples. Sample batches that contain less than 20 samples may be reported with a Matrix Spike from another batch. The percent recovery is calculated using the formula below. Acceptable recovery limits are 70% to 130%.

$$\frac{\text{(Spike Sample Result} - \text{Sample Result)}}{\text{Concentration of Spike Added}} \times 100$$

Surrogate Spikes

Samples are spiked with a known concentration of compounds that are chemically related to the analyte being investigated but unlikely to be detected in the environment. The purpose of the Surrogate Spikes is to check the accuracy of the analytical technique. Surrogate Spikes are reported as percent recovery.

Duplicates

Laboratory duplicates measure precision, expressed as Relative Percent Difference. Duplicates are prepared from a single field sample and analysed as two separate extraction procedures in the laboratory. The RPD is calculated using the formula where D1 is the sample concentration and D2 is the duplicate sample concentration:

$$\frac{(D1 - D2)}{\{(D1 + D2)/2\}} \times 100$$