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REMEDIAL ACTION PLAN

Abercrombie Precinct Redevelopment, Darlington NSW

24 September 2012

Quality Management

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REMEDIAL ACTION PLAN

Abercrombie Precinct Redevelopment, Darlington, NSW

24/09/2012

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Executive Summary

WSP Environmental Pty Ltd, trading as WSP Environment & Energy (WSP), was engaged by The University of Sydney (UoS) to provide Environmental Services in support of the proposed redevelopment of the Abercrombie Precinct in Darlington, NSW (the Site). The Site location is provided in Figure 1, **Appendix A**. It is understood that the proposed redevelopment includes the construction of a Business School with the approximate footprint illustrated on Figure 2, **Appendix A**.

The previous environmental investigations have resulted in an understanding of the vertical and horizontal extent of impacted fill material within roadways and accessible areas of the Site. Principally, total polycyclic aromatic hydrocarbons (PAH) including benzo(a)pyrene (B(a)P) and TPH (C₁₀-C₃₆) concentrations have been detected above the adopted HIL F (Commercial / Industrial) and HIL E (open space) criteria.

This remedial action plan (RAP) is designed to minimise any ongoing liability and risk associated with the localised impacted fill material and to render the Site suitable for the proposed Business School redevelopment.

Following demolition of Site structures, additional investigation works are required. The purpose of these works will be to further characterise the nature and extent of identified contamination as well as validate building footprints following demolition.

An assessment of feasible remediation options has determined that the preferred remediation strategy is the excavation and off-Site disposal of impacted soil from seven remediation areas. Excavated soil shall be segregated and stockpiled on Site for waste classification, prior to off-Site disposal to a suitably licenced waste disposal facility.

Soil validation samples shall be obtained from the excavated areas, analysed for the contaminants of concern (PAHs, TPH, BTEX and asbestos) and compared with the adopted validation criteria.

The recommended scope of works is considered appropriate to meet City of Sydney Council, NSW EPA and UoS requirements, minimise human health risks to current and future Site occupiers and to render the Site suitable for the proposed redevelopment.

1 Introduction

1.1 BACKGROUND

WSP Environmental Pty Ltd, trading as WSP Environment & Energy (WSP), was engaged by The University of Sydney (UoS) to provide Environmental Services, including the preparation of this remedial action plan (RAP), in support of the proposed redevelopment of the Abercrombie Precinct in Darlington, NSW (the Site). The Abercrombie Precinct forms part of the UoS Darlington Campus and is located on the corner of Abercrombie Street and Codrington Street as shown in Figure 1, **Appendix A**.

The Abercrombie Precinct Redevelopment project is a key component of the Darlington Campus Masterplan, developed as part of the Campus 2020 Masterplan. It aligns with the University Strategic Plan to redevelop the Site to create a new World-class Business School (USBS) at the southern end of the Darlington Campus which will also form the Southern gateway into the University improving access and connectivity to the main Campus. The approximate proposed building footprint is illustrated in Figure 2, **Appendix A**. Specifically; the redevelopment will involve the following key works:

- Subdivision of the Site to consolidate existing lots (including the closure of Rose Street and Boundary Lane), and create two development lots;
- Demolition of all buildings and structures within the Site, with the exception of the existing Economics and Business Building (H69). Refurbishment works to the existing H69 building to integrate it with the new USBS;
- Construction of the new USBS facility;
- Construction of new student accommodation on Abercrombie St; and
- Ancillary works, including services and minor works to Darlington Public School.

The previous environmental investigations (each summarised separately in Section 4 of this RAP) have resulted in an understanding of the vertical and horizontal extent of impacted fill material within roadways and accessible areas of the Site. Principally total polycyclic aromatic hydrocarbons (PAH) including benzo(a)pyrene (B(a)P) and TPH (C₁₀-C₃₆) concentrations have been detected across the Site above the adopted HIL F (Commercial / Industrial) and HIL E (open space) criteria.

1.2 OBJECTIVES OF THE RAP

WSP was commissioned to prepare this RAP to minimise any ongoing liability and risk associated with the localised impacted fill material and to render the Site suitable for the proposed USBS redevelopment.

This report assesses various remedial options, selects a preferred remedial approach and details the appropriate management measures required during development works and subsequent remediation and validation for contaminated materials.

The RAP includes a discussion of the following:

- Remediation goal;
- Extent of remediation required;
- Discussion of remediation options;
- Rationale for the selection of the preferred remedial option, including consideration of the NSW EPA waste hierarchy;

-
- Classification of the remediation works (as either 'Category 1' or 'Category 2') in accordance with SEPP 55;
 - Identification of regulatory compliance requirements;
 - Site management controls before and during remediation (including safety, Site security and environmental controls);
 - Validation sampling program;
 - Remediation schedule and proposed hours of work;
 - Contingency planning; and
 - Long term Site management considerations.

The RAP is proposed to be implemented such that the Site complies, where practicable, with relevant guidelines, including:

- National Environment Protection Council (1999) National Environment Protection Measure – Assessment of Site Contamination Schedule B (1) Health Based Investigation Level (HIL) (E) for parks, recreational open space and playing fields;
- National Environment Protection Council (1999) National Environment Protection Measure – Assessment of Site Contamination Schedule B (1) Health Based Investigation Level (HIL) (F) for commercial / industrial land;
- National Environment Protection Council (1999) National Environment Protection Measure – Assessment of Site Contamination Schedule B (1) Ecological Investigation Level (EIL);
- In the absence of National Environment Protection Council guidelines for TPH and BTEX, results will be assessed against NSW EPA (1994) Contaminated Sites: Service Station Guidelines;
- Department of Environment, Climate Change and Water (DECCW, 1999) Waste Classification Guidelines, Part 1: Classifying Waste for waste disposal purposes;
- In the absence of NSW endorsed guidelines for reporting on asbestos, WSP will adopt the EnHealth (2005) trigger value of 'no detection of fibres or fragments in surface soils' at the laboratory reporting limit of <0.1g/kg as the criteria;
- NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme;
- State Environmental Planning Policy No. 55 (1998) – Remediation of Land (SEPP 55); and
- City of Sydney Council (2004) Development Control Plan – Contaminated Land.

1.3 RAP STRUCTURE

The RAP is structured as follows:

Section 2 – Describes the Site characteristics including the layout and surrounding land uses;

Section 3 – Describes the Site environmental setting including topography, hydrology, soil and geology;

Section 4 – Presents a summary of previous environmental assessments completed at the Site;

Section 5 – Outlines the current soil status and areas of concern;

Section 6 – Presents feasible remediation options and the preferred remediation strategy;

Section 7 – Outlines the proposed scope of remedial works;

Section 8 – Outlines the adopted remediation acceptance criteria and proposed sampling and validation program, including Data Quality Objectives (DQO);

Section 9 – Outlines the intended remedial action strategy for the Site;

Section 10 – Details the relevant regulatory approvals and licensing requirements for the proposed remediation works;

Section 11 – Outlines contingency plans for the proposed remediation works;

Section 12 – Details Site operational controls and strategies to address environmental considerations;

Section 13 – Identifies likely occupational health and safety hazards and considerations;

Section 14 – Concludes the RAP;

Section 15 – Outlines the report limitations; and

Section 16 – Lists the references used in compiling the RAP.

2 Site Characteristics

2.1 SITE LOCATION AND DESCRIPTION

The Site is approximately 1.92 hectares in size and is zoned 'Special Use (University)'. The Site comprises a number of buildings associated with tertiary education, access roadways (currently being purchased from the City of Sydney Council), landscaping and a small park located on the corner of Abercrombie and Codrington Streets. Demolition of existing buildings is proposed with the exception of Building H69 (Faculty of Economics and Business). Building H67 (Mandelbaum House) will also remain and is considered to lie outside the Site boundary.

The Site is underlain by approximately 0.5 to 1.0m of fill, generally consisting of dark brown silty clay with crushed sandstone, roadbase and ash, beneath which lie natural clays and Shale bedrock.

Four areas of ashy fill material were identified in previous investigations (CH2M HILL) as being impacted with TPH and PAH and require remediation. These include MW02 at 0.4-0.5m (PAH only); MW03 at 0.1-0.6m; BH05 at 0.3-0.4m; and BH06 at 0.1-0.3m. Nine additional areas of fill material were identified as being impacted with TPH and PAH during the 2012 WSP Investigation. These were primarily located on Rose Street (TPH and PAH impacts) with others noted on Boundary Lane and in the park located on the corner of Abercrombie and Codrington Street (PAH only).

During previous investigations elevated metals were recorded in groundwater samples, however, these were considered to be representative of background concentrations typical of up-gradient areas. Consequently, the current scope of work does not include assessment and / or remediation of groundwater.

The Site location and layout are shown in Figures 1 and 2, **Appendix A**.

Refer to Table 2.1 for Site description details.

Table 2.1: Site Description

Parameter	Site Details
Address	Corner of Abercrombie and Codrington Street, Darlington, NSW
Lot / DP	Part Lot 237 of DP900968
Local Government Area	Sydney City Council
Land Zoning	Zone No.5 Special Uses (University)
Investigation Area	Approximately 1.92 hectares
Current Landuse	Tertiary education buildings, landscaped areas, park and access roadways
Proposed Landuse	Business School

2.2 SITE LAYOUT AND ACTIVITIES

According to the 2011 CH2M HILL Phase II EA, the Site has been used for a number of activities from 1961 to 2011, which have the potential to cause contamination. These activities included filling, landscaping, joiners shop, car parking and the demolition of former residential buildings.

The Site comprises:

- A number of buildings owned by UoS;
- Access roadways owned by the City of Sydney Council (Council) which are being purchased by UoS;
- The UoS landscaping compound; and

-
- A small park located on the corner of Abercrombie and Codrington Streets.

2.3 SURROUNDING LAND USES

The Site is surrounded by the following land uses:

- North: Darlington Lane beyond which are UoS owned residential terrace buildings;
- East: Codrington Street beyond which is the UoS Services Building and Sports and Aquatic Centre;
- South: Abercrombie Street beyond which are residential housing, Eveleigh carriage works and train line; and
- West: Darlington Public School beyond which is Golden Grove Street and residential properties.

2.4 SENSITIVE ENVIRONMENTS

The nearest sensitive environments are as follows:

- Boundary Land Childcare Centre located immediately beyond the southern boundary of the of Site;
- The Shepherd Centre for deaf children located on Abercrombie Street to the south of the Site;
- Residential properties adjacent to Darlington Lane and Abercrombie Street;
- Darlington Public School located adjacent to eastern Site boundary; and
- The environmental receptor down-gradient of the Site is Centennial Park, located approximately 3km south east.

3 Environmental Setting

3.1 TOPOGRAPHY AND HYDROLOGY

According to the Botany Bay Topographic Series Sheet 9030-3S, the Site is elevated approximately 30m Australian Height Datum (AHD). Due to the highly modified nature of the area, surface water flow is via council storm water infrastructure toward Blackwattle Bay.

3.2 SOILS AND GEOLOGY

According to the 1:100,000 Sydney Soil Landscape Series Sheet 9130, the Site is situated in the Blacktown soil landscape. The soils of the Blacktown Landscape are shallow to moderately deep (<100cm) Red and Brown Podzolic Soils on crests, grading to Yellow Podzolic Soils and Soloths on lower slopes and in drainage lines. The landscape plan describes the soils as being moderately reactive highly plastic sub soil with low fertility and poor soil drainage.

The 1:100,000 Sydney Geological Series Sheet 9130 indicates that the Site is underlain by Triassic Age Wianamatta Group sediments, known as Ashfield Shale. These sediments are black to dark grey shale and laminate. Ashfield Shale weathers to hard packed clays, which tend to form natural barriers of low permeability which would be expected to inhibit the migration of groundwater and any potential contaminants. It is anticipated that the majority of groundwater flow would be restricted to the fracture lineaments within the shale bedrock.

Based on the existing ground investigation information fill material was identified across the Site between 0.5 – 1.0bgl and is underlain by natural clays and shale.

3.3 HYDROGEOLOGY

The CH2M HILL (2011) Assessment indicated standing water level in three wells across the Site to be from 21.01 to 31.39m AHD. A review of Site information conducted by WSP indicates an easterly / south easterly groundwater flow direction.

Monitoring wells MW01, MW02 and MW03 were sampled by CH2M HILL during their 2011 Phase II Environmental Assessment summarised in Section 4.3. Results of laboratory groundwater analysis generally reported contaminant concentrations below the adopted site criteria with the exception of low level exceedances of heavy metals. These heavy metals were considered by CH2MHill to be migrating onto the Site from up hydraulic gradient. Although TPH and PAH concentrations in fill material exceeded the adopted Site criteria these contaminants were not detected above the laboratory limit of reporting in groundwater. Therefore it is considered unlikely that the observed impact in fill material is mobilising into groundwater.

4 Previous Investigations

4.1 GEOTECHNICAL INVESTIGATION AND PRELIMINARY CONTAMINATION ASSESSMENT, DOUGLAS PARTNERS (1998)

Douglas Partners carried out a Preliminary Contamination Assessment of the Economic and Business Building (H69) in 1998. The assessment was conducted in order to provide information on subsurface conditions and to make a preliminary assessment of potential heavy metal (M8), PAH and TPH contamination at the Site.

The report identified a hotspot of PAH contamination located below the future building footprint. Douglas Partners advised that the Site was suitable for development on the proviso that all fill material under the proposed building be excavated, classified and disposed of to a NSW EPA approved landfill.

4.2 PHASE I ENVIRONMENTAL ASSESSMENT, SKM (2010)

SKM's Phase I Environmental Assessment included the whole Site area as well as several adjacent areas owned by the UoS. The assessment included:

- Review of historical sources of information (aerial photographs, Department of Health files, Council property files, publicly available Council records and historical land titles);
- Site inspection; and
- Review of Site condition and surrounding environment.

SKM identified the following potential areas of concern (PAOC):

- Fill areas around the borders of existing buildings and areas to the west of Building H69 and between Buildings H12 and H05 (potential to contain construction waste materials from previous developments);
- Building H05 (Joiners Shop);
- Chemical storage in shed located in landscaping compound;
- Generator located to the east of Building H08; and
- Transformers located between Buildings H67 and H08, and to the west of Building H69 adjacent to Darlington Lane.

SKM recommended that an intrusive Phase II Environmental Assessment be conducted to further define potential risks associated with possible contamination at the Site.

4.3 PHASE II ENVIRONMENTAL ASSESSMENT, CH2M HILL (2011)

CH2M HILL Australia Pty Ltd (CH2M HILL) was commissioned by UoS to conduct a Phase II Environmental Assessment (Phase II EA) as part of the Abercrombie Precinct Redevelopment. The Phase II EA focused on characterising soil and groundwater in accessible areas of the Site.

The objectives of the Phase II EA were to:

- Further investigate and characterise the PAOC identified by SKM in their Phase I EA (2010);
- Provide baseline information on soil and groundwater quality across other areas of the Site; and
- Provide preliminary waste classification of material present at the Site.

The scope of works included:

- Review of background information;
- Advancement of 13 boreholes;
- Conversion of three of the boreholes to groundwater monitoring wells;
- Collection of soil and groundwater samples;
- Analysis for typical contaminants associated with former uses and possible imported fill material;
- Assess results against adopted Site criteria (commercial / industrial land-use); and
- Provide preliminary waste classification of material.

CH2M HILL found Site soils generally consisted of 0.5 - 0.7m of fill, underlain by natural clays and shale. Contaminant levels in soil samples collected were generally below adopted Site criteria with the exception of a few specific locations which exceeded for TPH and PAH. These locations were primarily identified within the ash material present in the fill across the Site (BH05, BH06, MW02 and MW03). The majority of fill material was classified as 'general solid waste'. A limited volume of soil at one location was classified as 'restricted solid waste' (MW02 between approximately 0.4 and 0.7m bgl). These four locations were identified as being hotspots of contamination.

CH2M HILL encountered groundwater at depths of between 3.3 and 4.45m below ground level. Groundwater samples were generally below the adopted Site criteria with the exception of heavy metals. It was considered that the heavy metals were likely to be migrating onto the Site from up-hydraulic gradient. It was considered unlikely that the TPH and PAH detected in the fill material was mobilising into the groundwater.

CH2M HILL recommended management and remediation, prior to or during redevelopment, to reduce the risk to construction workers and future users of the Site. It was also recommended that remediation / management of the identified soil contamination hotspots be conducted.

4.4 PRE-DEMOLITION ENVIRONMENTAL INVESTIGATION, WSP (2012)

WSP was engaged by UoS to provide Environmental Services in support of the proposed redevelopment of the Site. The scope of work included the advancement of 20 boreholes in roadways and landscaped areas prior to the demolition of existing buildings to characterise the fill material at the Site. These works were undertaken in conjunction with a geotechnical investigation conducted by Coffey Geotechnics.

WSP made the following conclusions and recommendations:

- Fill material exceeding the adopted land use criteria for PAH was identified across the Site. Due to the non-volatile nature of this contaminant, containment of the material via capping is considered to be a viable remedial option where excavation is not envisaged to facilitate the proposed redevelopment;
- Fill material exceeding the adopted land use criteria for TPH and benzene were identified in Rose Street, the landscaping compound and the park area on the corner of Abercrombie Street and Codrington Street. Due to the volatile nature of these contaminants, remediation is required to prevent a potential vapour risk to Site occupants. WSP expects excavation and validation of this material to be the most favourable remedial option; and
- It is noted that the natural material underlying the fill generally returned results below the adopted land use criteria.

WSP also undertook a preliminary waste classification for the material expected to require off-site disposal during Site redevelopment. This is summarised as follows:

- The bulk of material can be classified as general solid waste;
- Material located on Rose Street in the vicinity of BH01_0.4 and BH02_0.8 falls into the Restricted Waste classification;
- Material located in the west of the Site adjacent to MW02 (CH2M HILL) and east of the Site adjacent to MW03 (CH2M HILL) falls into the Hazardous Waste classification;
- Material located on Rose Street and Boundary Lane in the vicinity of BH05_0.3, BH06_0.2 and BH11_0.6 fall into the Hazardous Waste classification; and
- Natural soils present beneath the fill material (generally observed to consist of red and grey mottled clay) may be classified as VENM.

It is recommended that further delineation of areas classified as Hazardous or Restricted waste is undertaken to reduce disposal costs wherever possible.

4.5 ASBESTOS MANAGEMENT PLAN, WSP (2012)

WSP was engaged by UoS to take samples of suspected asbestos containing materials (ACM) to positively identify ACMs and to provide advice on action to be taken through the provision of an Asbestos Management Plan (AMP).

WSP made the following recommendations:

Friable Asbestos in Air Handling Units of the Computer Centre

Friable asbestos was identified by Pickford & Ryder in March 2010 to be located in the heater bank ducts, consisting of asbestos lining around the ductwork and asbestos insulated wiring.

The WSP hazardous material survey reports these two items as high risk. The asbestos located in this area were observed by Pickford and Ryder to be friable asbestos containing materials. As these asbestos materials are located within the air supply ducts there is potential for asbestos fibres to be distributed into the occupied areas of the building. This material should be targeted for removal as soon as practicable.

Non-Friable Materials (Computer Centre)

A number of non-friable asbestos containing materials were identified. WSP report these items as having a low risk rating as they present an extremely low risk with regards to personnel exposure. It was recommended that these materials be managed in-situ.

5 Site Characterisation

5.1 EVALUATION OF CONTAMINANTS OF CONCERN

Based on a review of previous investigations, WSP identified the following contaminants of potential concern with concentrations above the adopted Site criteria:

- Benzo(a)pyrene;
- Total PAH;
- Benzene; and
- TPH (C₁₀-C₃₆)

The environmental status of the Site has been characterised based on previous investigations conducted between 1998 and 2012. Soil sample locations are shown in Figure 2, **Appendix A**. Figures 3 and 4, **Appendix A** indicate assessment criteria exceedances and preliminary waste classification results.

5.2 SITE SOILS AND FILL MATERIAL

Based on the intrusive works conducted by WSP from 5 March to 13 March 2012, the soil profile generally comprised the following:

- Asphalt / roadbase (all locations with exception of BH18, BH19 and BH20) to a maximum of 0.3m bgl
- Fill: Grey / orange / brown clayey sand and/or crushed sandstone with occasional ash and blue metal inclusions from approximately 0.3 to 0.5m bgl
- Fill: Dark brown/grey silty clay with gravel and charcoal inclusions from approximately 0.4 to 1.0m bgl
- Natural: Red / grey mottled clay extending from approximately 0.5 to 1.0m bgl.

Inclusions of ash, charcoal and/or blue metal were noted in fill material in BH02, BH03, BH04, BH07, BH08, BH12, BH13 and BH16. No potential ACMs were visually identified at any of the investigation locations.

Fill material exceeded the most sensitive HIL E land use criteria for B(a)P and/or PAH (total) in the following areas:

- Rose Street to the north of the Site (BH03_0.5);
- Adjacent to the garage on Darlington Lane (BH08_0.5). BH08 is considered off-site and is not discussed further in this RAP; and
- In the park area on the corner of Codrington and Abercrombie Streets (BH20_0.3).

In addition, fill material exceeded the less sensitive HIL F (in addition to the HIL E) land use criteria for B(a)P and/or PAH (total) in the following areas:

- Rose Street to the north of the Site (BH01_0.4, BH02_0.8, BH4_0.5, BH05_0.3 and BH06_0.2);
- Boundary Street adjacent to building H67 (BH11_0.6); and
- In the park area on the corner of Codrington and Abercrombie Streets (BH19_0.3).

Fill material exceeded the adopted NSW EPA land use criteria for TPH (C₁₀-C₃₆) and/or benzene in the following areas:

- Rose Street to the north of the Site (BH01_0.4, BH02_0.8, BH05_0.3 and BH06_0.2).

Natural material marginally exceeded the HIL E land use criteria on Rose Street to the north of the Site (BH05_0.6) for B(a)P.

Summary results tables are included as **Appendix B** and borehole logs are included as **Appendix C**.

6 Selection of Remedial Strategy

6.1 REMEDIATION OBJECTIVES

The main objectives of the remediation program are to:

- Minimise any ongoing liability and risk associated with the localised impacted fill material; and
- Render the Site suitable for redevelopment works and future use.

6.2 EXTENT OF REMEDIATION

The extent of the remediation is limited to TPH and PAH impacted soils in a number of locations across the Site. As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. Previous studies indicate that fill is likely to extend to a maximum depth of 1m bgl.

Remediation areas have been estimated with the principal that contamination may laterally extend approximately half the distance to the nearest 'clean' soil bore location. Soil bores are defined as 'clean' where all soil samples at that location exhibited contaminant concentrations below the adopted Site assessment criteria.

It should be noted that the estimated extents of remediation provided herein will need to be reviewed (and consequently may change in both extent, volume and classification) following completion of preliminary delineation sampling works (Section 7.1) which will be conducted following completion of demolition. Using the principals outlined above, the approximate extent of each Remediation Area is shown in Figure 5, **Appendix A**.

It is recommended that the assumptions, areas and volumes outlined below are checked and compared to most current drawings before providing to contractors for pricing purposes.

Remediation Area 1

Targeting BH05 (CH2M HILL) – B(a)P, Total PAH and TPH(C10-C36) Contamination

- Estimated to extend approximately half the distance to BH07 (CH2M HILL) and BH04 (CH2M HILL). The excavation area will not extend beyond the Site boundary to the North West.
- Excavation estimated to cover an area of approximately 150m².

As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. On the basis of borelogs presented by CH2M HILL (2011) and WSP (2012), fill material is expected to the following depths:

- BH05 (CH2MHILL) = 0.6m bgl

The greatest depth of fill has been used to determine the maximum total volume of material requiring remediation. Remediation Area 1 is estimated to be approximately 90m³.

Preliminary in-situ waste classification suggests that this material is classified as 'restricted' waste.

Remediation Area 2

Targeting BH06 (CH2M HILL), BH05 (WSP) and BH06 (WSP) – B(a)P, Total PAH and TPH(C10-C36) Contamination

- Estimated to extend approximately half the distance to BH07/MW04 (WSP), BH13 (CH2M HILL), BH04 (WSP) and BH07, MW01, BH03 and BH01 (CH2M HILL).
- Excavation estimated to cover an area of approximately 1,400m².

As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. On the basis of borelogs presented by CH2M HILL (2011) and WSP (2012), fill material is expected to the following depths:

- BH06 (CH2M HILL) = 0.65m bgl
- BH06 (WSP) = 0.35m bgl
- BH05 (WSP) = 0.5m bgl

The greatest depth of fill has been used to determine the maximum total volume of material requiring remediation. Remediation Area 2 is estimated to be approximately 910m³.

Preliminary in-situ waste classification suggests that this material is classified as 'hazardous' waste.

Remediation Area 3

Targeting BH04 (WSP) and BH03 (WSP) – B(a)P and Total PAH Contamination

- Estimated to extend approximately half the distance to BH02 (WSP), BH13 (WSP), BH11 and BH12 (CH2M HILL). The excavation area will not extend beneath the H69 building.
- Excavation estimated to cover an area of approximately 900m².

As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. On the basis of borelogs presented by WSP (2012), fill material is expected to the following depths:

- BH03 (WSP) = 0.8m bgl
- BH04 (WSP) = 0.55m bgl

The greatest depth of fill has been used to determine the maximum total volume of material requiring remediation. Remediation Area 3 is estimated to be approximately 720m³.

Preliminary in-situ waste classification suggests that this material is classified as 'general solid' waste (non-putrescible).

Remediation Area 4

Targeting BH01 (WSP) and BH02 (WSP) – B(a)P, Total PAH and TPH(C10-C36) Contamination

- Estimated to extend approximately half the distance to BH14/MW05 (CH2M HILL), BH13 (WSP) and BH03 (WSP). The excavation area will not extend beneath Building H69. The excavation area for remediation purposes may extend beyond the proposed redevelopment excavation works.
- Excavation estimated to cover an area of approximately 1,100m².

As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. On the basis of borelogs presented by WSP (2012), fill material is expected to the following depths:

- BH01 (WSP) = 1.1m bgl
- BH02 (WSP) = 0.9m bgl

The greatest depth of fill has been used to determine the maximum total volume of material requiring remediation. Remediation Area 4 is estimated to be approximately 1,210m³.

Preliminary in-situ waste classification suggests that this material is classified as 'restricted solid' waste.

Remediation Area 5

Targeting MW02 (CH2M HILL) – B(a)P and Total PAH Contamination

- Estimated to extend approximately half the distance to BH18 (WSP), BH09 (WSP) and BH10 (CH2M HILL). The excavation area for remediation purposes may extend beyond the proposed redevelopment excavation works.
- Excavation estimated to cover an area of approximately 200m².

As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. On the basis of borelogs presented by WSP (2012), fill material is expected to the following depths:

- MW02 (CH2M HILL) = 1.0m bgl

The greatest depth of fill has been used to determine the maximum total volume of material requiring remediation. Remediation Area 5 is estimated to be approximately 200m³.

Preliminary in-situ waste classification suggests that this material is classified as 'restricted solid waste'.

Remediation Area 6

Targeting BH11 (WSP) – B(a)P and Total PAH Contamination

- Estimated to extend approximately half the distance to BH12 (WSP), BH15 (WSP), BH13 (CH2M HILL) and BH12 (CH2M HILL). The excavation area will not extend beyond the Site boundary to the south east.
- Excavation estimated to cover an area of approximately 300m².

As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. On the basis of borelogs presented by CH2M HILL (2011) and WSP (2012), fill material is expected to the following depths:

- BH11 (WSP) = 0.60m bgl

The greatest depth of fill has been used to determine the maximum total volume of material requiring remediation. Remediation Area 6 is estimated to be approximately 180m³.

Preliminary in-situ waste classification suggests that this material is classified as 'hazardous' waste.

Remediation Area 7

Targeting BH19 (WSP), BH20 (WSP) and MW03 (CH2M HILL) – B(a)P and Total PAH Contamination

- Estimated to extend approximately half the distance to BH08 (CH2M HILL), BH09 (CH2M HILL) and BH13 (WSP). The excavation area for remediation purposes may extend beyond the proposed redevelopment excavation works.
- Excavation estimated to cover an area of approximately 250m².

As a conservative approach, fill material at each remediation location shall be considered to require remediation up to the depth of underlying natural soils. On the basis of borelogs presented by CH2M HILL (2011), fill material is expected to the following depths:

- MW03 (CH2M HILL) = 0.7m bgl

The depth of fill has been used to determine the maximum total volume of material requiring remediation. Remediation Area 7 is estimated to be approximately 175m³.

Preliminary in-situ waste classification suggests that material immediately surrounding MW03 is classified as 'hazardous' waste (15m³). The remainder of material from this excavation, surrounding BH09 and BH20, is classified as 'general solid' waste

It is noted that fill material (with concentrations of contaminants less than the adopted criteria) is also located across the remainder of the Site. The majority of the fill is likely to be removed as part of redevelopment works.

Fill material with concentrations above the adopted criteria may also remain onsite in areas where existing buildings are to be retained (H67 and H69). An Environmental Management Plan will be developed for the Site to address these ongoing issues.

Any fill remaining at the Site, will require suitable cover (hardstand / topsoil of at least 300mm) to manage potential aesthetic issues in areas of open space land use.

6.3 SOIL REMEDIATION OPTIONS

Possible remediation options were considered against the NSW EPA remediation hierarchy (DEC, 2006) and in accordance with the remediation objectives.

A suitability evaluation of feasible soil remediation options is outlined below and summarised in Table 6.1. Soil treatment was not considered feasible due to the nature of the contaminants (TPH, benzene and PAHs).

6.3.1 Do Nothing

No remedial action is taken using this approach. The advantages of this option are that no remedial costs are incurred.

The disadvantages of this option are that a large portion of the Site will be excavated due to re-development

works therefore a remediation plan will need to be incorporated to deal with contaminated soils removed. Any remaining soils left in-situ do not render the Site suitable for future use and potential liability remains at the Site following redevelopment.

This is an unacceptable approach for UoS.

6.3.2 Excavation and OffSite Disposal

This process would involve the excavation, removal and off-Site disposal of TPH and PAH impacted fill material from the identified remediation areas. Validation sampling would need to be carried out to demonstrate that the areas had been successfully remediated. This option is a highly successful and proven method for removal of soils impacted with TPH, benzene and PAHs.

The advantage of this remediation option includes no ongoing liability and unrestricted land use following remediation and validation in excavated areas. Excavation remedial works can be carried out in conjunction with the proposed basement excavations required to facilitate Site redevelopment.

The disadvantages of this option include the high cost of transport and disposal of soils if classified as restricted or hazardous waste. This method will not address potential contamination beneath existing buildings which are to be retained (H67 and H69). An ongoing Environmental Management Plan (EMP) would need to be developed and then approved by both Council and the Site Auditor. A notation on the Section 149 planning certificate for the land may also be required to identify that the areas that are restricted and subject to the EMP.

6.3.3 Capping and Containment

This approach reduces potential exposure to contaminant impacted shallow soils through a purpose built cap. The cap may include an impermeable barrier, such as concrete, placed on the existing Site surface, or the placement of a specified thickness of clean soil over impacted areas. The capping and containment of TPH impacted soils may still result vapour risk associated with the contaminants.

The advantage of this option is that soils do not have to be transported off-Site, which reduces remediation costs. Capping can also be integrated into the proposed development design as building footprints, roadways and footpaths.

A large portion of the Site is planned to be excavated as part of the re-development works. This excavation will remove contaminated soil and hence a remediation plan would still need to be incorporated to deal with these soils.

Disadvantages also include the need to alter development designs to accommodate the cap and the restricted use of the land following the remediation works, as an ongoing Environmental Management Plan (EMP) would need to be developed and then approved by both Council and the Site Auditor. A notation on the Section 149 planning certificate for the land may also be required to identify that the areas that are restricted and subject to the EMP.

Containment of non-volatile material via capping is considered to be a viable remedial option where excavation is not envisaged to facilitate the proposed redevelopment.

6.4 PREFERRED SOIL REMEDIATION STRATEGY

On the basis of the soil remediation options evaluated in Table 6.1 below, the preferred remediation strategy is the excavation and off-Site disposal of impacted soil where required to facilitate development. All excavations shall be validated. Where excavations lie outside the proposed basement footprint and design levels require, reinstatement of Site levels will be achieved using imported VENM or ENM.

Fill material exceeding the adopted land use criteria for PAH was identified across the Site. Due to the non-volatile nature of this contaminant, containment of the material via capping is considered to be a viable remedial option where excavation is not envisaged to facilitate the proposed redevelopment.

Potentially contaminated soils beneath building footprints which are to be retained (primarily H67 and H69) will need to be addressed by an ongoing EMP.

Table 6.1: Remediation Options & Feasibility Summary For Soil

Remedial Option	Benefits	Limitations	Acceptability	Time effectiveness	Cost (comparative)
Do nothing	Nil cost	Does not render the Site suitable for the proposed future land use. Not possible due to Site redevelopment plans	Potential liability for UoS Does not meet UoS or Council requirements.	Excellent - no time required	Nil
Excavation and offSite disposal	Removes contamination in exposed areas – no ongoing liability and unrestricted land use. Excavations already proposed as part of Site re-development.	Civil works required. Does not address potential soil contamination beneath buildings which are to be retained. These issues need to be addressed in an EMP.	Acceptable approach. Is implemented in conjunction with EMP. Meets EPA requirements for remediation and satisfies project objectives. Will facilitate Site Auditor sign-off.	Acceptable - approximately 2 months (dependent upon re-development works schedule) EMP is ongoing	High
Capping and containment	Reduced civil works program at the Site. Eliminates requirement for offsite disposal.	Ongoing liability and EMP required (restrictions for future Site use). Not possible in areas where excavations proposed as part of the Site development design. Council approval required.	Would only be an acceptable solution where contaminants are non volatile, will not impact groundwater and lie outside the proposed basement excavations.	Acceptable - approximately 3 months (includes revised RAP and approvals) EMP is ongoing	Low

7 Scope of Remediation

7.1 PRELIMINARIES

In accordance with State Environment Planning Policy No. 55 - Remediation of Land (SEPP55), written notification of the proposed remediation works is required to be submitted to Council prior to the commencement of Site works (refer to Section 9.1). Copies of the investigation reports and RAP shall also be provided to Council. Council shall be provided with contact details for the remediation contractor at least 14 days prior to the commencement of the proposed remediation works. The PCA and Council shall be given written notice, at least 48 hours prior to the commencement of excavation, shoring or underpinning works on the Subject Site

The demolition of all buildings and removal of hardstand surfaces will be required prior to the commencement of remediation works. As all structures will be demolished, environmental controls will be required to minimise the potential for liberating and spreading additional contamination associated with potentially hazardous building materials. The demolition contractor will be required to provide documentation to demonstrate that all hazardous materials have been removed, managed and disposed off site in accordance with prevailing legislation before demolition each building (or part thereof) can commence.

Following demolition of Site structures, additional investigation works are required. The purpose of these works will be to further characterise the nature and extent of identified contamination as well as validate building footprints following demolition. The investigation works will include the following scope:

- Additional delineation works around CH2M HILL identified TPH and PAH impact in order to minimise the volume of waste classified as restricted or hazardous.
- Additional delineation works around WSP identified TPH and PAH impact in order to minimise the volume of waste classified as restricted or hazardous.
- Undertake additional contamination assessment beneath the building footprints following demolition.
- Validation sampling and reporting post excavation.

Based on the findings of the further investigation works an addendum letter to this RAP will be issued, if required.

Underground services shall be located and protected prior to commencing excavation works at the Site. As Site structures will be demolished as part of the proposed development, pre-works dilapidation surveys are not considered necessary for the remediation works.

7.2 SAFETY AND ENVIRONMENTAL CONTROLS

Prior to remedial works, safety and environmental controls shall be established in accordance with approved safety and environmental management plans. Safety and environmental controls are likely to include:

- Safety barriers surrounding work areas (excavations in particular).
- Dust and sediment controls.

Where asbestos materials are suspected, a Class A (friable) and Class B (non friable) asbestos removal licensed contractor will be required to coordinate the works and specify appropriate environmental control measures in accordance with existing legislation and guidance.

7.3 MARK OUT OF REMEDIATION AREAS

The lateral extent of the soils requiring removal as noted in Section 6.2 and Figure 5, **Appendix A**, shall be marked out with spray paint.

7.4 ON SITE CAPPING AND CONTAINMENT

Where feasible and in areas not required to be excavated to facilitate development, containment of fill material exceeding the adopted land use criteria for PAH (or other non volatile contaminants which will not adversely affect groundwater quality) via capping is considered to be a viable remedial option due to the non-volatile nature of this contaminant.

7.5 EXCAVATION OF IMPACTED SOILS

Excavation of impacted soils shall be completed using an appropriately sized excavator.

Impacted soil shall be excavated in each remediation area to the depth of natural soils as indicated in Section 6.2.

Once the proposed extent of soil removal has been achieved, WSP will complete field screening (visual, olfactory and PID) to assess the potential for contamination to remain within the excavations. Where required, WSP may direct additional contaminant chase-out, noting potential safety, geotechnical and time constraints associated with additional excavation works.

Final excavation volumes shall be surveyed to assist with documentation of remediation extents and waste tracking.

To minimise the potential for re-contaminating excavated areas, excavation works shall be staged and where feasible, excavation shall commence at the end of the marked excavation zone which is furthest from the dedicated stockpile area, with the work Site retreating toward the stockpile area as works progress.

7.6 MATERIALS SEGREGATION AND STOCKPILING

Using field screening techniques (visual, olfactory, PID screening), and based on borelogs presented by CH2M HILL (2011) and WSP (2012), WSP personnel will direct the stockpiling of excavated material into discrete stockpiles to facilitate waste classification. VENM shall be excavated and stockpiled separately to fill material.

Where feasible the stockpiling area will be adjacent to excavations to minimise tracking of material across the Site.

Stockpiles shall:

- Not be placed on footpaths or nature strips without prior Council approval.
- Be placed away from drainage lines, gutters and stormwater pits / inlets.
- Be covered and secured.
- Be placed on a level area as a low, elongated mound.

7.7 OFF-SITE REMOVAL OF CONTAMINATED SOIL

Material shall be transported and disposed off-site in accordance with the waste classification (Section 9.5). On the basis of existing data, including limited TCLP analysis, segregated soil stockpiles are likely to be classified as either 'Hazardous Solid Waste', 'Restricted Solid Waste' or 'General Solid Waste' (non-putrescible) (Tables 1 and 2, Waste Classification Guidelines, DECCW, 2009).

All material being removed off-site will be disposed of to an appropriately licensed facility and records of truck / load movements, tipping dockets and landfill licences will be provided in the Validation Report.

7.8 SOIL VALIDATION

Validation sampling and analyses of excavations shall be conducted in accordance with the Validation Plan (Section 8). If validation objectives are not achieved, additional excavation and disposal works may be required in accordance with Sections 7.4 to 7.6 inclusive.

In accordance with the provisions of SEPP55, Council shall be notified of validation within one month of completion of remediation work.

7.9 SITE REINSTATEMENT

The excavations shall be left in a condition which renders the Site safe. Where required, excavations shall be backfilled (after successful soil validation) using validated VENM or ENM imported to the Site to levels to facilitate site redevelopment. The backfill material shall be compatible with the existing soil characteristics for Site drainage and geotechnical purposes. Council (or the alternative consent authority) shall be consulted regarding approvals related to the importation of ENM.

7.10 SITE DEMOBILISATION

Remediation works are likely to be conducted in conjunction with Site-redevelopment works. Plant/equipment and safety/environmental controls will therefore be left in place until all works are completed or areas are deemed suitable/safe.

7.11 REMEDIATION SCHEDULE

The remediation program will be undertaken in conjunction with Site redevelopment works. Sampling and analysis will be conducted as efficiently as possible to minimise delays.

8 Validation Plan

8.1 DATA QUALITY OBJECTIVES (DQOS)

The data quality objectives (DQO) process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The data quality objectives define the experimental process required to test a hypothesis. The DQO process was developed to ensure that efforts relating to data collection are cost effective, by eliminating unnecessary, duplicative or overly precise data whilst at the same time, ensuring the data collected is of sufficient quality and quantity to support defensible decision making.

It is recognised that the most efficient way to accomplish these goals is to establish criteria for defensible decision making before the data collection begins, and then develop a data collection design based on these criteria. By using the DQO process to plan the validation works, the relevant parties can improve the effectiveness, efficiency and defensibility of a decision in a resource and cost effective manner.

The DQO process consists of seven steps, which are designed to clarify the study objectives, define the appropriate type of data and specify tolerable levels of potential decision errors. The seven-step DQO process that will be adopted for the remediation and validation works will be as follows:

Step 1 – Defining the Problem. The first step in the DQO process is to ‘define the problem’ that has initiated remedial works;

Step 2 – Identify the Decision. The second step in the process is to define the decision statement that the works will attempt to resolve;

Step 3 – Identify Inputs to the Decision. In this step, the different types of information needed to resolve the decision statement are identified.

Step 4 – Define the Study Boundaries;

Step 5 – Develop a Decision Rule;

Step 6 – Specify Limits on Decision Errors; and

Step 7 – Optimise the Design for Obtaining the Data.

8.2 DEFINE THE PROBLEM

The problem under consideration is that the fill material at the Site does not meet the NSW EPA and NEPM commercial / industrial and parks, recreational open space and playing fields land use criteria with respect to the proposed redevelopment for the Site. The vertical and horizontal extent of the impacted fill has been established and now a remediation / management strategy is required.

A preliminary waste classification has been conducted and has identified a number of areas which are classified as Hazardous, Restricted or General Solid waste. These areas will need to be further delineated following demolition of existing structures to minimise costs and ensure wastes are being disposed of appropriately.

8.3 IDENTIFY THE DECISION

The principle decision is ‘*what is the most appropriate way to minimise ongoing liability and risk associated with the localised fill material and to render the Site suitable for future redevelopment works*’.

Requirements of the adopted remediation and validation works must include:

- No unacceptable on or off-Site impacts during and after remedial works;
- Provisions to verify that the remedial actions are adequate and will not result in on or off-Site impacts (i.e. validation); and
- Provisions to verify that the Site is suitable for the proposed development.

8.4 IDENTIFY THE INPUTS TO THE DECISION

The inputs to the decision are as follows:

- Assessment data gathered for the Site to date – B(a)P, PAH (total), TPH (C₁₀-C₃₆) and benzene contamination has been identified in soils at concentrations which may present a risk to human health and/or the environment under the proposed land use setting;
- Remedial action preferences – An assessment of the remedial action preferences has been conducted to adopt the most appropriate remedial action;
- Assessment of the preliminary waste classification including further delineation works where necessary;
- Additional assessment data obtained following the demolition of Site structures;
- Materials tracking documentation, including stockpiling, vehicle movements and waste disposal documentation;
- Validation data obtained during the remediation works program, including validated excavations, confirmatory validation of fill materials which will remain at the Site and validation of imported backfill materials.

8.5 DEFINE THE BOUNDARIES OF THE STUDY

The Site boundary is shown in Figure 2, **Appendix A** and the estimated remediation areas are shown in Figure 3, **Appendix A**.

The horizontal extent of the RAP is limited to the boundaries of the Site, shown in Figure 2 in **Appendix A**. The vertical extent of the required remedial /management works is limited to impacted fill material which ranges in thickness to a maximum of 1.0m. However, final depths of excavation will be based on observations made during the remedial works.

As part of the remedial strategy developed in Section 5, the boundaries of the remedial process are defined as follows:

- Remediation Area 1
Targeting BH05 (CH2M HILL) – B(a)P, Total PAH and TPH(C10-C36) Contamination. Impact is associated with sand fill containing sandstone nodules and black ash. Area 1 has been estimated to have and impacted volume of approximately 90m³. Preliminary waste classification indicates this material is Restricted Solid waste.
- Remediation Area 2
Targeting BH06 (CH2M HILL), BH05 (WSP) and BH06 (WSP) – B(a)P, Total PAH and TPH(C10-C36) Contamination. Impact is associated with sandy clay, crushed sandstone, and gravelly sand fill containing gravel and black ash. Area 2 has been estimated to have and impacted volume of approximately 910m³. Preliminary waste classification indicates this material is Hazardous waste.

- Remediation Area 3

Targeting BH04 (WSP) and BH03 (WSP) – B(a)P and Total PAH Contamination. Impact is associated with silty clay containing rounded gravels and charcoal and crushed sandstone fill containing blue metal and asphalt. Area 3 has been estimated to have and impacted volume of approximately 720m³. Preliminary waste classification indicates this material is General Solid waste.

- Remediation Area 4

Targeting BH01 (WSP) and BH02 (WSP) – B(a)P, Total PAH and TPH(C10-C36) Contamination. Impact is associated with clayey sand and silty clay fill containing some ash/charcoal and with slight hydrocarbon odours. Area 4 has been estimated to have and impacted volume of approximately 1210m³. Preliminary waste classification indicates this material is Restricted Solid waste.

- Remediation Area 5

Targeting MW02 (CH2M HILL) – B(a)P and Total PAH Contamination. Impact is associated with sand fill. Area 5 has been estimated to have and impacted volume of approximately 200m³. Preliminary waste classification indicates this material is Hazardous waste.

- Remediation Area 6

Targeting BH11 (WSP) – B(a)P and Total PAH Contamination. Impact is associated with clay fill containing rounded gravel. Area 6 has been estimated to have and impacted volume of approximately 180m³. Preliminary waste classification indicates this material is Hazardous waste.

- Remediation Area 7

Targeting BH19 (WSP), BH20 (WSP) and MW03 (CH2M HILL) – B(a)P and Total PAH Contamination. Impact is associated with sandy gravel fill containing organic matter. Gravel fill with crushed brick, ash, slag and possible furnace waste should also be removed to meet aesthetic requirements. Area 7 has been estimated to have and impacted volume of approximately 175m³. Preliminary waste classification indicates this material is Hazardous waste (15m³). The remainder of material from this excavation, surrounding BH09 and BH20, is classified as General Solid waste.

Each of the above areas will be treated separately during remedial works.

8.6 DEVELOP A DECISION RULE

Based on the available Site assessment information and in accordance with DEC (2006), elements of the decision rule can be established as follows:

- Have the identified impacts been removed from the Site?
- Have fill materials which will remain at the Site been adequately validated?
- If potential contamination remains at the Site (beneath building footprints to be retained), will ongoing issues be managed via an EMP?
- Have remedial works adequately reduced the overall risk of the Site?
- Is the Site rendered suitable for the proposed use?
- Have aesthetic issues been addressed where appropriate?
- Has validation been reported in accordance with NSW OEH (2011)?

Validation sampling is required to demonstrate that the impacted areas have been remediated / fill materials remaining in-situ have been validated as suitable for the proposed land use.

The criteria published by NSW DEC (2006) are conservative thresholds for assessing potential impacts of contamination on human health and as such, are considered appropriate for use as validation criteria.

Surface soils (less than 300mm depth) in areas of residential and open space land use shall also be free from rubble (including bricks, glass and tiles), stained soils and odour such that they are deemed aesthetically suitable for the proposed uses.

In the event that soil needs to be imported to the Site to facilitate the development (e.g. backfill excavations), it will be obtained from reputable suppliers and will comprise Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) where appropriate characterisation of the source material has occurred in accordance with the published NSW DECCW General Waste Exemption for ENM. By definition VENM is unimpacted material and should meet NEPM (1999) HIL A land use criteria or be demonstrated to be representative of background concentrations common to the source materials.

It is intended that Site soils be validated to the adopted Validation Criteria to ensure that:

- The remedial works adequately reduce the overall risk of the Site; and
- The Site be rendered suitable for the proposed use and to obtain Auditor sign off, if required.

8.7 SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

Quality Assurance and Quality Control (QA/QC) protocols in accordance with DEC (2006) guidelines will be applied to the remediation and validation works.

The acceptable limits for data QA are outlined in Section 8.14 (QA/QC).

8.8 OPTIMISE THE DESIGN OF OBTAINING DATA

The purpose of this step is to identify a resource-effective data collection design for generating data to meet the project objectives. This will be achieved by the proposed Sampling and Analysis program for the validation of the excavations at the Site, including the number of sample locations, media to be sampled, number of samples retained for analysis, analytical suite and method of sample collection.

Validation sampling works associated with remedial works are to be in accordance with the guidelines presented in Section 5. The following sampling pattern and density was designed to meet the objectives of the validation works:

Table 8.1: Sampling Design

WSP Sampling Design	Sampling Pattern	Sampling Density	Analytical Suite
Demolished building footprints	Systematic	Twelve test pits across the site with at least one sample per building footprint	PAH, TPH and asbestos
Area 1, Area 2, Area 3, Area 4, Area 5: Soil Validation –walls of excavations	Systematic	Minimum of 1 per wall adjacent to BH exceedances.	PAH, TPH (C10-C36), BTEX (in vicinity of BH05)
Area 6: Soil Validation –walls of excavations	Systematic	Minimum of 1 per wall adjacent to BH exceedance.	PAH
Area 7: Soil Validation –Western walls of	Systematic	Minimum of 1 sample	PAH, TPH (C10-C36)

WSP Sampling Design	Sampling Pattern	Sampling Density	Analytical Suite
excavations		per wall or 1 per 10 linear metres.	
All Areas: Soil Validation - Base of excavations	Systematic	One base sample per remediation area, visual and photographic record of VENM status	PAH, TPH (C10-C36), BTEX (in vicinity of BH05)
Validation of any VENM material prior to importation to Site (as required). ENM can only be brought to Site if the use and testing accordance is conducted with the ENM Exemption and comprises a minimum of 10 samples for the comprehensive suite listed therein.	Random	1 / 100m ³	Metals, TPH, OCP, OPP, PAH, asbestos and source history review to demonstrate material is VENM.

Waste material generated from Area 3 and part of Area 7 is classified as general solid waste (non-putrescible). Therefore, material excavated from this area can be disposed of in conjunction with the majority of excavated soils during the remediation works. However, the PAH impacts in the vicinity of BH03 BH04, BH19 and BH20 still need to be managed either by removal offsite or capping.

9 Remedial Action Strategy

As part of WSP's Pre-Demolition Environmental Investigation (May 2012), analytical results from previous investigations were compiled for the purposes of gaining a robust understanding of the contamination of the Site and developing the most appropriate remediation strategy.

9.1 SOIL VALIDATION METHODOLOGY – EXCAVATIONS

Validation sampling will be completed on an approximate 10m x 10m grid across the base of the excavation. Soil samples will also be obtained at 10m intervals along each excavation wall. Should excavations exceed 1m depth, two wall samples shall be obtained per location (shallow and deep).

Excavation soil samples will be analysed as per the sampling design outlined in Table 8.2.

Soil samples will be collected from the excavator bucket or directly from the excavation surface by using a decontaminated stainless steel trowel or by hand with nitrile gloves. Where samples are collected from the excavator bucket, the sample will be obtained from the centre of the bucket to minimise the potential for cross-contamination and to ensure a representative sample is obtained.

If a hand trowel is used for collecting soil validation samples, the equipment shall be rinsed with de-ionised water and phosphate free detergent (Decon 90) between sampling locations. In order to maintain sample integrity, new nitrile gloves will be used to collect each sample.

All sample containers will be clearly labelled with a sample number, sample location, sample depth, sample date and samplers initials. The sample containers will then transferred into a Esky for shipment to the testing laboratory for analysis. A chain-of-custody (COC) form will be completed, and forwarded with the samples to the testing laboratory. Sample analysis is to be conducted NATA accredited laboratory in accordance with NATA approved methods.

9.2 VALIDATION SAMPLING

Validation sampling will form a crucial part of the remedial works for the Site and will be carried out by appropriately qualified personnel. The main types of validation sampling can be described as:

- Excavation validation work from Areas 1 to 7 will entail collecting soil samples for laboratory testing when it is judged in the field that all material requiring excavation has been removed. Visual checks will also be made in the excavations for potential preferred migration pathways such as underground service trenches. Where identified, contamination will be chased out. The number of validation samples will be decided on the basis of size of each excavation. Where remedial excavation depths are greater than approximately 1.5m (not expected), the need for additional wall validation samples will be considered (e.g. a further wall sample per additional 1 to 1.5m of excavation depth).
- If a UST is identified during remedial works, validation sampling will be conducted in accordance with NSW EPA (1994) Service Station Guidelines.
- Imported VENM material that may be required for backfilling purposes will require validation sampling to confirm the VENM status of the material prior to backfilling.

A PID will be used for all validation works associated with the hydrocarbon contamination including base and wall sample collection from the excavation pit. Sample collection methods will be recorded and reported, with rationale for sample selection.

Based on the validation sampling results for each remediation area, one of the following actions will be made:

- If some of the validation samples fail to meet the remediation criteria, the soils identified as failing the remediation criteria will be further excavated. Further validation of these areas will be required.
- If some of the validation samples fail the remediation (acceptance) criteria and further excavation is not considered practicable, alternate remedial strategies and / or risk assessment to assess the significance of the remaining contamination may be considered in consultation with the Site Auditor.
- If all validation samples meet the remediation criteria, no further remedial works will be required.

9.3 SOIL VALIDATION CRITERIA

Assessment criteria have been selected following consideration of the proposed land use following redevelopment. It is noted that redevelopment will primarily consist of commercial land use however the land use in selected areas, including the vicinity of BH14, BH19 and BH20, is likely to consist of parks and open space. In addition, it is likely that quantities of fill material will require offsite disposal during the construction process. Based on the above, the analytical soil results were assessed against the following criteria:

- National Environment Protection Council (1999) National Environment Protection Measure – Assessment of Site Contamination Schedule B (1) Health Based Investigation Level (HIL) (E) for parks, recreational open space and playing fields;
- National Environment Protection Council (1999) National Environment Protection Measure – Assessment of Site Contamination Schedule B (1) Health Based Investigation Level (HIL) (F) for commercial / industrial land;
- National Environment Protection Council (1999) National Environment Protection Measure – Assessment of Site Contamination Schedule B (1) Ecological Investigation Level (EIL);
- In the absence of National Environment Protection Council guidelines for TPH and BTEX, results were assessed against NSW EPA (1994) Contaminated Sites: Service Station Guidelines;
- Department of Environment, Climate Change and Water (DECCW, 1999) Waste Classification Guidelines, Part 1: Classifying Waste for waste disposal purposes; and
- In the absence of NSW endorsed guidelines for reporting on asbestos, WSP adopted the EnHealth (2005) trigger value of 'no detection of fibres or fragments in surface soils' at the laboratory reporting limit of <0.1g/kg as the criteria.

Surface soils (less than 300mm depth) in areas of residential and open space land use shall also be free from rubble (including bricks, glass and tiles), stained soils and odour such that they are deemed aesthetically suitable for the proposed uses.

The assessment criteria are summarised in **Tables 9.1 and 9.2**.

Table 9.1: Assessment Criteria

	Ecological	Parks / Recreation / Open Space	Commercial / Industrial Landuse	Service Station
	EIL (mg/kg)	HIL E (mg/kg)	HIL F (mg/kg)	(mg/kg)
POLYCYCLIC AROMATIC HYDROCARBONS				
Benzo(a)pyrene	No guideline	2	5	-
Total PAH's	No guideline	40	100	-

	Ecological	Parks / Recreation / Open Space	Commercial / Industrial Landuse	Service Station
	EIL (mg/kg)	HIL E (mg/kg)	HIL F (mg/kg)	(mg/kg)
ORGANOCHLORINE PESTICIDES				
Aldrin+Dieldrin	No guideline	20	50	-
DDT+DDD+DDE	No guideline	400	1,000	-
Heptachlor	No guideline	20	50	-
TOTAL PETROLEUM HYDROCARBONS				
TPH C6 – C9 Fraction	No guideline	No guideline	No guideline	25
TPH C9 – C36 Fraction	No guideline	No guideline	No guideline	1,000
BTEX				
Benzene	No guideline	No guideline	No guideline	1
Toluene	No guideline	No guideline	No guideline	130
Ethylbenzene	No guideline	No guideline	No guideline	50
Xylenes	No guideline	No guideline	No guideline	25
OTHER				
Asbestos	NIL			

Note: Values have not been included where not used for assessment.

Table 9.2: Waste Classification Criteria

	DECC(2009) General Solid Waste			DECC(2009) Restricted Waste		
	CT1 (mg/L)	TCLP1 (mg/L)	SCC1 (mg/kg)	CT2 (mg/L)	TCLP2 (mg/L)	SCC2 (mg/kg)
POLYCYCLIC AROMATIC HYDROCARBONS						
Benzo(a)pyrene	0.8	0.04	10	3.2	0.16	23
Total PAH's	-	-	200	-	-	800
TOTAL PETROLEUM HYDROCARBONS						
TPH C6 – C9 Fraction	-	-	650	-	-	2600
TPH C9 – C36 Fraction	-	-	10,000	-	-	40,000
TOTAL PETROLEUM HYDROCARBONS						
Benzene	10	-	18	40	20	72
Toluene	288	-	518	1152	-	2073
Ethylbenzene	600	-	1080	2400	-	4320
Xylenes	1000	-	1800	4000	-	7200
OTHER						

	DECC(2009) General Solid Waste			DECC(2009) Restricted Waste		
	CT1 (mg/L)	TCLP1 (mg/L)	SCC1 (mg/kg)	CT2 (mg/L)	TCLP2 (mg/L)	SCC2 (mg/kg)
Asbestos	Presence confirms the waste is special waste under Step 1 of DECC(2009) Guideline					

Note: Values have not been included where not used for assessment.

The data obtained from the validation program will not be analysed statistically. If an excavation validation sample fails the clean-up criteria, further excavation and subsequent validation of the impacted area will be required.

9.4 WASTE CLASSIFICATION OF FILL MATERIAL

It is noted that this preliminary waste classification is limited to areas illustrated on Figure 5, **Appendix A**.

Contaminant concentrations were compared against Waste Classification Guidelines. Where criteria were exceeded, TCLP tests were conducted on the samples with the highest concentrations.

Contaminant concentrations exceeding the Waste Classification criteria in fill material at each location is presented in Table 9.2 below:

Table 9.3: Waste Classification of Impacted Material

Sample ID	Fill / Natural	Contaminant**	Remediation Area	Waste Classification (DECCW, 2009)
BH01_0.4 (WSP)	Fill	B(a)P , PAH (total), TPH(C ₁₀ -C ₃₆)	Area 4	Restricted
BH02_0.8 (WSP)	Fill	B(a)P , PAH (total), TPH(C ₁₀ -C ₃₆)	Area 4	Restricted
BH03_0.5 (WSP)	Fill	B(a)P	Area 3	General
BH04_0.5 (WSP)	Fill	B(a)P, PAH (total)	Area 3	General
BH05_0.3 (WSP)	Fill	B(a)P , PAH (total) , TPH(C₁₀-C₃₆) , benzene	Area 2	Hazardous
BH06_0.2 (WSP)	Fill	B(a)P , PAH (total) , TPH(C ₁₀ -C ₃₆)	Area 2	Hazardous
BH11_0.6* (WSP)	Fill	B(a)P , PAH (total)	Area 6	Hazardous
BH19_0.3 (WSP)	Fill	B(a)P, PAH (total)	Area 7	General
BH20_0.3 (WSP)	Fill	B(a)P	Area 7	General
BH05 0.3-0.4 (CH2M HILL)	Fill	B(a)P , PAH (total), TPH(C ₁₀ -C ₃₆)	Area 1	Restricted
BH06 0.1-0.3 (CH2M HILL)	Fill	B(a)P , PAH (total) , TPH(C ₁₀ -C ₃₆)	Area 2	Hazardous
MW02 0.4-0.5 (CH2M HILL)	Fill	B(a)P , PAH (total)	Area 5	Restricted
MW03 0.1-0.2 (CH2M HILL)	Fill	B(a)P , PAH (total) , TPH(C ₁₀ -C ₃₆)	Area 7	Hazardous

*Including highest value of primary sample and QA/QC sample.

**Bold indicates contaminate concentrations which classify as Restricted or Hazardous waste.

Additional waste classification testing (both total and leachable) and statistical analysis of results will be required following demolition of the existing buildings and prior to commencement of remedial works to control disposal costs and ensure as-dug materials are appropriately classified in accordance with DECCW (2009) Waste

Classification Guidelines.

In summary, results indicated that:

- The bulk of material can be classified as General Solid Waste;
- Material located on Rose Street in the vicinity of BH01 (WSP) and BH02 (WSP), adjacent to Darlington Lane in the vicinity of BH05 (CH2M HILL) and in the west of the Site in the vicinity of MW02 (CH2M HILL) falls into the Restricted Waste classification; and
- Material located on Rose Street in the vicinity of BH05 (WSP) and BH06 (WSP), in the north west of the Site in the vicinity of BH06 (CH2M HILL), on Boundary Lane in the vicinity of BH11 (WSP) and in the south east of the Site in the vicinity of MW03 (CH2M HILL) falls into the Hazardous Waste classification.

Ash material was noted during works conducted at the Site to date. NSW EPA has issued a number of general immobilisation approvals in accordance with clause 50 of the Protection of the Environment Operations (Waste) Regulation 2005, for wastes classified as hazardous wastes. General immobilisation approval 1999/05 relates to ash, ash contaminated natural excavated materials or coal contaminated natural excavated materials.

The immobilisation approval states that:

“The total concentration (SCC) limits for PAHs (total) and BaP listed in Table A4 of the Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (Waste Guidelines – EPA 1999) do not apply to the assessment of ash, ash-contaminated natural excavated materials or coal-contaminated natural excavated materials. With respect to BaP, ash, ash-contaminated natural excavated materials or coal-contaminated natural excavated materials can be classified according to their leachable concentration (TCLP) values alone.”

In WSP's opinion, the presence of charcoal and organic odour with mixed sands and clay is unlikely to satisfy the criteria of natural excavated materials referred to above. However, discussions will be held with NSW EPA and Site Auditor (yet to be appointed) to confirm the applicability of the immobilisation approval in an effort to reduce waste disposal costs.

9.5 IMPORTED FILL

Where required, excavations shall be backfilled (after successful soil validation) using validated VENM or ENM imported to the Site. The source Site should be inspected to confirm suitability of the material.

If the imported fill requires testing to validate it as VENM, samples will require analysis for heavy metals, TPH, BTEX, PAH, OCP, PCB and asbestos. VENM shall be considered suitable for reuse on Site where:

- Heavy metals (M8) concentrations are less than representative background concentrations expected for the material.
- TPH, BTEX, PAH, OCP, PCB concentrations are less than the laboratory limit of reporting
- Asbestos is not detected at the laboratory limit of reporting

A minimum of three samples of imported fill will be analysed (per source Site). If more than 1,000m³ is imported to the Site, one additional sample shall be obtained per 1,000m³.

If ENM is to be used to backfill the excavations, the material will be tested in accordance with the NSW DECC General Waste Exemption for Excavated Natural Material, 2008.

9.6 ENVIRONMENTAL MANAGEMENT PLAN

The post-construction EMP will provide clear direction on the management of PAH and TPH contaminated fill that may remain beneath the retained buildings (H69 and H67) and potentially beneath Darlington Lane.

The EMP will:

- Define roles and responsibilities associated with the EMP (regulatory and management requirements);
- Identify the OH&S requirements and measures required to protect the health of Site workers from PAH and TPH contaminated materials;
- Provide recommendations for work procedures to be implemented during any works undertaken on the Site which entails disturbing contaminated soil by breaching the building cap.

The EMP will require enforcement through Council under the relevant provisions of the Environmental Planning & Assessment Act 1979 and planning instruments that apply to the Site. Additionally, the EMP will require referencing on the Planning Certificate under Section 149 of the Environmental Planning & Assessment Act 1979.

9.7 QUALITY ASSURANCE / QUALITY CONTROL

Samples will be collected by experienced personnel in accordance with WSP's standard operating procedures (based on the NEPM, Australian Standard AS4482.1 (2005) and AS4482.2 (1999) and NSW EPA requirements).

Samples will be collected using a new pair of disposal latex gloves where applicable. Sampling equipment which has direct contact with samples will be decontaminated between samples by scrubbing with a Decon 90 solution and then with potable water.

For validation sampling associated with Remediation Area excavations:

- Immediately after the final excavation face has been created a sample will be collected from the excavation face (approximately 250 grams).
- Approximately 125 grams of the sample will be placed in laboratory supplied glass jars with Teflon lined lids.
- The remaining soil will be placed in a zip-locked bag which will be screened in the field using a calibrated PID to detect the presence of volatile hydrocarbons.

During validation sampling, adequate quality control samples comprising field inter and intra laboratory duplicates (at a minimum rate of 5% for intra-laboratory duplicate samples and 5% for inter-laboratory duplicate samples), and equipment wash blanks will be collected, where appropriate. Trip spikes and blanks will be used for each batch of samples collected and analysed. Samples will be kept in ice or in a cool room of approximately 4°C and sample handling will be carried out under chain of custody protocols and in accordance with industry's accepted standard practice.

9.8 LABORATORY TESTING

The chemical testing laboratories engaged to perform the laboratory testing will be NATA registered for the analysis undertaken. The laboratory will be instructed to perform and report results of internal quality control tests, which will consist of performing reagent blanks and surrogate spike analysis for organics and standard reference matrix for inorganic analysis.

The laboratory quality control data will be checked as follows:

- Checking that the reporting limits and procedures are satisfactory;

- Checking that the samples are analysed within holding times;
- Checking that laboratory blanks / reagent blanks are less than the laboratory reporting limits;
- Checking the reproducibility of samples by calculating the Relative Percentage Differences (RPDs) between primary and duplicate laboratory samples using a control limit of 50%; and
- Checking that laboratory spikes, surrogate spikes, matrix spikes and duplicate matrix spike recoveries are within acceptable control limits.

The pre-determined Data Quality Indicators (DQIs) established for the project in relation to precision, accuracy, representativeness, comparability and completeness are presented in Table 9.4.

Table 9.4: Data Quality Objectives and Indicators

Data Quality Objective	Frequency conducted	Data Quality Indicator ²
<u>Precision</u>		
Intra-laboratory field duplicates	1/20 samples	<5xLOR : <100% RPD ¹ 5-10xLOR : <75% RPD or >5xLOR: M8 <30% RPD >5xLOR: Other <50% RPD
Inter-laboratory field duplicates	1/20 samples	
Laboratory duplicates (Envirolab and ALS)	1/20 samples	<5xLOR : no limit ¹ 5-10xLOR : <70% RPD or >5xLOR: M8 <30% RPD >5xLOR: Other <50% RPD
Laboratory method blanks	1/20 samples	< LOR ¹
<u>Accuracy</u>		
Matrix spikes	1/20 samples	60 to 140%
Laboratory control samples	1/20 samples	70 to 130% (inorganic) As specified by lab (organic)
<u>Representativeness</u>		
Sampling handling storage and transport appropriate for media and analytes	-	Yes
Rinsate blanks	1 per day per equipment	<LOR
Laboratory blanks	1 per sampling event	<LOR
Trip Spike	1 per media	70 to 130% (inorganic) As specified by lab (organic)
Samples extracted and analysed within holding times.	-	Hold Times: 14 days - organics 6 months – inorganics
<u>Comparability</u>		
Standard operating procedures used for sample collection and handling (including decontamination)	All Samples	Yes
Standard analytical methods used for all analyses	All Samples	Yes
Consistent field conditions, sampling staff and laboratory analysis	All Samples	Yes

Data Quality Objective	Frequency conducted	Data Quality Indicator ²
Limits of reporting appropriate and consistent	All Samples	Yes
<u>Completeness</u>		
Soil description and COCs completed and appropriate	All Samples	Yes
Appropriate documentation for testing	All Samples	Yes
Data set to be 95% complete after validation	All Samples	Yes

¹ - If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgment will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

9.9 VALIDATION REPORTING

At the completion of the remedial works a Validation Report will be prepared, documenting the works as completed in accordance with *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW OEH 2011). This report will include:

- Scope of remedial works completed including any variations to the RAP during the works;
- Unexpected finds during the remedial works program, including details of management, materials tracking and validation;
- Results of all validation sampling undertaken during the course of the remedial works;
- QA/QC and data acceptance;
- Waste tracking documentation including the volume of soil excavated and stockpiled (including segregation details), the volume of material disposed of offsite, truck / load movements and waste disposal dockets;
- Waste classification and landfill licences;
- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents; and
- Other information as appropriate.

10 Regulatory Approvals / Licensing

The remedial program will be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the Site.

10.1 STATE ENVIRONMENT PLANNING POLICY NUMBER 55 (SEPP55) REMEDIATION OF LAND

SEPP 55 provides the planning framework for the remediation of contaminated land within NSW. The definition of Category 1 and Category 2 remediation are provided in Clause 9 and Clause 14 of SEPP55 respectively.

A review of the Section 149 certificate for the Site, the Australian Heritage Database and the State Heritage Register is required to determine if the proposed remediation works fall under Category 1 or 2 of SEPP 55.

In general terms, Category 1 remediation requires consent, in this case in the form of a Project Approval under Section 75J of the Environmental Planning & Assessment Act 1979 from NSW Government Department of Planning & Infrastructure, and submission of a RAP..

For the purposes of Category 2 remediation, no formal consent is required; however Council must be given written notice at least 30 days prior to the commencement of remedial works in accordance with Clause 16 of SEPP55. Council may then make their own determination as to whether the proposed works are Category 1 or Category 2 remediation.

It is noted that Category 2 remediation work that is ancillary to other designated development may be made part of the development application for the designated development, or be treated as a Category 2 remediation work.

Category 1 remediation work must be treated as such even if it is ancillary to development that may be carried out without consent.

10.2 PROTECTION OF THE ENVIRONMENT OPERATIONS (POEO) ACT 1997

Under Section 48 of the Act, Schedule 1; Clause 48, the transporting of waste which includes hazardous waste, restricted solid waste, liquid waste, clinical and related waste or friable asbestos waste (or any combination of them) a licence is required if it involves the transport of more than 200 kilograms in any load. If more than 200 kilograms of restricted solid is required to be transported from the Site, the transporter of waste will require a licence.

Soils classified as General Solid Waste do not require a licence for transport.

10.3 PROTECTION OF THE ENVIRONMENT OPERATIONS (WASTE) REGULATION 2005

The regulations define a “non-paying landfill” as any premise that is carried on for business or other commercial purposes, and involves the generating or storage of waste, and is not licensed under the Act, or landfill Sites that receive virgin excavated natural material only (and not any other type of waste).

Part 6 of the waste regulations apply to non-paying landfill Sites and transporting. These require:

- Certain reporting requirements for non-licensed landfill Sites (Reg 47);

-
- The waste must be stored in an environmentally safe manner (Reg 48);
 - Certain transport requirements relating to the transportation of waste (Reg 49);
 - If the waste is transported from the premises, the waste generator must ensure that the waste is transported:
 - to a waste facility that is licensed under the Act; or
 - to a person carrying on mobile waste processing that is licensed under the Act; or
 - to a place that can otherwise lawfully be used as a waste facility for that waste.
 - Under the POEO (Waste) regulation 2005, Reg 32 (Record keeping requirements relating to occupiers of waste facilities): An occupier of a waste facility (which includes the storage, treatment, processing or sorting of waste) who is not a consignor of the waste must retain the following records for at least 4 years: (a) copies of each waste transport certificate given to the occupier of a waste facility by the consignor of the waste, (b) copies of each agreement evidencing the appointment of an authorised agent as referred to in clause 27 (2) (b). An authorised agent under the regulations, means a person appointed as an authorised agent for the transportation of the waste.

As part of the validation report, waste disposal and tipping dockets must be provided to confirm compliance with PoEO Regulations.

10.4 WASTE CLASSIFICATION GUIDELINES, PART 1: CLASSIFYING WASTE (DECC 2009)

The NSW 2009 Waste Guidelines (DECC 2009) provide guidance to waste generators to classify the wastes they produce and ensure the environmental and human health risks associated with it are managed appropriately and in accordance with the POEO Act 1997. The following important notes are provided:

- Under “Step 5” of the guidelines, hazardous waste cannot be disposed of and must be treated.
- If the waste is not chemically assessed, the waste must be managed as if it were hazardous waste.
- If any of the SCC or toxicity characteristics leaching procedure (TCLP) threshold values specified in Table 1 or 2 are exceeded for Restricted Solid Waste, the waste must be classified as Hazardous Waste.

Waste classification shall be undertaken on all soil proposed for off-Site disposal.

In accordance with Table 9.2 above, soils have been classified as General, Restricted or Hazardous Solid Waste. Further waste classification works are intended post building demolition and in conjunction with remediation excavations.

Following stockpile sampling and analysis, a waste classification letter will be required for any soil which is proposed to be removed from the Site. The letter shall be used to seek pre-approval for disposal from the selected waste facility.

10.5 WATER MANAGEMENT ACT 2000

The remediation works shall be completed in accordance with the requirements of the *Water Management Act 2000* including (where required):

- adopting the principles of ecologically sustainable development;
- the protection and enhancement of water quality and associated ecosystems;

-
- best practice in the management and use of water;
 - access licencing for water use;
 - aquifer interference approval; and
 - Water management requirements shall be identified and outlined in the Contractor's Remediation Management Plan.

10.6 TRANSPORTATION OF MATERIAL AND EQUIPMENT

According to the City of Sydney Contaminated Land Development Control Plan (DCP 2004), all haulage routes for trucks transporting soil, materials, equipment or machinery to and from the Site must:

- Comply with all road and traffic rules;
- Aim to minimise noise, vibration and odour to adjacent premises; and
- Utilise State roads and minimise the use of local roads.

11 Contingency Plan

11.1 UNEXPECTED MATERIAL ENCOUNTERED

If during the remediation works, material is encountered which appears to be potentially contaminated and appears to be different from the soils described in previous assessment reports, WSP should be contacted for advice / sampling services and the following procedures should apply:

- Any suspicious material / soil which has already been excavated should be banded and stockpiled on a minimum of two layers of polythene or low-density polyethylene sheet of at least 0.25mm thickness, protected from erosion and all seepage retained.
- Excavation works at that part of the Site where the suspicious material (soil) was encountered should cease until an inspection is carried out.
- Based on visual inspection and communication with the Site Auditor, interim advice on health and safety of remedial works, soil storage and soil disposal options will be provided to allow remediation to proceed if possible.
- Following sampling and analysis of the material, advice will be provided on remedial requirements.

In the context of the above, “suspicious” material would include fibrous, oily or odorous material, drums, metal or plastic chemical containers or brightly coloured material etc.

WSP previously conducted investigations for UoS at the Former Raglan Street building located approximately 50m east of the Site. A backfilled east-west trending watercourse was identified and believed to be impacted with hydrocarbons. Should this backfilled watercourse be encountered during excavations, the above unexpected materials protocol should be applied.

11.2 ODOURS

Given the TPH contamination associated with Area 2 a potential for nuisance odours exists from removal of the impacted fill. Odours are expected to be minimal as TPH contamination is predominantly in the non-volatile range. Controls are to be applied when necessary and include:

- Biosolve surfactant sprays or sprinklers to reduce odour.
- Immediate off-Site disposal of odours material as it excavated or covering odours material as practical.
- Smoothing the surface of any stockpiled material to minimise escape of fugitive odours.
- Establishment of a documented complaints / actions procedure.

11.3 SEEPAGE WATER

Where surface water run off or perched groundwater is encountered in areas of impacted soils, a strategy will be established to ensure that off-Site (i.e. laterally) or vertical migration (i.e. to the underlying groundwater table at approximately 3.3 and 4.45m bgl) of contaminated waters does not occur.

Should excavations require dewatering, water samples will be collected by experienced personnel and analysed for TPH, BTEX and PAHs prior to pump-out and offSite disposal. Waste liquid disposal dockets will be provided in the validation report.

11.4 INCLEMENT WEATHER

Where extended periods of inclement weather are anticipated or experienced:

- Excavation and backfilling shall proceed in a staged manner to minimise the volume of excavation which remains 'open'.
- Sediment control measures shall be inspected and maintained to minimise potential for off-Site migration of sediment or migration of sediment to stormwater infrastructure.
- Stockpiles should be adequately covered (secured HDPE).
- Ponded water in excavations shall be managed in accordance with the procedures outlined in Section 10.2.

11.5 VALIDATION SAMPLE FAILURE

Where soil validation samples fail after reaching the maximum forecast remediation extent, WSP will liaise with UoS regarding a preferred management approach.

Following UoS approval, excavation works may be extended prior to re-sampling. Where feasible, field screening would guide the extent of additional excavations.

11.6 OTHER

Any other unexpected events which may affect the outcome of the investigation would be notified to the Contract Manager. At that time potential actions to address the unexpected event will be assessed and presented.

12 Site Management Plan

12.1 SITE RESPONSIBILITIES

The remediation contractor will be responsible for the preparation and implementation of a remedial works Site Management Plan (Construction Environmental Management Plan) which will be required to comply with Project Approval (PA) conditions and the relevant legislative requirements outlined in Section 9 of this RAP. The Construction Environmental Management Plan (CEMP) shall be submitted to PCA prior to commencement of site works.

12.2 HOURS OF OPERATION

Remediation works shall only be permitted during the times stated in the PA conditions.

Emergency work is permitted to be completed outside of these hours.

12.3 UNDERGROUND SERVICES

The remediation contractor shall be responsible for the location and protection of underground services which have the potential to be impacted by the remedial works.

12.4 SOIL, WATER AND WASTE MANAGEMENT

Soil excavation works will be conducted in a manner that minimises the potential migration of impacted soil and water off Site and complies with the requirements of the PA. Sediment controls shall be erected downgradient of excavations to assist with sediment control. Soil erosion and sediment control measures shall be designed in accordance with the document *Managing Urban Stormwater–Soils & Construction Volume 1* (2004) by Landcom.

Stormwater may be managed through diversion (around excavation and stockpile areas) or detention (prior to controlled release). Detailed soil and water management plans shall be provided in the Site Management Plan for the remedial works.

Work shall be suspended during periods of inclement weather.

In addition, A Construction Waste Management Plan is required to be prepared by a suitably qualified person in consultation with Council and shall be submitted to the PCA.

As a result of the recent incidents at the Orica manufacturing site in NSW, The Protection of the Environment Legislation Amendment Act 2011 has been implemented to improve the way pollution incidents are reported and managed. Particular focus is on requirements for businesses with existing POEO licences in place. The key changes include:

- Requirement for **‘immediate notification of pollution incidents’** rather than ‘as soon as practicable’ for organisations holding a licence under the POEO act, or anyone causing a pollution incident where material harm¹ is caused or threatened to the environment.
- Notification to **each of the relevant authorities** including the Appropriate Regulatory Authority (ARA), the EPA (if not the ARA), the Ministry of Health, the WorkCover Authority, the Local Authority (if not the ARA)

and Fire and Rescue NSW.

¹ What is material harm?

S147 Protection of the Environment Operations Act 1997 (POEO Act 1997) states that “harm to the environment is material if:

- (i) it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or*
 - (ii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000 (or such other amount as is prescribed by the regulations), and*
 - (b) loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.*
- (2) For the purposes of this Part, it does not matter that harm to the environment is caused only in the premises where the pollution incident occurs.”*

12.5 NOISE

The remediation works shall comply the requirements of the PA as well as AS2436-1981 Guide to Noise Control on Construction, Maintenance Demolition Sites and the NSW EPA’s Environmental Noise Control Manual for the control of noise from construction Sites.

Where machinery and mechanical equipment is used on Site, it will be in good working order and will be fitted with appropriate silencers when necessary.

No work will be undertaken outside the hours of stated in the PA in accordance with Department of Environment and Climate Change NSW (DECC), Interim Construction Noise Guideline, DECC 2009/265 July 2009.

12.6 DUST AND ODOUR

Dust emissions shall be confined within the Site boundary by implementing the following controls:

- Erection of dust screens at Site perimeter;
- Securely covering all loads entering or exiting the Site;
- Wetting down excavated materials / excavations;
- Covering stockpiles;
- Sealing of Site ingress / egress points.

Due to the nature of the contaminants, odour is not expected to be a significant environmental hazard.

12.7 MATERIAL TRANSPORTING

The remediation contractor shall ensure that there is no material tracked onto the street and that loads are securely covered. Soil, earth, mud or similar materials must be removed from the roadway by sweeping, shovelling, or a means other than washing, on a daily basis or as required. Soil washings from wheels shall be collected and disposed of in a manner that does not pollute waters.

All road rules shall be observed and the use of local roads shall be minimised.

The transporter of waste must:

- Before transporting the waste, certify that any part of the waste transport certificate for the waste that is required to be removed by the transporter has been completed accurately;
- Before transporting the waste, ensure that there is a consignment authorisation that authorises the transport of the waste; and
- Carry in the vehicle transporting the waste the waste transport certificate for the waste.

A record of truck movements shall be kept in order to enable the waste to be tracked to the receiving location. The receiving location shall issue disposal dockets and these shall be reconciled against the truck movement records to ensure accountability for all materials transported from the Site.

12.8 COMMUNITY CONSULTATION

All owners and/or occupants of adjoining and opposite (across roadways) premises shall be notified of the remedial works program prior to works being commenced.

12.9 COMPLAINT REPORTING AND RESOLUTION

Complaints received from adjoining Sites or the general public shall be directed to the remediation contractor Site supervisor. The Site supervisor shall maintain a Complaints Register (Date, Complainant Details, Nature of Complaint, Action Required, Responsibility, Due Date) to ensure that any concerns are recorded and addressed.

Within one working day of receiving the complaint, the remediation contractor shall prepare a written report detailing the nature of the complaint and all the actions taken to provide a solution.

13 Occupational Health and Safety

A Site Specific Occupational Health & Safety Plan will be developed by the remediation contractor prior to the commencement of remedial works in order to protect the health and safety of contractor staff.

The following health and safety plan contains procedures and requirements that are to be implemented as a minimum during the remediation works. The objectives of the health and safety plan are to:

- Apply standard procedures that reduce risks resulting from the above works.
- Ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner.
- Have procedures to protect other Site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities.
- An evaluation of hazards.
- Establishment of personal protection standards and mandatory safety practices and procedures.
- Provision for contingencies that may arise while operations are being conducted at the Site.

This health and safety plan does not provide safety information specific to construction and other demolition or excavation activities carried out by contractors, such as the safe operation, maintenance and inspection of plant, etc. Contractors will be required to prepare their own Safe Work Method Statements for their work activities. All parties working on the Site shall comply with all applicable Health and Safety legislation, regulations, codes and guidelines.

13.1 RESPONSIBILITIES

The remediation supervisor is responsible for ensuring that the work is carried out in accordance with the health and safety plan. This will include:

- Ensuring a copy of the health and safety plan and RAP is available at the Site during the remediation activities.
- Confirming individuals are competent in performing assigned tasks.
- Liaison with the contractor representatives, as appropriate, regarding safety matters.
- Investigation and reporting of incidents and accidents.

The remediation supervisor has not yet been commissioned.

Every individual worker is responsible for conducting their allocated tasks in a safe manner and in accordance with their training and experience. They must give due consideration to the safety of all others in their proximity and cooperate in matters of health and safety. All workers must leave their work areas in such a condition that the location will not be hazardous to others at any time.

13.2 HAZARDS

The known or potential hazards associated with the work activities described in Section 5 are listed below:

Chemical Hazards:

The main chemical hazard associated with the remediation / validation works are TPH, PAH, BTEX and heavy metals. When working with contaminated materials in general, care needs to be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation or dermal contact. The personal protective equipment (PPE) and decontamination requirements outlined in Sections 13.3 and 13.5 shall be followed to control the risks posed by chemical hazards at the Site.

Physical Hazards:

The main physical hazards are listed below:

- Operating machinery: Heavy plant and equipment operating in the vicinity of field personnel presents a risk of physical injury. Personnel should be cognisant of their position in relation to operating machinery at all times. Never walk behind or to the side of any operating equipment without the operator's knowledge. Do not assume that the operator knows your position. Personnel should stay at least 2 m from the operational area of heavy equipment and should not stand directly below any load or piece of equipment (e.g. excavators).
- Working in or near excavations: All excavations shall be shored, sloped or otherwise constructed so as to minimise the potential for collapse. No excavations greater than 1.0m are anticipated during the remediation stage. Deeper excavation associated with re-development works will be constructed in accordance with development plans. In addition, groundwater is present at 3-4m bgl and is not expected to be encountered during remediation works.
- Cuts and abrasions: The manual work associated with the remediation works gives rise to the risk of cuts and abrasions to personnel working in the area. As well as the direct consequences of any cut or abrasion, such injuries can lead to the possibility of exposure to contaminants through the wound as well as diseases such as tetanus. To minimise the risk of direct or indirect injury, personnel will wear the PPE as described in Section 13.3.
- Heat stress and UV exposure: Site personnel may experience heat stress due to a combination of elevated ambient temperatures and the concurrent use of personal protection equipment; this depends in part on the type of work and the time of year. There are four main types of heat stress related problems: (a) Heat Rash: caused by continuous exposure to heat and humid air and aggravated by chafing clothes. (b) Heat Cramps: caused by profuse perspiration with inadequate fluid intake and chemical replacement. Signs: muscle spasms and pain in the extremities and abdomen. (c) Heat Exhaustion: is caused by increased stress on various organs as they meet the increasing demand to cool the body. Signs: shallow breathing; pale, cool, moist skin; profuse sweating; dizziness, and lassitude. (d) Heat Stroke: result of overworked cooling system. Heat Stroke is the most severe form of heat stress. Body must be cooled immediately to prevent severe injury and/or death. Signs: red, hot, dry skin; no perspiration, nausea; dizziness and confusion; strong, rapid pulse and coma. Medical help must be obtained immediately.
- In addition to the above, overexposure to UV radiation in sunlight can result in sunburn to exposed skin. The use of a high protection sunscreen (SPF15 or greater) on all exposed skin is recommended. Hats (including hard hats in specified areas) will also provide additional sun protection during the peak (i.e. 10:00 am to 3:00 PM) sun period. Sunglasses should be worn (where appropriate) to protect eyes from effects of UV exposure.
- Underground services: There is the potential for underground services (electricity, natural gas lines, water, telephone, sewer, and stormwater) to be present beneath the work area. The remediation contractor shall ensure that appropriate procedures will be taken to minimise the risk associated with excavation near

services.

- Above ground electrical hazards: All electrical plant and equipment must comply with the requirements of Australian Standard AS 3000. Hand held portable tools shall comply with AS/NZS 3160 "hand-held portable electric tools" and shall be double insulated. Cord connected portable hand lamps shall comply with AS/NZS 3118. A Residual Current Device (RCD) shall protect plug-in portable equipment, which is connected to a supply above Extra Low Voltage 12 / 24volts (including equipment supplied from a generator or welding set). RCD protection shall be provided during maintenance of portable electrical equipment at all times while the equipment is connected to a power supply above Extra Low Voltage, irrespective of whether power is switched ON or OFF. RCD's shall comply with AS 3190 and shall be type II units, rated to trip at or below 30 milliamps within 40 milliseconds. No excavator may work within 2m of overhead distribution power lines.
- Manual handling: When lifting or handling heavy objects, use correct lifting techniques, bending the knees not the back. If the item to be lifted is too heavy or awkward for one person to lift, seek assistance from other employees or use mechanical help.
- Noise: Long-term exposure to high levels of noise is unlikely. However, operating machinery may cause significant noise exposures for short periods. Earplugs or earmuffs should be worn in any situation where noise levels make normal conversation difficult.

13.3 PERSONAL PROTECTIVE EQUIPMENT

All workers who may come into direct contact with contaminated soil or work within the vicinity of the remediation area will be required to wear (and be trained in the use and care) of following personal protective equipment:

- Overalls or long sleeved collared shirt.
- Heavy duty outer gloves (e.g. leather) where there is a risk of cuts or abrasions, otherwise nitrile gloves if in direct contact with soil (or contaminated water).
- Steel capped boots.
- Safety glasses.
- High visibility vest or jacket.
- Hard hat.
- Safety goggles.
- Earmuffs or earplugs, when noise levels make normal conversation difficult (approx. 85dBA).

In addition to the above, an approved half-faced respirator with organic cartridge shall be worn when the PID readings are above 30ppm are recorded in the breathing zone. The half face respirator cartridges shall be replaced as stipulated by the manufacturer.

If any personal protective equipment is damaged or is suspected to not be functioning properly, it should be repaired or replaced immediately.

Personnel in PPE can be more susceptible to heat exhaustion and heat stroke. If the ambient temperature is greater than 25 degrees centigrade, employee temperature or overheating will be monitored during breaks, as well as recommending and encouraging above average levels of water consumption.

13.4 AIR MONITORING

Air monitoring shall be conducted to determine if soil vapours pose an unacceptable risk to human health as a result of remedial activities. Boundary monitoring with a PID will be conducted during days when contaminated soil is been excavated, stockpiled or loaded for transport. Site activities will cease if PID concentrations at the boundaries of the Site exceed 10ppm.

13.5 DECONTAMINATION PROCEDURES

The decontamination procedures specified below will be followed whenever personnel, plant or equipment leave the Site.

- Personnel:
 - Wash boots in clean water.
 - Remove outer gloves and store for reuse.
 - Remove overalls and store for reuse (during the day) or place in a cleaning sack (end of each day).
 - Remove respirator and goggles (if used) and store for reuse or decontamination, as appropriate.
 - Thoroughly wash hands and face.
 - If any part of a worker's body comes into direct contact with any potentially contaminated material, the affected part(s) should be immediately washed with clean water.
- Vehicle, plant and equipment: All equipment will be washed or otherwise cleaned to ensure that contaminated soil, water or dust is removed before it leaves the Site. All plant and equipment will have their outer bodies thoroughly cleaned of soil and sediment before moving off the Site. Plant and equipment decontamination must be undertaken on hardstand areas to prevent re-contamination of the Site.

13.6 EMERGENCY RESPONSE

In the event of an emergency arising on the Site, appropriate action should be taken. Site evacuation procedures should be followed, as necessary.

In the event of an accident: evaluate the seriousness of the injury, and contact emergency services, if necessary; provide first aid, as appropriate, and if safe to do so evacuate the injured person; make the area as safe as possible without jeopardising safety. If a serious accident occurs, do not disturb the scene, except to make safe and prevent further injury or damage, and keep all unauthorised people out; and report all accidents to the Contract Manager.

EMERGENCY CONTACT NUMBERS:

Police, Fire Brigade or Ambulance: 000

Royal Prince Alfred Hospital: (02) 9515 6111

14 Conclusions

This RAP is designed to minimise any on-going liability and risk associated with the localised impacted fill material and to render the Site suitable for the proposed Business School redevelopment.

An assessment of feasible remediation options has determined that the preferred remediation strategy is the excavation and off-Site disposal of impacted soil from seven remediation areas. Excavated soil shall be segregated and stockpiled on Site for waste classification, prior to off-Site disposal to a suitably licenced waste disposal facility. All excavations shall be validated, and where required, reinstated with imported VENM or ENM.

Where feasible, and in areas not required to be excavated to facilitate development, containment of fill material exceeding the adopted land use criteria for PAH (or other non-volatile contaminants which will not adversely affect groundwater quality) via capping is considered to be a viable remedial option due to the non-volatile nature of this contaminant. Any potentially contaminated material remaining on site will be managed by an on-going EMP.

Soil validation samples shall be obtained from the excavated areas, analysed for the contaminants of concern (PAHs, TPH, BTEX and asbestos) and compared with the adopted validation criteria.

The strategy presented in this RAP is considered to be the most effective method to:

- Meet EPA, University of Sydney and Council requirements;
- Minimise potential risks posed to human health and the environment; and
- Render the Site suitable for the proposed re-development.

15 Report Limitations

WSP prepared this RAP in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession.

This report relates only to the objectives stated and does not relate to any other work undertaken for the Client. It is a report based on the concentrations of contaminants observed in soil by CH2M HILL (2011) and WSP (2012). These conditions may change with time and space. The absence of any identified hazardous or toxic materials on the subject property should not be interpreted as a guarantee that such materials do not exist on the Site.

All conclusions regarding the property area are the professional opinions of WSP, subject to the qualifications in the report. While normal assessments of data reliability have been made, WSP assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of WSP, or developments resulting from situations outside the scope of this project.

The client acknowledges that this report is for the exclusive use of the client.

16 References

- ANZECC/NHMRC (1992) Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites.
- Australian/New Zealand Standard, AN/NZS 4360:2004, Risk Management.
- CH2M HILL (2011), Abercrombie Precinct Redevelopment, Phase II Environmental Assessment.
- CSIRO (2006) 'Australian Soil Resource Information System'.
- Contaminated Land Management Act.
- Douglas Partners (1998), Report on Geotechnical Investigations and Preliminary Contamination Assessment.
- National Environment Protection Council (1999) National Environment Protection Measure 1999 – Assessment of Site Contamination. Schedule B(2) Guideline on Data Collection, Sample Design and Reporting.
- NSW EPA, (1995) Contaminated Sites: Sampling Design Guidelines.
- NSW EPA, (1997) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.
- NSW EPA, (1999) Contaminated Sites: Guidelines on Significant Risk of Harm and Duty to Report.
- NSW DEC, (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme, 2nd Edition.
- NSW DEC, (2009) Waste Classification Guidelines Part 1: Classifying Waste.
- Sinclair Knight Merz (SKM, 2010), Abercrombie Street Economics Precinct Development, Phase I Environmental Assessment.
- State Environmental Planning Policy No 55 – Remediation of Land.

Appendix A Figures

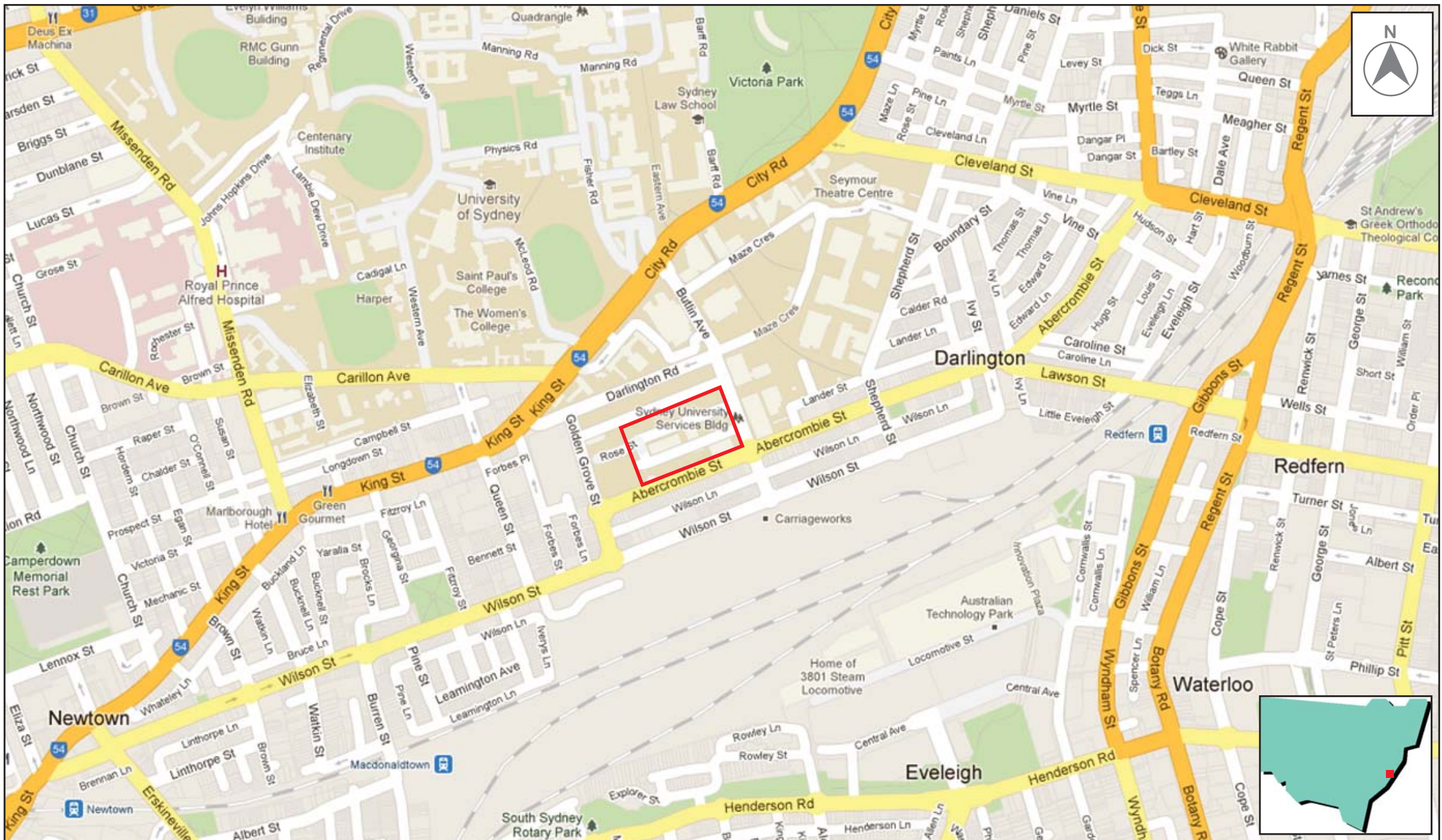
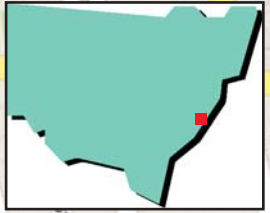
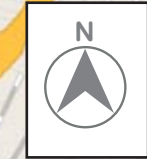


Image Courtesy of Google Maps (2012)

 Site Boundary



Site Location

The University of Sydney - Abercrombie Precinct Redevelopment

00027858

FIGURE 1

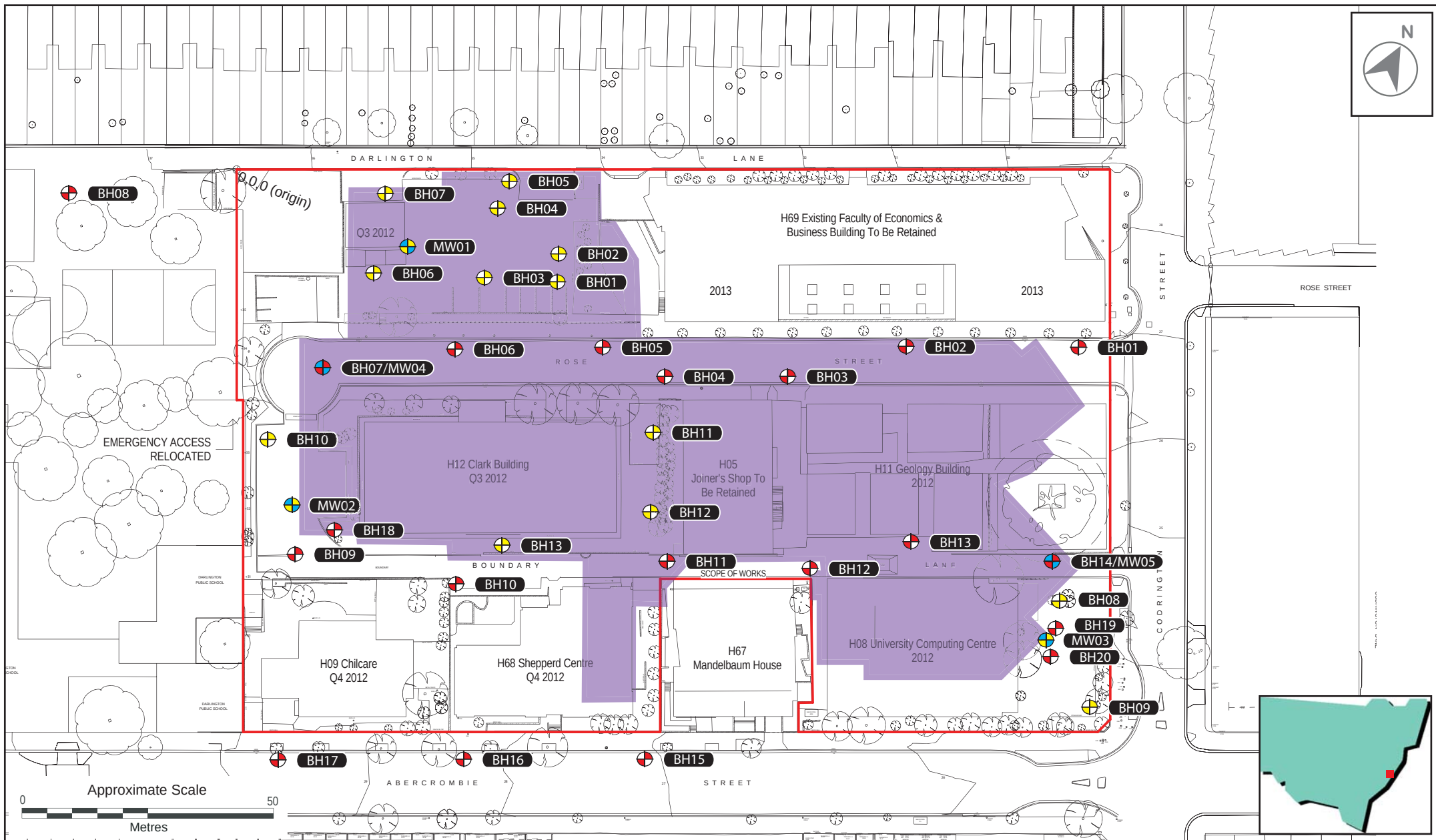


Image Courtesy of Woods Bagot: 2-20-1874 Drawing No. A1003

- Site Boundary
- BH01 WSP / Coffey Geotechnics Soil Bore Location
- MW01 WSP / Coffey Geotechnics Soil Bore & Monitoring Well Location
- BH01 CH2M HILL Soil Bore Location
- MW01 CH2M HILL Soil Bore and Monitoring Well Location
- Redevelopment Excavation

Site Layout

The University of Sydney - Abercrombie Precinct Redevelopment

00027858

FIGURE 2

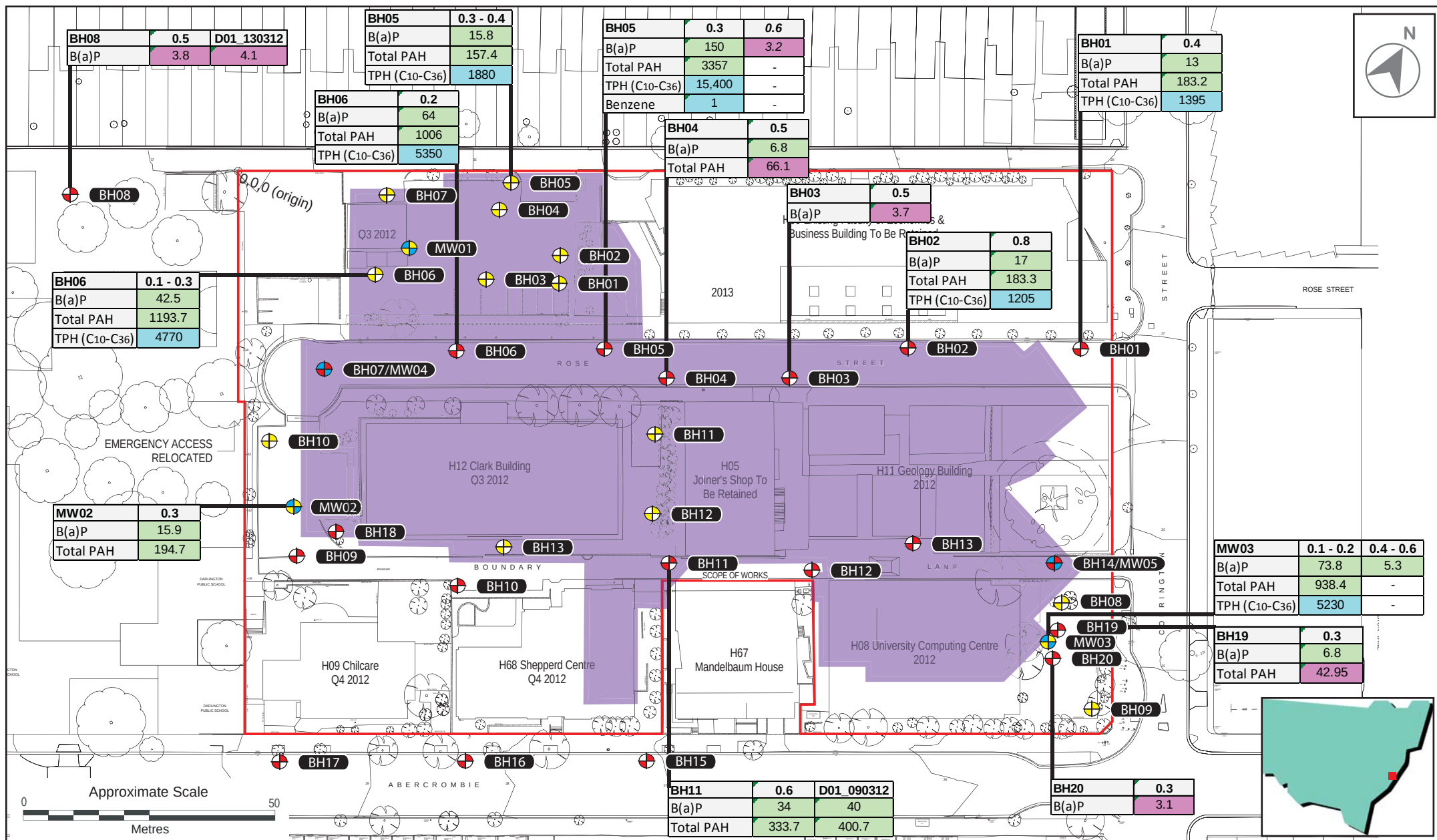


Image Courtesy of Woods Bagot: 2-20-1874 Drawing No. A1003

[Red outline]	Site Boundary
[Red circle with cross]	BH01 WSP / Coffey Geotechnics Soil Bore Location
[Blue circle with cross]	MW01 WSP / Coffey Geotechnics Soil Bore & Monitoring Well Location
[Yellow circle with cross]	BH01 CH2M HILL Soil Bore Location
[Blue circle with cross]	MW01 CH2M HILL Soil Bore and Monitoring Well Location
[Purple fill]	Redevelopment Excavation

Borehole Location	BH x	1.0 (m)	Sample Depth
Analyte	B(a)P		Sample Results (mg/kg)
	TPH (C10-C36)		
	Benzene		
	Arsenic		
	Mercury		
	Zinc		Service Station (1994)
	Lead		NEPM 1999 HIL E
	Total PAH		NEPM 1999 HIL F

Assessment Criteria Exceedances

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FIGURE 3

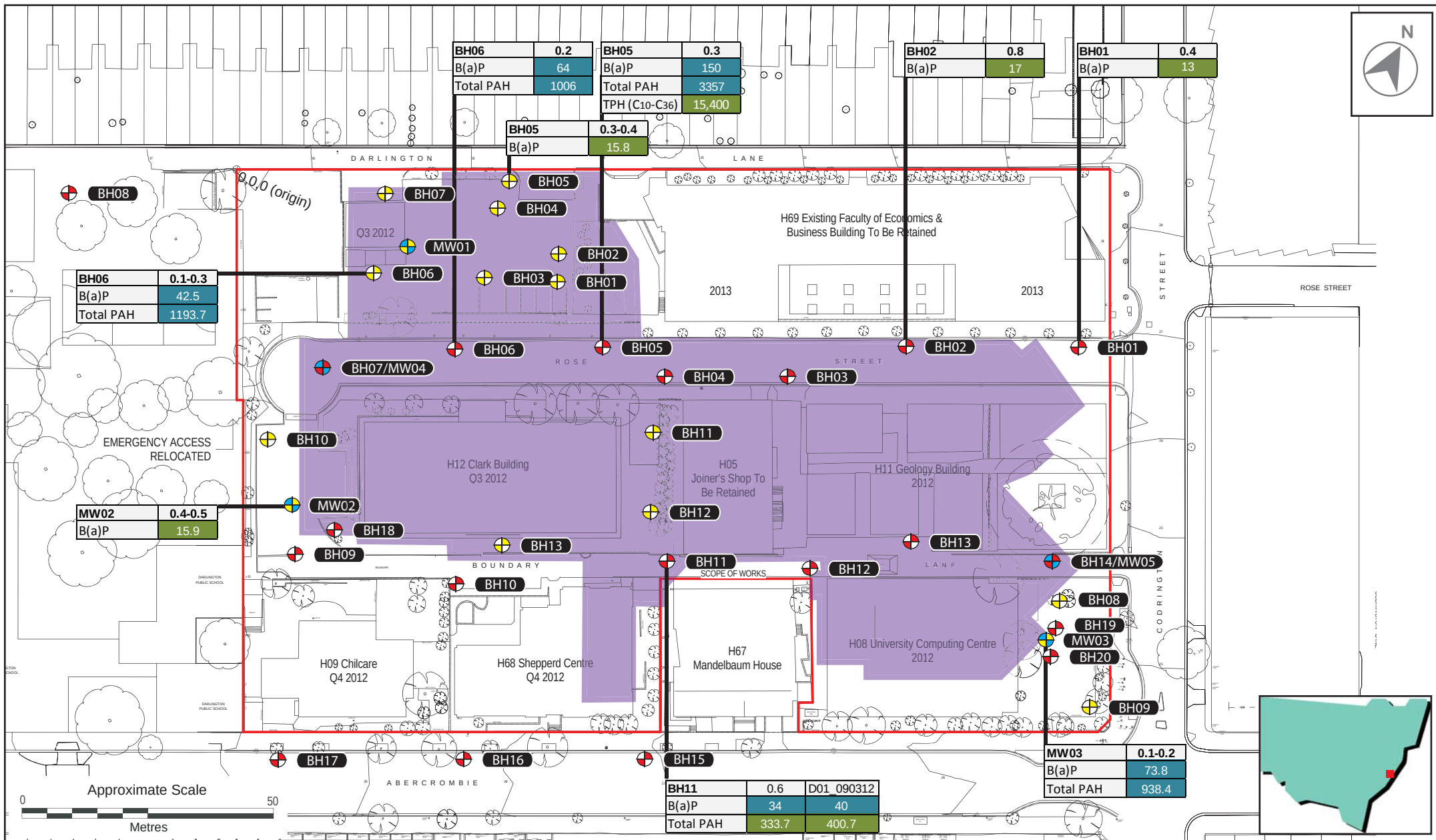


Image Courtesy of Woods Bagot: 2-20-1874 Drawing No. A1003

- Site Boundary
- BH01 WSP / Coffey Geotechnics Soil Bore Location
- MW01 WSP / Coffey Geotechnics Soil Bore & Monitoring Well Location
- BH01 CH2M HILL Soil Bore Location
- MW01 CH2M HILL Soil Bore and Monitoring Well Location
- Redevelopment Excavation

Borehole Location	BH x	1.0 (m)	Sample Depth
	B(a)P		
Analyte	TPH(C10-C36)		Sample Results (mg/kg)
	Benzene		
	Arsenic		
	Mercury		
	Zinc		
	Lead		
	Total PAH		Restricted Solid Waste
			Hazardous Solid Waste

Waste Classification

The University of Sydney - Abercrombie Precinct Redevelopment

00027858

FIGURE 4

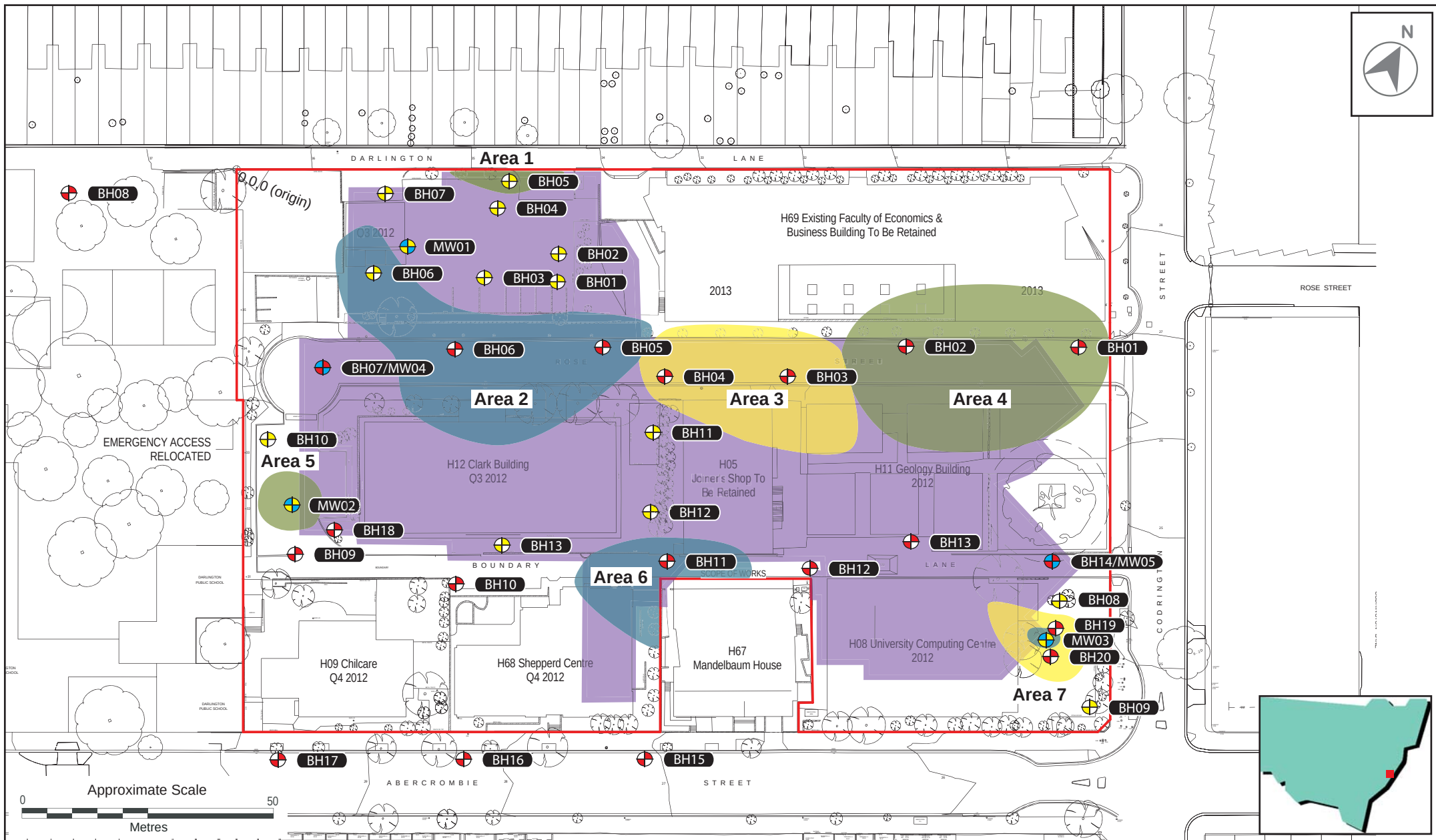


Image Courtesy of Woods Bagot: 2-20-1874 Drawing No. A1003



Preliminary Remediation Areas
The University of Sydney - Abercrombie Precinct Redevelopment
00027858

FIGURE 5

Appendix B Soil Summary Results Tables

Table 1. Analytical Soil Results

				8 metals in soil									PAHs																PCBs												
				Asbestos	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc	Scheduled chemicals (NSW Waste 2008)	Aldrin + Dieldrin	DDT+DDE+DDD	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAH (total, NSW Waste 2008)	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260			
				g/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	4	0.5	1	1	1	0.1	1	1				0.1	0.1	0.1	0.1	0.05	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
EPA 1994 Health and Ecological (Service Station)																																									
NEPM 1999 HIL E					200	40		2000	600	30	600	14000		20	400						2											40									
NEPM 1999 HIL F					500	100		5000	1500	75	3000	35000		50	1000						5											100									

Field ID	LocCode	Depth	Date	ND	<4	<0.5	20	31	31	0.1	4	25	-	-	-	6.3	1.4	11	13	13	18	8.4	14	2.1	27	7.3	8.4	7.3	32	32	183.2	-	-	-	-	-	-	-
BH01	BH01	0.4	9/03/2012	ND	<4	<0.5	20	31	31	0.1	4	25	-	-	-	6.3	1.4	11	13	13	18	8.4	14	2.1	27	7.3	8.4	7.3	32	32	183.2	-	-	-	-	-	-	-
BH01	BH01	0.8	9/03/2012	ND	8	0.6	26	6	21	<0.1	3	6	-	-	-	0.2	<0.1	0.5	0.7	0.79	1	0.4	0.7	0.1	1.7	0.4	0.4	0.3	1.7	1.8	9.74	-	-	-	-	-	-	-
BH02	BH02	0.8	9/03/2012	-	7	<0.5	17	27	23	<0.1	3	16	-	-	-	6.2	1	10	13	17	22	8.8	14	2.1	27	7.4	8.7	9.1	31	28	183.3	-	-	-	-	-	-	-
BH02	BH02	1.5	9/03/2012	-	32	<0.5	5	7	17	<0.1	<1	1	-	-	-	<0.1	<0.1	0.2	0.2	0.29	0.4	0.2	0.2	<0.1	0.7	0.1	0.2	<0.1	0.7	0.7	3.69	-	-	-	-	-	-	-
BH03	BH03	0.5	12/03/2012	ND	7	0.7	26	3	20	<0.1	3	4	-	-	-	0.5	<0.1	1	2.5	3.7	5	2.4	2.7	0.4	5.4	0.5	2.2	0.2	3	6	30.55	-	-	-	-	-	-	-
BH04	BH04	0.5	12/03/2012	ND	<4	<0.5	13	22	17	<0.1	3	21	-	-	-	1	0.5	3.1	5.4	6.8	9.2	3.8	6	0.8	12	1.1	3.8	0.4	9.4	12	66.1	-	-	-	-	-	-	-
BH05	BH05	0.3	12/03/2012	ND	<4	<0.5	8	63	30	<0.1	4	26	-	-	-	66	88	140	130	150	200	65	140	17	570	130	71	460	810	520	3357	-	-	-	-	-	-	-
BH05	BH05	0.6	12/03/2012	-	-	-	-	-	-	-	-	-	-	-	-	1.4	1.4	3.2	3.3	3.2	4.3	2.4	3.5	0.4	9	3	3.3	4.9	73	8.3	64.6	-	-	-	-	-	-	-
BH06	BH06	0.2	12/03/2012	ND	<4	<0.5	9	57	22	<0.1	9	35	<13	<2	<3	43	2.7	69	64	64	87	16	67	4.5	150	48	18	100	210	150	1006	<1	<1	<1	<1	<1	<1	<1
BH06	BH06	1.3	12/03/2012	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	-	-	-	-	-	-	-	
BH07	BH07	0.1	13/03/2012	ND	<4	<0.5	13	26	5	<0.1	40	24	-	-	-	<0.1	<0.1	0.1	0.5	0.62	1.2	0.4	0.6	<0.1	1	0.1	0.4	<0.1	0.6	1	5.52	-	-	-	-	-	-	-
BH08	BH08	0.5	13/03/2012	ND	<4	<0.5	9	4	16	<0.1	2	16	<1.3	<0.2	<0.3	0.1	0.3	0.7	3	3.8	5.2	2	3.3	0.4	5.9	<0.1	2.1	<0.1	2.6	6.3	30.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D01_130312	BH08	0.5	13/03/2012	-	<4	<0.5	9	7	27	<0.1	2	26	-	-	-	<0.1	0.4	0.8	3.1	4.1	5.8	2.3	3.5	0.5	6	<0.1	2.4	<0.1	3.3	6.4	32.95	-	-	-	-	-	-	-
BH09	BH09	0.6	6/03/2012	ND	5	<0.5	25	7	20	<0.1	10	50	-	-	-	<0.1	0.1	0.1	0.8	0.98	1.6	0.5	0.9	<0.1	1	<0.1	0.6	<0.1	0.3	1.2	6.68	-	-	-	-	-	-	-
BH10	BH10	0.6	7/03/2012	ND	4	<0.5	21	43	70	<0.1	5	200	-	-	-	<0.1	<0.1	0.1	0.5	0.55	0.8	0.3	0.5	<0.1	1	<0.1	0.3	<0.1	0.5	1	5	-	-	-	-	-	-	-
BH11	BH11	0.6	9/03/2012	-	5	<0.5	25	15	30	<0.1	5	17	-	-	-	3.5	3.8	13	29	34	46	14	29	3.4	67	10	15	4	50	58	333.7	-	-	-	-	-	-	-
D01_090312	BH11	0.6	9/03/2012	-	6	0.5	29	7	24	<0.1	7	15	-	-	-	4.4	5.4	18	34	40	54	15	34	3.8	76	13	17	7.1	63	70	400.7	-	-	-	-	-	-	-
BH12	BH12	0.4	9/03/2012	ND	<4	<0.5	15	40	3	<0.1	110	34	-	-	-	<0.1	0.2	0.2	0.9	0.76	1.2	0.6	0.7	0.1	1.7	<0.1	0.6	<0.1	0.7	1.7	8.31	-	-	-	-	-	-	-
BH13	BH13	0.5	9/03/2012	ND	6	<0.5	22	22	20	<0.1	5	11	-	-	-	<0.1	<0.1	<0.1	<0.1	0.06	<0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.81	-	-	-	-	-	-	-
BH14	BH14	0.6	7/03/2012	ND	7	0.6	25	3	28	<0.1	3	8	-	-	-	0.2	0.2	0.7	1.7	1.4	2.1	0.5	1.5	<0.1	4.4	0.4	0.7	<0.1	3.4	3.6	18.8	-	-	-	-	-	-	-
BH15	BH15	0.6	6/03/2012	-	4	<0.5	18	7	20	<0.1	5	5	-	-	-	<0.1	<0.1	<0.1	<0.1	0.07	<0.2	<0.1	0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	0.2	1.07	-	-	-	-	-	-	-
BH16	BH16	0.6	6/03/2012	-	<4	<0.5	4	1	7	<0.1	2	13	-	-	-	<0.1	<0.1	<0.1	<0.1	0.05	<0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.8	-	-	-	-	-	-	-
BH17	BH17	0.6	5/03/2012	-	<4	<0.5	14	2	15	<0.1	2	6	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.35	-	-	-	-	-	-	-
BH17 - triplicate	BH17	0.6	5/03/2012	-	<4	<0.5	12	3	14	<0.1	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH18	BH18	0.5	9/03/2012	-	<4	<0.5	7	10	16	<0.1	9	28	-	-	-	<0.1	<0.1	<0.1	<0.1	0.13	<0.2	0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	0.2	1.08	-	-	-	-	-	-	-
BH19	BH19	0.3	9/03/2012	ND	12	0.7	13	49	85	12	7	370																										

Table 1. Analytical Soil Results

				TPH					BTEX					Organochlorine Pesticides																					
				TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10-C36 (Sum of Total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	4,4-DDE	a-BHC	Aldrin	b-BHC	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor	
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				25	50	100	100	100	0.2	1	0.5	2	1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
EPA 1994 Health and Ecological (Service Station)				65				1000	1	50	130			25																					
NEPM 1999 HIL E																															20				
NEPM 1999 HIL F																															50				

Field ID	LocCode	Depth	Date	<25	<50	880	490	1395	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH01	BH01	0.4	9/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH01	BH01	0.8	9/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH02	BH02	0.8	9/03/2012	<25	<50	790	390	1205	0.3	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH02	BH02	1.5	9/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH03	BH03	0.5	12/03/2012	<25	<50	100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH04	BH04	0.5	12/03/2012	<25	<50	200	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	BH05	0.3	12/03/2012	<25	1200	10,000	4200	15,400	1	<1	1	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05	BH05	0.6	12/03/2012	<25	<50	170	<100	245	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH06	BH06	0.2	12/03/2012	<25	250	3500	1600	5350	0.6	<1	<0.5	<2	<1	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH06	BH06	1.3	12/03/2012	<25	<50	<100	<100	<250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH07	BH07	0.1	13/03/2012	<25	<50	<100	500	575	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH08	BH08	0.5	13/03/2012	<25	<50	110	<100	185	<0.2	<1	<0.5	<2	<1	<3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
D01_130312	BH08	0.5	13/03/2012	<25	<50	120	<100	195	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH09	BH09	0.6	6/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH10	BH10	0.6	7/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH11	BH11	0.6	9/03/2012	<25	<50	280	150	455	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D01_090312	BH11	0.6	9/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH12	BH12	0.4	9/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH13	BH13	0.5	9/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH14	BH14	0.6	7/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH15	BH15	0.6	6/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH16	BH16	0.6	6/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17	BH17	0.6	5/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17 - triplicate	BH17	0.6	5/03/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH18	BH18	0.5	9/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH19	BH19	0.3	9/03/2012	<25	<50	200	220	445	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH19 - triplicate	BH19 - triplicate	0.3	9/03/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH20	BH20	0.3	13/03/2012	<25	<50	<100	<100	<250	<0.2	<1	<0.5	<2	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Statistical Summary				26	26	26	26	26	26	26	26	26	26	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Number of Results				26	26	26	26	26	26	26	26	26	26	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Number of Detects				0	2	11	7	10	4	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Minimum Concentration				<25	<50	<100	<100	185	<0.2	<1	<0.5	<2	<1	<3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Minimum Detect				ND	250	100	150	185	0.3	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration				<25	1200	10,000	4200	15,400	1	<1	1	<2	<1	<3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Maximum Detect				ND	1200	10,000	4200	15,400	1	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration				13	79	658	327	1056	0.16	0.5	0.28	1	0.5	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Median Concentration				12.5	25	50	50	125	0.1	0.5	0.25	1	0.5	1.5	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.2									

Italics = Natural soil sample

Table 2. Waste Classification

				8 metals in soil												PAHs																PCBs											
				Arsenic	Cadmium	Chromium (III-VI)	Copper	Lead	TCLP Lead	Mercury	TCLP Mercury	Nickel	TCLP Nickel	Zinc	Scheduled chemicals (NSW Waste 2008)	Aldrin + Dieldrin	DDT + DDE + DDD	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	TCLP Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAH (total, NSW Waste 2008)	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260		
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				4	0.5	1	1	1	0.03	0.1	0.0005	1	0.02	1				0.1	0.1	0.1	0.1	0.05	0.001	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NSW 2009 General Solid Waste CT1				100	20	100		100			4	40										0.8																					
NSW 2009 General Solid Waste SCC1				500	100	1900		1500			50	1050										10																					
NSW 2009 General Solid Waste TCLP1									5		0.2	2										0.04																					
NSW 2009 Restricted Solid Waste CT2				400	80	400		400		16		160										3.2																					
NSW 2009 Restricted Solid Waste SCC2				2000	400	7600		6000		200		4200										23																					
NSW 2009 Restricted Solid Waste TCLP2								20		0.8		8										0.16																					
Field ID	LocCode	Depth	Date	<4	<0.5	20	31	31	-	0.1	-	4	-	25	-	-	-	6.3	1.4	11	13	13	<0.001	18	8.4	14	2.1	27	7.3	8.4	7.3	32	32	183.2	-	-	-	-	-	-	-	-	
BH01	BH01	0.4	9/03/2012	8	0.6	26	6	21	-	<0.1	-	3	-	6	-	-	-	0.2	<0.1	0.5	0.7	0.79	-	1	0.4	0.7	0.1	1.7	0.4	0.4	0.3	1.7	1.8	9.74	-	-	-	-	-	-	-	-	
BH02	BH02	0.8	9/03/2012	7	<0.5	17	27	23	-	<0.1	-	3	-	16	-	-	-	6.2	1	10	13	13*	<0.001	22	8.8	14	2.1	27	7.4	8.7	9.1	31	28	183.3	-	-	-	-	-	-	-	-	
BH02	BH02	1.5	9/03/2012	32	<0.5	5	7	17	-	<0.1	-	<1	-	1	-	-	-	<0.1	<0.1	0.2	0.2	0.29	<0.001	0.4	0.2	0.2	<0.1	0.7	0.1	0.2	<0.1	0.7	0.7	3.69	-	-	-	-	-	-	-	-	
BH03	BH03	0.5	12/03/2012	7	0.7	26	3	20	-	<0.1	-	3	-	4	-	-	-	0.5	<0.1	1	2.5	3.7*	<0.001	5	2.4	2.7	0.4	5.4	0.5	2.2	0.2	3	6	30.55	-	-	-	-	-	-	-	-	
BH04	BH04	0.5	12/03/2012	<4	<0.5	13	22	17	-	<0.1	-	3	-	21	-	-	-	1	0.5	3.1	5.4	6.8*	<0.001	9.2	3.8	6	0.8	12	1.1	3.8	0.4	9.4	12	66.1	-	-	-	-	-	-	-	-	
BH05	BH05	0.3	12/03/2012	<4	<0.5	8	63	30	-	<0.1	-	4	-	26	-	-	-	66	88	140	130	150	<0.001	200	65	140	17	570	130	71	460	810	520	3357	-	-	-	-	-	-	-	-	
BH05	BH05	0.6	12/03/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	1.4	3.2	3.3	3.2*	0.001	4.3	2.4	3.5	0.4	9	3	3.3	4.9	13	8.3	-	-	-	-	-	-	-			
BH06	BH06	0.2	12/03/2012	<4	<0.5	9	57	22	-	<0.1	-	9	-	35	<13	<2	<3	43	2.7	69	64	64	0.001	87	16	67	4.5	150	48	18	100	210	150	1006	<1	<1	<1	<1	<1	<1	<1	<1	
BH06	BH06	1.3	12/03/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.05	<0.001	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
BH07	BH07	0.1	13/03/2012	<4	<0.5	13	26	5	-	<0.1	-	40*	-	24	-	-	-	<0.1	<0.1	0.1	0.5	0.62	-	1.2	0.4	0.6	<0.1	1	0.1	0.4	<0.1	0.6	1	5.52	-	-	-	-	-	-	-		
BH08	BH08	0.5	13/03/2012	<4	<0.5	9	4	16	-	<0.1	-	*	-	16	<1.3	<0.2	<0.3	0.1	0.3	0.7	3	3.8*	<0.001	5.2	2	3.3	0.4	5.9	<0.1	2.1	<0.1	2.6	6.3	30.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
D01_130312	BH08	0.5	13/03/2012	<4	<0.5	9	7	27	-	<0.1	-	2	-	26	-	-	-	<0.1	0.4	0.8	3.1	4.1*	-	5.8	2.3	3.5	0.5	6	<0.1	2.4	<0.1	3.3	6.4	32.95	-	-	-	-	-	-	-	-	
BH09	BH09	0.6	6/03/2012	5	<0.5	25	7	20	-	<0.1	-	10	-	50	-	-	-	<0.1	0.1	0.1	0.8	0.98*	<0.001	1.6	0.5	0.9	<0.1	1	<0.1	0.6	<0.1	0.3	1.2	6.68	-	-	-	-	-	-	-	-	
BH10	BH10	0.6	7/03/2012	4	<0.5	21	43	70	-	<0.1	-	5	-	200	-	-	-	<0.1	<0.1	0.1	0.5	0.55	-	0.8	0.3	0.5	<0.1	1	<0.1	0.3	<0.1	0.5	1	5	-	-	-	-	-	-	-		
BH11	BH11	0.6	9/03/2012	5	<0.5	25	15	30	-	<0.1	-	5	-	17	-	-	-	3.5	3.8	13	29	34	-	46	14	29	3.4	67	10	15	4	50	58	333.7	-	-	-	-	-	-	-	-	
D01_090312	BH11	0.6	9/03/2012	6	0.5	29	7	24	-	<0.1	-	7	-	15	-	-	-	4.4	5.4	18	34	40	<0.001	54	15	34	3.8	76	13	17	7.1	63	70	400.7	-	-	-	-	-	-	-	-	
BH12	BH12	0.4	9/03/2012	<4	<0.5	15	40	3	-	<0.1	-	110*	0.1	34	-	-	-	<0.1	<0.1	<0.1	<0.1	0.06	-	<0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	0.81	-	-	-	-	-	-	-			
BH13	BH13	0.5	9/03/2012	6	<0.5	22	22	20	-	<0.1	-	5	-	11	-	-	-	<0.1	<0.1	<0.1	<0.1	1.06	<0.001	2.1	0.5	1.5	<0.1	4.4	0.4	0.7	<0.1	3.4	3.6	18.8	-	-	-	-	-	-	-		
BH14	BH14	0.6	7/03/2012	7	0.6	25	3	28	-	<0.1	-	3	-	8	-	-	-	0.2	0.2	0.7	1.7	1.4*	<0.001	2.1	0.5	1.5	<0.1	4.4	0.4	0.7	<0.1	3.4	3.6	18.8	-	-	-	-	-	-	-		
BH15	BH15	0.6	6/03/2012	4	<0.5	18	7	20	-	<0.1	-	5	-	5	-	-	-	<0.1	<0.1	<0.1	<0.1	0.07	-	<0.2	<0.1	0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.2	1.07	-	-	-	-	-	-	-			
BH16	BH16	0.6	6/03/2012	<4	<0.5	4	1	7	-	<0.1	-	2	-	13	-	-	-	<0.1	<0.1	<0.1	<0.1	0.05	-	<0.2	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	0.8	-	-	-	-	-	-	-			
BH17	BH17	0.6	5/03/2012	<4	<0.5	14	2	15	-	<0.1	-	2	-	6	-	-	-	<0.1	<0.1	<0.1	<0.1	0.05	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
BH17 - triplicate	BH17	0.6	5/03/2012	<4	<0.5	12	3	14	-	<0.1	-	3	-	8	-	-	-	<0.1	<0.1	<0.1	<0.1	0.13	-	<0.2	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
BH18	BH18	0.5	9/03/2012	<4	<0.5	7	10	16	-	<0.1	-	9	-	28	-	-	-	<0.1	<0.1	<0.1	<0.1	0.05	-	<0.2	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.2	1.08	-	-	-	-	-	-	-	-		
BH19	BH19	0.3	9/03/2012	12	0.7	13	49	85	0.1	12*	0.002	7	-	370	-	-	-	<0.1	1.1	0.8	4.2	6.8*	<0.001	9.2	5.9	3.4	1.3	5.2	0.1	5.5	0.3	1.6	6.7	42.95	-	-	-	-	-	-	-	-	
BH19 - triplicate	BH19 - triplicate	0.3	9/03/2012	14	3.3	12	120	-	-	15	-	10	-	850	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-</					

Table 2. Waste Classification

	TPH					BTEX					Organochlorine Pesticides																							
	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10-C36 (Sum of Total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	4,4-DDE	4-BHC	Aldrin	4-BHC	Chlordane (cis)	Chlordane (trans)	4-BHC	DDD	DDT	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	4-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Hexachlorobenzene	Methoxychlor			
EQL	25	50	100	100	100	0.2	1	0.5	2	1	1000	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
NSW 2009 General Solid Waste CT1						10	600	288			1000																							
NSW 2009 General Solid Waste SCC1	650				10,000	18	1080	518			1800																							
NSW 2009 General Solid Waste TCLP1																																		
NSW 2009 Restricted Solid Waste CT2						40	2400	1152			4000																							
NSW 2009 Restricted Solid Waste SCC2	2600				40,000	72	4320	2073			7200																							
NSW 2009 Restricted Solid Waste TCLP2																																		
																					</													

CT = Contaminant Threshold
TCLP = Toxicity Characteristics Leaching Procedure
SCC = Specific Contaminant Concentration
* = Result fall below General Solid Waste Classification after TCLP analysis
Italics = Natural soil sample

Table A - Soil Analytical Results

Sample ID					BH01	BH01	BH02	BH02	BH03	BH03	BH04	BH04	BH05	BH05	MW01	MW01	BH06	BH06	BH07	BH07	BH09	BH09	BH08	BH08	BH10	BH10	MW03	MW03	BH11	BH11	BH12	BH12	BH13	BH13	MW02	MW02	
Depth (mbgl)					0.1-0.3	0.8-1.0	0.1-0.3	0.8-1.0	0.2-04	0.6-0.8	0.1-0.3	0.6-0.8	0.3-0.4	0.5-0.7	0.1-0.3	0.4-0.5	0.1-0.3	0.5-0.7	0.2-0.4	0.6-0.7	0.1-0.2	0.4-0.5	0.1-0.2	1.0-1.2	0.3-0.5	0.5-0.6	0.1-0.2	0.2-0.3	0.4-0.5	0.3-0.4	0.4-0.6	0.3-0.4	0.4-0.6	0.1-0.2	0.4-0.5		
Sample Date					22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11	22-03-11		
Analyte/Soil Type	Units	LOR	NSW DEC	NSW EPA	Fill	Clay	Fill	Sandy Clay	Fill	Fill	Fill	Clay	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Sandy Clay	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill		
Heavy Metals																																					
Arsenic	mg/kg	5	500	*	<5	12	<5	10	<5	<5	<5	7	24	11	<5	5	<5	6	<5	<5	<5	<5	8	8	<5	<5	<5	<5	5	7	8	10	10	6	7	<5	8
Cadmium	mg/kg	1	100	*	<1	<1	<1	<1	<1	<1	<1	<1	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Chromium*	mg/kg	2	500	*	13	23	29	29	18	23	21	31	31	29	24	34	29	33	14	18	78	16	17	18	14	8	9	18	19	22	16	18	36	36	6	17	
Copper	mg/kg	5	5000	*	103	<5	14	21	21	8	14	5	123	5	10	8	20	<5	10	191	198	16	32	34	20	12	32	32	77	52	55	49	<5	<5	23	38	
Lead	mg/kg	5	1500	*	701	33	42	396	303	79	83	40	948	35	63	30	376	33	46	346	358	43	76	195	32	15	343	148	140	179	122	107	22	22	22	142	
Nickel	mg/kg	2	3000	*	6	<2	27	13	4	3	4	<2	24	<2	5	3	303	2	6	4	9	<2	7	5	10	3	5	6	8	9	6	3	4	5	6		
Zinc	mg/kg	5	35,000	*	220	<5	38	124	177	14	692	428	3560	93	25	12	0.1	7	66	95	734	33	215	190	26	10	267	95	395	448	339	322	<5	6	10	146	
Mercury	mg/kg	0.1	75	*	0.2	0.1	<0.1	<0.1	0.2	0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	16	<0.1	0.5	0.2	0.4	0.2	<0.1	0.2	<0.1	<0.1	0.2	0.4	8	0.3	0.3	<0.1	<0.1	<0.1	0.1	0.2	
Monocyclic Aromatic Hydrocarbons																																					
Benzene	mg/kg	0.2	*	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
Ethylbenzene	mg/kg	0.5	*	50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
Toluene	mg/kg	0.5	*	130	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
Xylenes(meta,para)	mg/kg	0.5	*	*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
Xylenes(ortho)	mg/kg	0.5	*	*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
Xylenes (total)	mg/kg	-	*	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Total Petroleum Hydrocarbons																																					
TPH C6-C9	mg/kg	10	*	65	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10		
TPH C10-C14	mg/kg	50	*	*	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	430	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		
TPH C15-C28	mg/kg	100	*	*	420	<100	<100	<100	<100	180	<100	<100	<100	1060	<100	<100	<100	3440	<100	<100	<100	<100	130	<100	<100	<100	3260	160	<100	<100	110	<100	<100	<100	120	150	
TPH C29-C36	mg/kg	100	*	*	250	<100	<100	<100	<100	120	<100	<100	<100	820	<100	<100	<100	900	<100	<100	<100	<100	110	<100	<100	<100	<100	1970	110	<100	<100	<100	<100	100	150		
TPH C10-C36	mg/kg	50	*	1000	670	<50	<50	<50	<50	300	<50	<50	<50	1880	<50	<50	<50	4770	<50	<50	<50	240	<50	<50	150	<50	<50	5230	270	<50	<50	110	<50	<50	220	300	
Polycyclic Aromatic Hydrocarbons																																					
Naphthalene	mg/kg	0.5	*	*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	29.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	6.8	
Acenaphthylene	mg/kg	0.5	*	*	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	27.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.7	
Acenaphthene	mg/kg	0.5	*	*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	10.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.6		
Fluorene	mg/kg	0.5	*	*	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	51	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.6		
Phenanthrene	mg/kg	0.5	*	*	1.7	<0.5	<0.5	1.1	7.1	<0.5	<0.5	<0.5	<0.5	11.3	<0.5	0.8	<0.5	329	<0.5	1.9	<0.5	1	<0.5	<0.5	1.2	<0.5	<0.5	104	5.8	<0.5	0.7	7.8	0.8	<0.5	0.7	4.6	23.9
Anthracene	mg/kg	0.5	*	*	<0.5	<0.5	<0.5	<0.5	1.7	<0.5	<0.5	<0.5	<0.5	2.2	<0.5	<0.5	<0.5	47.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	36.4	1.9	<0.5	<0.5	2.2	<0.5	<0.5	<0.5	1.5	7.2
Fluoranthene	mg/kg	0.5	*	*	2.7	<0.5	<0.5	2.2	11.4	<0.5	<0.5	<0.5	<0.5	26.9	<0.5	1.4	<0.5	247	<0.5	3.2	<0.5	1.9	<0.5</														

Table D - Waste Classification Analytical Results

Sample ID					BH01/0.1-0.3		BH05/0.3-0.4		BH06/0.1-0.3		MW03/0.1-0.2		MW02/0.4-0.5	
Soil Type	NSW DECC 2009		NSW DEC 2009		Fill - Silty Sand, Organic Material, Sandstone		Fill - Sand, Sandstone, Ash		Fill - Sandy Clay, Gravel, Ash		Fill - Sand, Organic Material, Gravel, Ash, Slag		Fill - Sand, Gravel	
Analyte/Analyte Grouping	General Solid Waste		Restricted Solid Waste											
	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg
	TCLP1	SCC1	TCLP2	SCC2										
Heavy Metals														
Arsenic	5	500	20	2000	<0.1	<5	<0.1	24	<0.1	<5	-	-	-	-
Cadmium	1	100	4	400	<0.05	<1	<0.05	4	<0.05	<1	-	-	-	-
Chromium	5	1900	20	7600	<0.1	13	<0.1	31	<0.1	29	-	-	-	-
Copper	*	*	*	*	0.2	103	<0.1	123	<0.1	20	-	-	-	-
Lead	5	1500	20	6000	0.3	701	0.2	948	2.2	376	-	-	-	-
Nickel	2	1050	8	4200	<0.1	6	<0.1	24	<0.1	303	-	-	-	-
Zinc	*	*	*	*	0.9	220	14.8	3560	1.2	0.1	-	-	-	-
Mercury	0.2	50	0.8	200	<0.0010	0.2	<0.0010	0.4	<0.0010	16	-	-	-	-
Polycyclic Aromatic Hydrocarbons														
Naphthalene	*	*	*	*	-	-	-	-	0.0094	29.6	0.0013	2.9	0.0352	6.8
Acenaphthylene	*	*	*	*	-	-	-	-	0.0069	27.6	<0.001	8.5	0.0027	4.7
Acenaphthene	*	*	*	*	-	-	-	-	0.0039	10.8	<0.001	2	0.0042	1.6
Fluorene	*	*	*	*	-	-	-	-	0.0133	51	<0.001	5.5	0.0044	3.6
Phenanthrene	*	*	*	*	-	-	-	-	0.0152	329	0.0029	104	0.0089	23.9
Anthracene	*	*	*	*	-	-	-	-	0.0026	47.1	<0.001	36.4	0.0016	7.2
Fluoranthene	*	*	*	*	-	-	-	-	0.0024	247	0.0019	175	0.0023	27.7
Pyrene	*	*	*	*	-	-	-	-	0.0016	204	0.0016	185	0.0019	27.3
Benzo(a)anthracene	*	*	*	*	-	-	-	-	<0.001	58.6	<0.001	80.1	<0.001	15.6
Chrysene	*	*	*	*	-	-	-	-	<0.001	46.2	<0.001	72.2	<0.001	14.2
Benzo(b)fluoranthene	*	*	*	*	-	-	-	-	<0.001	55.9	<0.001	88.8	<0.001	19.6
Benzo(k)fluoranthene					-	-	-	-	<0.001	15	<0.001	18.5	<0.001	6.1
Benzo(a)pyrene	0.04	10	0.16	23	-	-	-	-	<0.0005	42.5	<0.0005	73.8	0.0008	15.9
Indeno(1,2,3-c,d)pyrene	*	*	*	*	-	-	-	-	<0.001	13.8	<0.001	34.4	<0.001	8.4
Dibenzo(a,h)anthracene	*	*	*	*	-	-	-	-	<0.001	4	<0.001	10.8	<0.001	1.9
Benzo(g,h,i)perylene	*	*	*	*	-	-	-	-	<0.001	11.6	<0.001	40.5	<0.001	10.2
Total PAH	*	200	*	800	-	-	-	-	0.0553	1193.7	0.0077	938.4	0.062	194.7
Waste Classification Based on Chemical Assessment														
					General Solid		General Solid		Hazardous		Hazardous		Restricted Solid	

Waste Classification with Immobilisation					General Solid		General Solid		General Solid		General Solid		Restricted Solid	
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Table Notes:

- x.x Value exceeds criteria
- * Guidelines have not recommended a criterion value.
- Sample not tested for relevant analyte.

Appendix C Borehole Logs

Borehole Log		Hole ID. BH01
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier	Date Started: 9/03/2012 Date Completed: 9/03/2012 Hole Depth: 1.30 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Asphalt				
Solid Flight Auger		0.04		[Redacted]		Fill	ASPHALT. FILL - Roadbase, blue metal to 50mm Ø.				No odour.
		0.20		[Redacted]		Fill	FILL - Clayey Sand, orange & brown, medium.	slightly moist			Slight hydrocarbon odour.
		0.60		[Redacted]		Fill	FILL - Silty CLAY, dark brown / grey, soft.	moist	5.4	BH01 / 0.4m	Slight hydrocarbon odour.
		1.10		[Redacted]		Fill	FILL - Silty CLAY, dark brown / grey, soft.	moist	6.1	BH01 / 0.8m	Slight hydrocarbon odour.
		1.30		[Redacted]	CL	Natural	CLAY - red / grey mottled, soft.	moist	0.8	BH01 / 1.3m	No odour.
		1.4					End of Hole at 1.30 m Borehole continued for geotechnical assessment.				

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour Olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:09 PM

Borehole Log		Hole ID.	BH02
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier	Date Started: 9/03/2012 Date Completed: 9/03/2012 Hole Depth: 1.50 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1	

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Asphalt				
Solid Flight Auger		0.04		[Redacted]		Fill	ASPHALT. FILL - Roadbase, with blue metal.				No odour.
		0.20		[Redacted]		Fill	FILL - Crushed Sandstone, yellow / grey, medium, with ash and blue metal.	moist			
		0.40		[Redacted]		Fill	FILL - Silty CLAY, dark brown, soft, with some ash / charcoal, some grey sand, medium grained.	moist	5	BH02 / 0.5m	
		0.90		[Redacted]		Fill			15	BH02 / 0.8m	Hydrocarbon odour 0.8 to 1.0m.
		1.0		[Redacted]	CL	Natural	CLAY - red / grey mottled, soft, medium plasticity.	slightly moist			No odour.
		1.50					End of Hole at 1.50 m Borehole continued for geotechnical assessment.		2.1	BH02 / 1.5m	
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour Olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	

Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012
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WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:10 PM

Borehole Log		Hole ID. BH03
 WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com 	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier	
Date Started: 12/03/2012 Date Completed: 12/03/2012 Hole Depth: 1.00 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1		

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
Solid Flight Auger							Surface: Asphalt				
		0.06				Fill	ASPHALT.				No visual or olfactory signs of contamination throughout.
						Fill	FILL - Roadbase.				
		0.20				Fill	FILL - Crushed Sandstone, yellow / brown, medium, sandstone fragments to 20mm Ø, some ash / blue metal.	slightly moist			
		0.50				Fill	FILL - Silty Clay, dark brown, soft, with some rounded gravels, some charcoal inclusions.	moist	5.3	BH03 / 0.5m	
		0.80			CL	Natural	CLAY - red / grey mottled, soft, medium plasticity, with ironstone gravels.	slightly moist			
		1.00					End of Hole at 1.00 m Borehole continued for geotechnical assessment.				
		1.2									
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
 Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:11 PM

Borehole Log		Hole ID.	BH04
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier		Date Started: 12/03/2012 Date Completed: 12/03/2012 Hole Depth: 0.70 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Asphalt				
Solid Flight Auger		0.05		[Redacted]		Fill	ASPHALT. FILL - Roadbase, blue metal to 50mm Ø.				No visual or olfactory signs of contamination throughout.
		0.2		[Redacted]		Fill					
		0.30		[Redacted]		Fill	FILL - Crushed Sandstone, yellow / grey, fine, with blue metal, asphalt.	dry			
		0.4		[Redacted]		Fill					
		0.55		[Redacted]		CL	CLAY - red / grey mottled, stiff.	dry			
		0.6		[Redacted]							
		0.70		[Redacted]							
		0.8					End of Hole at 0.70 m Borehole continued for geotechnical assessment.				
		1.0									
		1.2									
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:12 PM

Borehole Log		Hole ID.	BH05
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment		Date Started: 12/03/2012
	Project Number: 27858		Date Completed: 12/03/2012
	Location / Site: Darlington, NSW		Hole Depth: 5.00 m
	Client: University of Sydney		Ground Level: -----
	Drilling Company: Nealing's Drilling		Easting: -----
Drill Method: Solid Flight Auger		Northing: -----	
Logged By: Aaron Young		Sheet: 1 of 1	

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Samples / Tests		Observations / Comments
								PID ppm	ID No.	
							Surface: Asphalt			
Solid Flight Auger		0.04				Fill	ASPHALT.	12.4	BH05 / 0.3-0.4m	No visual or olfactory signs of contamination throughout.
		0.22			FILL - Roadbase, dark brown.					
		0.50			FILL - Crushed Sandstone / Gravelly Sand, white / brown.					
					CLAY - red / grey mottled.	0.7	BH05 / 0.6-0.7m			
		1.0								
		1.5								
		2.0								
		2.5								
		3.0								
		3.5								
	4.0									
	4.5									
	5.00									
							End of Hole at 5.00 m Borehole continued for geotechnical assessment.			

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au Checked By: Melinda Collier Date: 7/05/2012	

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:13 PM

Borehole Log		Hole ID.	BH06
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment		Date Started: 12/03/2012
	Project Number: 27858		Date Completed: 12/03/2012
	Location / Site: Darlington, NSW		Hole Depth: 5.00 m
	Client: University of Sydney		Ground Level: -----
	Drilling Company: Nealing's Drilling		Easting: -----
Drill Method: Solid Flight Auger		Northing: -----	
Logged By: Aaron Young		Sheet: 1 of 1	

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Samples / Tests		Observations / Comments
								PID ppm	ID No.	
							Surface: Asphalt			
		0.04				Fill	ASPHALT.			
		0.30				Fill	FILL - Roadbase (Sandy Gravel), dark brown.	15.1	BH06 / 0.2m	Hydrocarbon odour.
		0.35				Fill	FILL - Crushed Sandstone (Gravelly Sand), white / brown.			
		0.5				CLAY	CLAY - red / grey mottled.	0.8	BH06 / 0.6m	Hydrocarbon odour.
		1.0								
		1.5								
		2.0								
		2.5								
		3.0								
		3.5								
		4.0								
		4.5								
		5.00								
							End of Hole at 5.00 m Borehole continued for geotechnical assessment.			

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour Olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au Checked By: Melinda Collier Date: 7/05/2012	

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:14 PM

Borehole Log		Hole ID. BH07	
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Aaron Young		Date Started: 13/03/2012 Date Completed: 13/03/2012 Hole Depth: 12.00 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Samples / Tests		Observations / Comments			
								PID ppm	ID No.				
							Surface: Asphalt						
Solid Flight Auger		0.03				Fill	ASPHALT.	0.5	BH07 / 0.1m	No visual or olfactory signs of contamination throughout.			
		0.14					FILL - Roadbase (Sandy Gravel), dark brown, with ash.	0.8	BH07 / 0.5m				
		0.80					FILL - Crushed Sandstone (Gravelly Sand), white / brown.	0.4	BH07 / 0.9m				
							CLAY - red / grey mottled.						
		2.0				CL	Natural						
		4.0											
		6.0											
		8.0											
		10.0											
		12.00											
							End of Hole at 12.00 m Borehole continued for geotechnical assessment.						

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:14 PM

Borehole Log		Hole ID.	BH08
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier		Date Started: 13/03/2012 Date Completed: 13/03/2012 Hole Depth: 1.50 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests			Observations / Comments
									PID ppm	ID No.	DUP TRIP QC	
							Surface: Asphalt					
Solid Flight Auger		0.04		[Symbol]			ASPHALT. CONCRETE SLAB - with reinforcement.					No visual or olfactory signs of contamination throughout.
		0.2		[Symbol]								
		0.25		[Symbol]								
		0.30		[Symbol]			FILL - Silty Sand, yellow / grey, with blue metal. FILL - Crushed Sandstone, orange / grey, fine to medium, with some blue metal.	dry slightly moist				
		0.4		[Symbol]								
		0.6		[Symbol]								
		0.70		[Symbol]			FILL - Silty Clay, dark brown, with some gravels, some red / grey mottled clay inclusions, stiff, dry.	moist				
		0.8		[Symbol]								
		1.0		[Symbol]								
		1.20		[Symbol]			CLAY - orange / brown, stiff.	dry				
		1.4		[Symbol]								
		1.50		[Symbol]			becoming grey at 1.5m.					
		1.6		[Symbol]			End of Hole at 1.50 m Borehole continued for geotechnical assessment.					
		1.8		[Symbol]								
		2.0		[Symbol]								

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:15 PM

Borehole Log		Hole ID. BH09
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier Date Started: 6/03/2012 Date Completed: 6/03/2012 Hole Depth: 1.00 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1	

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Asphalt				
Solid Flight Auger		0.05					ASPHALT.				No visual or olfactory signs of contamination throughout.
							FILL - Roadbase, 20mm band of grey sand with gravel at base.				
		0.20					FILL - Clay, red / brown, stiff.	slightly moist			
		0.90			CL	Nat.	CLAY - red / grey mottled, stiff, with ironstone inclusions.	slightly moist			
		1.00					End of Hole at 1.00 m Borehole continued for geotechnical assessment.				
		1.2									
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

Borehole Log		Hole ID.	BH10
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier		Date Started: 7/03/2012 Date Completed: 7/03/2012 Hole Depth: 0.60 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
Solid Flight Auger		0.20					FILL - Roadbase.				No visual or olfactory signs of contamination throughout.
		0.4					FILL - Clay, brown / red, stiff, with rounded gravel to 2mm Ø.	moist			
		0.60							1.4	BH10 / 0.6m	
		0.8					End of Hole at 0.60 m Borehole continued for geotechnical assessment.				
		1.0									
		1.2									
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:17 PM

Borehole Log		Hole ID. BH11	
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier		Date Started: 9/03/2012 Date Completed: 9/03/2012 Hole Depth: 0.60 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests			Observations / Comments
									PID ppm	ID No.	DUP TRIP QC	
							Surface: Asphalt					
Solid Flight Auger		0.04		[Redacted]			ASPHALT. FILL - Roadbase.					No visual or olfactory signs of contamination throughout.
		0.30		[Redacted]			FILL - Clay, red / brown, stiff, with some rounded gravel to 2mm Ø.	slightly moist				
		0.60		[Redacted]					1.8	BH11 / 0.6m	D01	D01_090312
		0.8					End of Hole at 0.60 m Borehole continued for geotechnical assessment.					
		1.0										
		1.2										
		1.4										
		1.6										
		1.8										
		2.0										

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:18 PM

Borehole Log		Hole ID.	BH12a
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier		Date Started: 9/03/2012 Date Completed: 9/03/2012 Hole Depth: 1.00 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: <i>Asphalt</i>				
Solid Flight Auger		0.05		[Pattern]			ASPHALT.				No visual or olfactory signs of contamination throughout.
		0.2		[Pattern]			FILL - Crushed Sandstone, orange, some clay.				
		0.40		[Pattern]			FILL - Clay, brown, stiff.	slightly moist			
		0.6		[Pattern]					2.5	BH12a / 0.6m	
		0.8		[Pattern]							
		1.00		[Pattern]			becoming orange / brown at 1.0m.				
		1.2					End of Hole at 1.00 m Borehole continued for geotechnical assessment.				
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	1. Located 1.0m North of BH12.
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:19 PM

Borehole Log		Hole ID. BH13
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier	
Date Started: 9/03/2012 Date Completed: 9/03/2012 Hole Depth: 1.00 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1		

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Asphalt				
Solid Flight Auger		0.04		[X]			ASPHALT.				No visual or olfactory signs of contamination throughout.
		0.20		[X]			FILL - Roadbase.				
		0.4		[X]			FILL - Sandy Clay, dark brown, with blue metal, some gravels.	moist			
		0.70		[X]			FILL - Clay, brown / red, stiff.	slightly moist			
		0.8		[X]			becoming lighter to red / grey mottled.	moist			
		1.00		[X]			End of Hole at 1.00 m Borehole continued for geotechnical assessment.				
		1.2									
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:20 PM

Borehole Log		Hole ID. BH14	
 WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com 	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier		
		Date Started: 7/03/2012 Date Completed: 7/03/2012 Hole Depth: 1.10 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1	

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
Solid Flight Auger							Surface: Asphalt				
	0.05						ASPHALT.				No visual or olfactory signs of contamination throughout.
							FILL - Roadbase.				
	0.20						FILL - Crushed Sandstone, medium grained, pieces up to 50mm Ø.	moist			
									4.3		
	0.50					Fill	FILL - Silty Clay, dark brown, soft, some rootlets, organic material.	moist			No sample collected (mixed with material from above).
	0.6								1.1	BH14 / 0.6m	
	1.00										
	1.10				CL	Nat.	CLAY - red / brown, medium plasticity.	slightly moist			
		1.2					End of Hole at 1.10 m Borehole continued for geotechnical assessment.				
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
 Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:21 PM

Borehole Log		Hole ID.	BH15
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier		Date Started: 6/03/2012 Date Completed: 6/03/2012 Hole Depth: 1.20 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Bitumen				
Solid Flight Auger		0.05		[Pattern]			BITUMEN. FILL - Roadbase.				No visual or olfactory signs of contamination throughout.
		0.2		[Pattern]			with larger blue metal pieces below 0.3m.				
		0.40		[Pattern]			FILL - Sand / Crushed Sandstone, yellow / brown, medium grained.	moist			
		0.50		[Pattern]			FILL - Silty Clay, dark brown, medium plasticity.	moist			
		0.6		[Pattern]					0.9	BH15 / 0.6m	
		1.10		[Pattern]			CLAY - red / grey mottled, stiff, with ironstone inclusions.	slightly moist			
		1.20		[Pattern]	CL	Nat.					
							End of Hole at 1.20 m Borehole continued for geotechnical assessment.				
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:22 PM

Borehole Log		Hole ID. BH16
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier Date Started: 5/03/2012 Date Completed: 5/03/2012 Hole Depth: 1.50 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1	

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Bitumen				
Solid Flight Auger		0.05				Fill	BITUMEN. FILL - Roadbase, compacted. with blue metal pieces up to 30mm Ø below 0.13m.				No visual or olfactory signs of contamination throughout.
		0.2				Fill	FILL - Crushed Sandstone, brown / yellow, with pieces up to 50mm Ø.	moist			
		0.30				Fill	FILL - Sand, yellow / brown, medium grained, with some charcoal, some clay.	moist			
		0.40				Fill	clay content increasing with depth.				
		0.6				Fill	FILL - Silty Clay, dark brown, soft.	moist			
		0.70				Fill					
		0.8				Fill					
		0.90				Fill					
		1.0				Natural	CLAY - brown, some red / grey mottling.				
		1.2				Natural	becoming red / grey mottled, stiff.				
		1.4				Natural					
		1.50				Natural					
		1.6					End of Hole at 1.50 m Borehole continued for geotechnical assessment.				
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au Checked By: Melinda Collier Date: 7/05/2012	

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:23 PM

Borehole Log		Hole ID. BH17
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: Nealing's Drilling Drill Method: Solid Flight Auger Logged By: Melinda Collier	Date Started: 6/03/2012 Date Completed: 6/03/2012 Hole Depth: 1.10 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Asphalt				
Solid Flight Auger		0.05		[Redacted]			ASPHALT. FILL - Roadbase.				No visual or olfactory signs of contamination throughout.
		0.2		[Redacted]			with blue metal to 30mm Ø below 0.3m.				
		0.50		[Redacted]			FILL - Crushed Sandstone, yellow / brown, with pieces up to 70mm Ø, some silty clay inclusions.		2.7	BH17 / 0.6m	
		0.70		[Redacted]			FILL - Silty Clay, brown / grey, soft, medium plasticity, with minor gravel inclusions to 2mm Ø.	moist	2.0		
		1.00		[Redacted]							
		1.10		[Redacted]	CL	Nat	CLAY - red / grey mottled, stiff, with ironstone inclusions.	slightly moist			
		1.2					End of Hole at 1.10 m Borehole continued for geotechnical assessment.				
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:24 PM

Borehole Log		Hole ID. BH18	
WSP Environment & Energy Level 1, 41 McLaren Street North Sydney NSW 2060 Office: +61 (0)2 8925 6700 www.wspenvironmental.com	Project Name: Abercrombie Precinct Redevelopment Project Number: 27858 Location / Site: Darlington, NSW Client: University of Sydney Drilling Company: WSP Drill Method: Hand Auger Logged By: Melinda Collier		Date Started: 9/03/2012 Date Completed: 9/03/2012 Hole Depth: 0.70 m Ground Level: ----- Easting: ----- Northing: ----- Sheet: 1 of 1

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Samples / Tests		Observations / Comments
									PID ppm	ID No.	
							Surface: Grass				
Hand Auger		0.2				Fill	TOPSOIL - Sandy Clay, brown / dark brown, medium grained.	moist	1.1	BH18 / 0.5m	No visual or olfactory signs of contamination throughout.
		0.40			FILL - Crushed Sandstone, yellow & grey, medium grained, some large sandstone pieces up to 50mm Ø.		moist				
		0.6									
		0.70									
		0.8					End of Hole at 0.70 m				
		1.0									
		1.2									
		1.4									
		1.6									
		1.8									
		2.0									

Observations	Notes
Asbestos No visual evidence of asbestos noted during drilling. Staining No visual evidence of contamination (e.g. staining / precipitate) noted during drilling. Odour No olfactory (e.g. hydrocarbon odour) evidence of contamination noted during drilling. Groundwater No groundwater encountered during drilling.	
Log Drawn By: Laurie White Contact: laurie.white@reumad.com.au	Checked By: Melinda Collier Date: 7/05/2012

WSP LOG LT ABERCROMBIE 27858.GPJ WSP.GDT 5/7/12 12:56:25 PM

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