



ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

PRINCE OF WALES MEDICAL RESEARCH INSTITUTE

ON

STAGE 1 ENVIRONMENTAL SITE ASSESSMENT

FOR

**PROPOSED NEW RESEARCH BUILDING
DEVELOPMENT**

AT

BARKER STREET, RANDWICK

JANUARY 2009

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Senior Associate: A Kingswell BSc MSc

115 WICKS ROAD, MACQUARIE PARK NSW 2113 • TEL: 02 9888 5000 • FAX: 02 9888 5004

POSTAL ADDRESS: PO BOX 976, NORTH RYDE BC NSW 1670

EIS IS A DIVISION OF JEFFERY & KATAUSKAS PTY LTD • ABN 17 003 550 801

Principals: B F Walker BE DIC MSc P Stubbs BSc MIEAust D Treweek Dip Tech L Speechley BE(Hons) MEngSc MIEAust
Consultant: E H Fletcher BSc (Eng) ME



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Important Information About Your Environmental Site Assessment:

Abbreviations

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Table B: Summary Of Laboratory Test Data – Soil

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Figure 1: Site Location Plan

Figure 2: Borehole Location Plan

Appendix A: Borehole Logs BH2 To BH9 Inclusive, BH3A, BH16 and BH17 and Geotechnical Explanatory Notes

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1 INTRODUCTION

Winton Associates on behalf of Prince Of Wales Medical Research Institute (POWMRI) commissioned Environmental Investigation Services (EIS), a division of Jeffery & Katauskas Pty Ltd (J&K), to undertake a Stage 1 environmental site assessment to assess the likelihood of contamination of the subsurface soils and groundwater for a proposed new research building development at Barker Street, Randwick. The site is identified as part of Lot 1 DP 870720 and at the time of this investigation was occupied by existing research centre and ambulance buildings. The site location is shown on Figure 1 and the investigation was confined to the site boundaries as shown on Figure 2.

The screening was undertaken generally in accordance with an EIS proposal of 9 July 2008 and written acceptance from Winton Associates on behalf of Prince Of Wales Medical Research Institute (POWMRI) of 30 October 2008.

The proposed development includes demolition of existing buildings and carpark facilities at the site and construction of a new research building. EIS understand the proposed building will include 9 above ground levels with a two storey basement.

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

A geotechnical investigation was performed concurrently with the environmental site screening by J&K and the results are presented in a separate report (Ref. 22529ZRPT).

2 ASSESSMENT OBJECTIVES

2.1 Investigation Objectives

The primary objective of the investigation was to assess the potential risk of significant widespread contamination of the site and the soil conditions at the site in relation to the suitability of the site for the proposed land use in accordance with the *Guidelines for Consultants Reporting on Contaminated Sites NSW DECC (formerly the EPA) 1997* and the *State Environmental Planning Policy No.55 – Remediation of Land* (SEPP55).

A secondary investigation objective was to undertake a waste classification assessment for off-site disposal of excavated soil and rock associated with the proposed development works.



2.2 Scope of Work

The scope of work undertaken to achieve the objective included:

1. Assessment of historical site use, including review of historical aerial photographs, land title records search, review of the deposited plan and development applications/building approvals held by Council.
2. Review of regional geology and groundwater conditions, including the location of registered groundwater bores and major underground services in the vicinity of the site.
3. Search of WorkCover records for licenses to store Dangerous Goods and investigation/remediation orders issued by the NSW DECC (EPA).
4. Design and implementation of a field sampling program.
5. Preparation of a report presenting the results of the assessment of potential soil contamination.

A site inspection was undertaken by environmental personnel on 11 November 2008.

2.3 Data Quality Objectives

The purpose of Data Quality Objectives is to develop criteria to assess the reliability of the laboratory data. The Data Quality Objectives established for this project are summarised below:

- Collection and analysis of 10% of the field samples as intra-laboratory duplicates.
- Relative percentage differences (RPDs) were calculated for intra-laboratory duplicates. The RPD was calculated as the absolute value of the difference between the initial and repeat result divided by the average value, expressed as a percentage. The following acceptance criteria were used to assess the RPD results:
 - For results that were greater than 10 times the Practical Quantitation Limit (PQL) RPDs less than 50% were considered acceptable.
 - For results that were between 5 and 10 times PQL RPDs less than 75% were considered acceptable.
 - For results that were less than 5 times the PQL RPDs less than 100% were considered acceptable.
- Review of laboratory QA/QC data (including surrogate recovery, repeat analysis, duplicates, matrix spikes and method blanks).

The success of the Data Quality Objectives is based on assessment of the data set as a whole and not on individual acceptance or exceedance within the data set.



3 PREVIOUS INVESTIGATIONS

An asbestos assessment was previously undertaken on the existing medical research building at the site by Pickford and Rhyder and the results are contained within the document titled "Asbestos Materials Survey, Prince of Wales Medical Research Institute, Randwick, NSW", dated 2 June 2008 (ref: Winton-080521-POWMRI-asbestos survey). The assessment was undertaken on 'Villa 1' and 'Villa 2' of the medical research buildings and did not include ambulance facilities or the 'Black Dog Institute' building.

The assessment encountered asbestos containing materials in the form of fibro cement cladding on walls and eaves of the buildings and as scattered fragments in basement underfloor spaces. The fragments were partially buried and were mixed with other building debris and were considered likely to be 'remains of pre-construction concrete formwork'.

4 SITE INFORMATION

4.1 Site Description

The site identification details are summarised below:

Site Owner:	South Eastern Sydney and Illawarra Area Health Services
Site Address:	220 Avoca Street, Randwick
Lot & Deposited Plan:	Lot 1 DP 870720
Local Government Authority:	Randwick City Council
Current Zoning:	Special Uses
Site Area:	Approximately 13,000m ²
AHD:	Approximately 45m
Geographical Location (MGA):	N: 6245270 E: 337120 (approximately)
Site Locality Plan:	Refer to Figure 1
Site Layout Plan	Refer to Figure 2

The site is located on the north side of Barker Street within a gently undulating regional topographic setting. The areas immediately surrounding the site typically fall to the south and south-west at approximately 1-2° with localised steeper areas. The site typically falls to the south-east at approximately 1-2°, with some flatter areas. The site has been cut into the hillslope at the north-east extent. The site is located in the south-west corner of the Prince of Wales Hospital.



At the time of the investigation the site was occupied by existing ambulance and medical research facilities. A single storey brick ambulance depot was located in the south-west corner of the site. A small 'outback' toilet building was located at the rear of and adjoining the ambulance depot. The toilet building was roofed with fibro cement. Two metal sheds were located to the east of the ambulance depot building. A two storey brick building was located to the north of the ambulance building and appeared to be used for ambulance personnel quarters. Possible fibro cement cladding was observed beneath windows on this building. Grassed and garden areas bounded the quarters building. An asphaltic concrete paved laneway was located to the north of the ambulance quarters.

Single and double storey Medical Research Institute (MRI) villa was located north of the ambulance depot facilities. The villa was clad with timber and fibro cement. An open grassed area with several trees was located to the north of the MRI villa. A relatively small construction site was located to the east of the MRI villa. Site sheds and amenities were located in the north section of the construction site.

Two storey brick and rendered buildings were located in the north-west section of the site and included the 'Black Dog Institute' for depression. A large liquid oxygen store was located adjacent to the south-west corner of the 'Black Dog' building.

Two storey demountable buildings were located in the central-south section of the site, to the east of the ambulance depot. The demountables were founded on brick piers and appeared to be used for offices.

A rendered single and double storey building was located in the south-east section of the site and was occupied by the Prince Of Wales Medical Research Institute (POWMRI). An asphaltic concrete paved carpark was located to the east of the building and extended to the east site boundary. The carpark extended to the small construction site, which adjoined the north side of the POWMRI building. Retained garden and grassed areas were located along the south and east site boundaries in the south-east section of the site. A block retaining wall was located to the north of the paved carpark area and retained the area to the north approximately 4-5m above the carpark.

The site was bound by Barker Street to the south and private roads associated with hospital to the east and west. A veterinary clinic and adjacent horse stable facility was located to the south of Barker Street. Randwick Girls Technology High School was located to the east of the horse stable facility. A dry cleaners was located



approximately 150m to the west of the veterinary clinic. A paved access road was located to the north of the 'Black Dog' Institute, with multi-storey hospital buildings beyond. A medium density residential area that typically included single and double storey brick houses, was located to the west of the site, beyond the paved access road. Various community and hospital buildings were located to the east of the site beyond the access road. The buildings included a bookshop, Ronald McDonald House and a childcare centre.

Sewer, stormwater and underground electrical and telecommunication services were observed across the site and in surrounding pavement and access roads.

4.2 Regional Geology and Hydrogeology

The 1:100,000 geological map of Sydney (Map 9130, 1:100,000 Department of Mineral Resources [now the Department of Primary Industries] – 1983) indicates the site to be underlain by Quaternary aged fluvial deposits that typically consist of medium to coarse grained 'marine' sand with podsols.

Department of Water and Energy (DWE) records were researched for the investigation and indicated that sixteen registered groundwater bores lie within 1km of the site. The details are summarised below:



Ref No	Approx. distance from site(m)	Approx. direction from site	Depth(m)	Registered Purpose
GW108971	750	North	216	Recreation
GW106158	400	North-east	-	Domestic
GW072463	100	South-west	43	Industrial
GW017851	250	South-west	4.5	Commercial
GW106098	900	West	-	Domestic
GW100768	900	West	17.39	Domestic
GW104947	300	South	5	Test Bore
GW108861	450	South-west	114	Recreation
GW072971	600	South	9	Commercial
GW023445	600	South	4.2	Domestic
GW072908	700	South	8	Domestic
GW026483	800	South-west	4.8	General Use
GW102222	850	South-west	9.5	Domestic
GW107289	850	South	-	Domestic
GW105877	950	South	-	Domestic
GW072974	950	South-west	10	Domestic

The stratigraphy of the site is expected to consist of relatively high permeability alluvial sandy soil overlying relatively deep bedrock. Based on these conditions, groundwater may be a significant resource in the area, although contamination by industry may have occurred rendering use of the resource questionable.

5 SITE HISTORY ASSESSMENT

5.1 Aerial Photographs

Aerial photographs were reviewed as part of the assessment of the site history. The following information was obtained:

1930 - The photograph was of poor quality. The site appeared to be vacant and grassed, except for two small buildings in the south-east corner and an area of exposed soil in the east section.

Rows of long buildings were located to the north-west of the site and appeared consistent with hospital buildings of that era. A north-south orientated access road extended between the rows of buildings, south to Barker Street, which bounded the site to the south. Some small to medium sized buildings and vacant areas were located south of Barker Street. Further vacant and grassed areas bounded the site to the north.



An area of exposed soil was located to the east of the site, beyond an access road. A residential area was located to the west of the site.

- 1951 - A small building/shed was located in the north section of the site. An additional small building was located in the south-east corner of the site. A small building was located in the east section of the site adjacent to the access road. Some unpaved tracks were apparent through and across the site.

Some small buildings were located to the north-east of the site, between the site and the access road. Medium sized buildings were located to the east of the access road. Some medium to large sized buildings were located to the south of Barker Street. Some medium sized buildings were located in the residential area to the west of the site.

- 1961 - The site appeared similar to the 1951 photograph, except for a small building in the north-east section.

The surrounds appeared similar to the 1951 photograph, except for some additional buildings to the east of the site and north of Barker Street.

- 1970 - Two buildings in the south-east section, the small building in the north-east section and the small building/shed in the north section had been demolished. Two buildings that appeared similar to the existing ambulance depot and ambulance quarters buildings were located in the south-west section of the site. A group of medium to large buildings was located in the central-south and south-east sections of the site. A paved carpark occupied the east and north-east sections of the site. Two groups of buildings were located in the north and north-west sections of the site that appeared similar to the existing hospital buildings.

Additional hospital buildings were located to the north of the site. A group of large buildings was located to the south-east of the site that appeared similar to the existing Randwick Girls Technology High School. A paved access road bounded the site to the west and appeared similar to the existing access road.

- 1978 - The site appeared similar to the 1970 photograph, except that the small building in the south-east corner had been demolished.



The medium sized buildings within the residential area to the west of the site had been demolished and new houses had been constructed.

- 1986 - The site and surrounds appeared similar to the 1978 photograph.
- 1994 - The site appeared similar to the 1986 photograph, except that the buildings in the north of the east section of the site had been demolished.

The rows of 'older style' hospital buildings located to the north-east of the site had been demolished and a large area of exposed soil occupied the area. New buildings had been constructed to the east of the site and appeared similar to the existing child care centre and library. Houses to the east of the site and north of Barker Street had been demolished and a new building that appeared similar to the existing Ronald McDonald House building occupied the area.

- 2005 - The buildings in the central-south and south-east sections of the site had been demolished and a new building had been constructed that appeared similar to the existing Prince Of Wales Medical Research Institute building. The east-most building of the group immediately north of the ambulance depot facilities appeared to have been demolished. Garden areas were located along the south and east boundaries in the south-east section of the site that appeared similar to the existing garden/grassed areas.

The buildings had been constructed to the north and north-east of the site and appeared similar to the existing hospital buildings. The access road to the east of the site had been widened and appeared similar to the existing road. New large buildings were located to the south and south-west of the site and appeared similar to the existing veterinary clinic and dog training facility.

5.2 Land Title Search

A limited historical land title search was performed on our behalf by Advance Legal Search. Details are presented in Appendix C and a summary of the relevant information is provided below:



The majority of the Prince Of Wales Hospital land (Lot 1 DP 870720) was owned by the Destitute Children's Society from 1863 to 1916, when it became Crown Land. The current proprietor is South Eastern Sydney and Illawarra Area Health Services.

A small area in the south-west section of the hospital land was occupied by several private proprietors from 1897 to 1987, when it was purchased by Eastern Health Service. The proprietors included horse trainers, solicitors, engineers and storekeepers. Two companies, Wilvere Pty Ltd and Ben Arthur Pty Ltd, owned this section of site from 1960 to 1978.

The land search has not indicated any particular land use that may be considered to have resulted in significant contamination of the soil and groundwater at the site.

5.3 Council Records

A search of Development Application (DA) and Building Approval (BA) records/the property file held by Randwick Council was undertaken on behalf of EIS. The results of the search are summarised below:

- BA/40/1965 – ambulance station/staff quarters;
- DA/875/1998 – convert existing villa into medical research facility, with first floor extensions and a two storey link with villa 2;
- DA/873/2002 – alterations and additions to the Prince Of Wales Medical Research Institute;
- DA/40/2003 – alterations and additions to existing Medical Research Institute including new first floor and signage;
- DA/468/2007 – proposed additions to Prince Of Wales Medical Research Institute, comprising additional open office spaces located to the northeast and southwest corners of the building envelope, additional stairs and rooftop plant room located above the north-eastern addition; and
- DA/878/2008 – extension of existing oxygen cylinder enclosure including new block concrete wall and extension of concrete slab and wire mesh fence at Prince Of Wales Hospital.

5.4 WorkCover Database Records

Current licenses to store dangerous goods issued by WorkCover were provided by the Prince of Wales Medical Research Institute. The records indicated the presence of above ground oxygen tanks in the north-west section of the site, on Hospital Road, and several flammable liquid and corrosives cabinets and roofed stores. The flammable



liquids cabinets included storage of alcohols (ethanol and methanol), xylenes and petrol (150L).

The records did not indicate the existence of any licences, including underground storage tanks, at this site. The details of the licenses are attached in Appendix C.

5.5 NSW EPA Records

A search of the NSW EPA on line database did not indicate the existence of any DECC (EPA) notices for the site under section 58 of the Contaminated Land Management Act (1997).

A search for licenses under Section 55 of the Protection of the Environment Operations Act 1997 indicated the existence of two licenses for the Prince of Wales Hospital site. Both licenses were for waste generation and storage of Hazardous, Industrial or Group A waste. One was licensed to P.O.W. Hospital Pty Ltd and one was licensed to South Eastern Sydney and Illawarra Area Health Service.

5.6 Assessment of Historical Information Integrity

The site history assessment has generally been obtained from: government records including the NSW land titles office, historical archives, historical aerial photographs and NSW WorkCover records. The veracity of the information from these sources is considered to be high, however, given the age of the development and the lack of information available on activities prior to 1900's, a certain degree of information loss is to be expected.

Non verifiable anecdotal information has not been relied upon during assessment of historical site use. Therefore, there is considered to be a high level of integrity associated with information obtained with respect to historical use of the site.

5.7 Summary of Historical Site Use

The search of historical information has indicated the following:

- Small buildings/sheds were previously located along the east site boundary and in the north section of the site.
- The existing ambulance depot (1965) and 'Black Dog' buildings were constructed in the 1960's.
- The existing medical research centre building was constructed between 1994 and 1998.
- The medical research centre was occupied by hospital villas prior to 1998.



- The site has been used for private and hospital related purposes since the late 1800's.
- There are no recorded notices listed on the NSW DECC CLM register and WorkCover have no records of underground storage tank licenses issued for the site.

5.8 Potential Contamination Sources

5.8.1 General Contamination Processes

Contamination of surface and subsurface soils generally arises from previous land use that can include petroleum hydrocarbon and warehouse storage, manufacturing processes and pesticide and fertiliser usage. Imported fill soils may contain contaminants derived from unknown sources. Migration of contaminants can occur in permeable subsurface soil or fill materials and via man-made and natural drainage systems. The extent of contamination migration is dependent on the hydro-geological environment and the chemical and physical characteristics of the contaminants. Contamination migration in clayey soils can be expected to be limited, whilst sandy soils are conducive to greater spatial migration.

Backfill to service trenches can form contamination migration pathways via poorly compacted or permeable backfill. Backfill may also be contaminated.

The general history of contamination of sites in the Sydney region indicates that analysis for heavy metals including lead, copper and zinc should be incorporated in the schedule of laboratory testing. In addition screening tests should be performed on selected samples for polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCs), polychlorinated biphenyls (PCBs), petroleum hydrocarbons (TPH), monocyclic aromatic hydrocarbons (BTEX) and asbestos.

5.8.2 Potential Site Specific Contamination

Contamination at the site would be anticipated to be associated with:

- Potentially contaminated, imported fill material; and
- Demolition of previous structures.

5.8.3 Site Specific Contaminants of Concern

The compounds identified as soil contaminants of concern at the subject site include:



- Heavy metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc;
- Total petroleum hydrocarbons (TPH);
- Monocyclic aromatic hydrocarbon (BTEX) compounds: Benzene, Toluene, Ethyl Benzene and Xylenes;
- Polycyclic aromatic hydrocarbons (PAHs) including Benzo(a)pyrene;
- Organochlorine pesticides (OCPs): Aldrin, dieldrin, DDT, chlordane, etc;
- Polychlorinated Biphenyls (PCBs); and
- Asbestos.

5.9 Potential Receptors

The main potential contamination receptors are considered to include:

- Eastlakes located approximately 1.6km to the south-west of the site and Coogee Bay located approximately 1.7km to east of the site.
- Site visitors, workers and adjacent property owners, who may come into contact with contaminated soil and/or be exposed to contaminated dust arising from construction activity.
- Future site occupants.

5.10 Contaminant Laydown and Transport Mechanisms

At this site, mobile contaminants would be expected to move down to the groundwater table and migrate laterally down-slope from the source. The movement of contaminants would be expected to be associated with groundwater flow.

6 ASSESSMENT CRITERIA DEVELOPMENT

6.1 Regulatory Background

In 1997 the NSW Government introduced the *Contaminated Land Management Act, 1997* (CLM Act). This act, associated regulations, State Environmental Planning Policy (SEPP) No.55 – Remediation of Land (1998) and associated NSW DECC (EPA) guidelines, were designed to provide uniform state-wide control of the management, investigation and remediation of contaminated land.

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

- consider whether the land is contaminated;
- consider whether the site is suitable, or if contaminated, can be made suitable by remediation, for the proposed land use;



- be satisfied that remediation works will be undertaken prior to use of the site for the proposed use.

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

The consent authority may request that a site audit be undertaken during, or following the completion of the site assessment process. Under the terms of the CLM Act the NSW DECC (EPA) Site Auditor Scheme was developed to provide a system of independent review for assessment reports. An accredited Contaminated Site Auditor is engaged to review reports prepared by suitably qualified consultants to ensure that the investigation has been undertaken in accordance with the guidelines and confirm that the sites are suitable for their intended use.

Section 59(2) of the CLM Act states that specific notation relating to contaminated land issues must be included on S.149 planning certificates prepared by Council where the land to which the certificate relates is:

- within an investigation or remediation area.
- subject to an investigation or remediation order by the DECC (EPA).
- the subject of a voluntary investigation or remediation proposal.
- the subject of a site audit statement.

Submission of contaminated site investigation and validation reports to council as part of rezoning or development application submissions may also result in notation of actual or potential site contamination on future S.149 certificates prepared for the site.

Section 60 of the CLM Act sets out a positive duty on an owner, or person whose activities cause contamination, to notify the DECC if they are aware that the contamination presents a significant risk of harm.

Off-site disposal of fill, contaminated material and excess soil/rock excavated as part of the proposed development works is regulated by the provisions of the Protection of the Environment Operations Act (POEO Act 1997) and associated regulations and guidelines including the *Waste Classification Guidelines Part 1: Classifying Waste*.



DECC NSW 2008. All materials should be classified in accordance with these guidelines prior to disposal.

Section 143 of the *Protection of the Environment Operations Act 1997* states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner.

6.2 Soil Contaminant Threshold Concentrations

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

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

Threshold concentrations for petroleum hydrocarbon contaminants including total petroleum hydrocarbons (TPH) and monocyclic aromatic hydrocarbon (BTEX) compounds have previously been established in the *NSW DECC (EPA) Contaminated Sites: Guidelines for Assessing Service Station Sites* (1994) publication and this document is referenced in the 1998 Site Auditor Guidelines. Heavy fraction petroleum hydrocarbon aliphatic/aromatic component threshold concentrations have also been introduced in the *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (NEPC Guidelines).



The Provisional Phyto-toxicity Investigation Levels (PPILs) are generic values based on phytotoxicity data for plant response to specific contaminants in a sandy loam matrix and are included in the contaminated site assessment where the proposed land use includes gardens and accessible soils.

The *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (NEPC Guidelines) do not provide numeric guidelines for the assessment of asbestos in soil. NSW DECC (EPA) advice (2006) has indicated that consultants should use their 'professional judgement' regarding determination of appropriate investigation and remediation levels for asbestos in soils; however the NSW DECC (EPA) have not published numerical guidelines for the assessment of asbestos in subsurface soils.

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

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

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

6.2.1 Site Assessment Criteria for Soil Contaminants

The 'commercial/industrial' exposure setting has been adopted for this assessment and the appropriate soil criteria are listed in the following table:



Site Soil Assessment Criteria (mg/kg)			
Contaminant	HIL Column F Exposure Setting	Guidelines for Assessing Service Station Sites (1994)	Phyto-toxicity Investigation Levels
Inorganics			
Arsenic (total)	500		20
Cadmium	100		3
Chromium (III)	60%		400
Copper	5000		100
Lead	1500		600
Mercury (inorganic)	75		1
Nickel	3000		60
Zinc	35000		200
Organic Contaminants			
TPH (C ₆ -C ₉)		65	
TPH (C ₁₀ -C ₃₆)		1000	
Benzene		1	
Toluene		1.4	
Ethylbenzene		3.1	
Total Xylenes		14	
Total PAHs	100		
Benzo(a)pyrene	5		
Aldrin + Dieldrin	50		
Chlordane	250		
DDT + DDD + DDE	1000		
Heptachlor	50		
PCBs (Total)	50		

For the purpose of off-site disposal, the classification of soil into 'General Solid Waste', "Restricted Solid Waste" and 'Hazardous Waste" categories is defined by chemical contaminant criteria outlined in *Waste Classification Guidelines Part 1: Classifying Waste. DECC NSW 2008*. These chemical contaminant criteria are summarised in Table A-2.

6.3 Evaluation of Soil Analysis Data and Contaminant Threshold Concentrations

Assessment of the soil analytical data using the soil contaminant threshold concentrations has been undertaken in accordance with the methodology outlined in the *National Environmental Protection (Assessment of Site Contamination) Measure (1999) Schedule 7(a) Soil Investigation Levels* and the statistical analysis methods outlined in the *NSW EPA Contaminated Sites Sampling Design Guidelines (1995)*.



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

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

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

7 ASSESSMENT PLAN AND METHODOLOGY

The *NSW DECC (EPA) Sampling Design Guidelines (1995)* for contaminated site investigations state that samples should be obtained from a minimum of 23 evenly spaced sampling points for a site of this size (approximately 13,000m²). Samples were obtained from 4 sampling locations for this investigation. This density is approximately 17% of the minimum sampling density.

The boreholes were drilled on a systematic sampling plan with a spacing of up to 75m between sampling points. A systematic sampling plan was considered most appropriate for this investigation as:

- no specific potential point sources of contamination were identified by the available site history.
- the distribution of contamination is expected to be associated with imported potentially contaminated fill material and is therefore likely to be random.



Sampling was not undertaken beneath the existing buildings at the site as access was not possible during the field investigation.

8 INVESTIGATION PROCEDURE

8.1 Subsurface Investigation and Soil Sampling Methods

Subsurface investigations were undertaken using a truck and track mounted hydraulically operated drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler.

The SPT sampler was washed with phosphate free detergent and rinsed following each sampling event. The spiral flight augers were decontaminated using a scrubbing brush and potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water. Sampling personnel used disposable Nitrile gloves during sampling activities.

Soil and rock samples were obtained at various depths, based on observations made during the field investigation. All samples were placed in glass jars with plastic caps and teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. During the investigation, soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with AS 4482.1-2005 and AS 4482.2-1999 as summarised in the following table:



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

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

On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody procedures. Detailed EIS field sampling protocols are included in Appendix D.

8.1.1 Photoionisation Detector (PID) Screening

A portable PID was used in this investigation to assist with selection of samples for laboratory hydrocarbon (TPH/BTEX) analysis. The PID is sensitive to volatile organic compounds. The sensitivity of the PID is dependent on the organic compound and varies for different mixtures of hydrocarbons. Some compounds give relatively high readings and some can be undetectable even though present in identical concentrations. The portable PID is best used semi-quantitatively to compare samples contaminated by the same hydrocarbon source.

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

Photoionisation detector (PID) screening of detectable volatile organic compounds (VOC) was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled glass jar samples following equilibration of the headspace gases. The PID headspace data is included on the COC documents.



8.2 Laboratory Analysis

8.2.1 Soil Samples

Analysis of soil samples was undertaken by NATA registered laboratories using analytical methods detailed in the Schedule B(3) NEPC (1999) Guideline on Laboratory Analysis of Potentially Contaminated Soils. Laboratory analysis was undertaken by Envirolab Services Pty Ltd (NATA Accreditation No. 2901).

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

- Heavy metals – Nitric acid digestion. Analysis by ICP.
- Low level mercury – cold vapour AAS.
- OC pesticides and PCBs – Extracted with acetone/hexane. Analysis by GC/ECD.
- PAHs – Soil extracted with dichloromethane/acetone. Analysis by GC/MS.
- TPH (volatile) – Soil extracted with methanol. Analysis by P&T GC/PID.
- TPH – Soil extracted with dichloromethane/acetone. Analysis by GC/FID.
- BTEX – Soil extracted with methanol. Analysis by P&T PID. Confirmed with column flame ionisation detection.
- Asbestos – Polarizing light microscopy.

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

9 RESULTS OF INVESTIGATION

9.1 Subsurface Conditions

Eleven boreholes were drilled as part of the geotechnical investigation (BH2, BH3, BH3A, BH4 to BH9 inclusive, BH16 and BH17A). Site details and borehole locations are shown on Figure 2. For details of the subsurface soil profile reference should be made to the borehole logs in Appendix A. A summary of the subsurface conditions encountered by the boreholes is presented below:

Pavement

Asphaltic concrete pavement was encountered at the surface in BH4, BH5, BH8, BH9 and BH16 and was generally 50mm to 100mm thick. The pavement was underlain by roadbase in BH4, BH5, BH8 and BH16, which was typically 100mm to 150mm thick.



Fill

Silty sand, silty gravelly sand or sandy gravel fill material was encountered at the surface or beneath the pavement in all boreholes and extended to depths of approximately 0.2m to 1.5m. Fill across the site was typically less than 1m deep, however, deeper fill (1.5m) was encountered in BH7. The fill material contained inclusions of igneous and sandstone gravel and some root fibres.

Natural Soils

Brown, grey and yellow-brown sand was encountered beneath the fill material in all boreholes and extended to depths of approximately 3.5m to 6.8m in all boreholes, except BH3A and BH17A, where the boreholes were terminated in the sand at a depth of approximately 2m. Clayey sand was encountered beneath the sand in BH16 and extended to a depth of approximately 4.65m.

Bedrock

Sandstone bedrock was encountered beneath the natural soils in all boreholes, except BH3A and BH17A, and extended to the termination of the boreholes at a maximum depth of approximately 16.36m.

9.2 Laboratory Results - Soil

The laboratory analysis results for soil samples are summarised in Table B to Table C inclusive and analysis reports are presented in Appendix B. The site soil assessment criteria for this investigation are specified in the "Site Assessment Criteria for Soil Contaminants" section earlier in this report. The results of the analyses are summarised below.

Heavy Metals

Four selected fill samples were analysed for heavy metals. The nickel result of 71mg/kg from the BH4 (0.15-0.4m) sample and the zinc result of 2,400mg/kg from the BH16 (0.5-0.7m) sample exceeded the provisional phyto-toxicity investigation levels (PPILs) of 60mg/kg and 200mg/kg, respectively. The remaining results of the analyses were below the site assessment criteria.

The results of all analyses were less than the SCC1 criteria outlined in the Waste Classification Guidelines Part 1: Classifying Waste DECC NSW 2008.

Petroleum Hydrocarbons (TPH) and Monocyclic Aromatic Hydrocarbons (BTEX)

PID soil sample headspace readings were all zero ppm equivalent isobutylene. These results indicate a lack of PID detectable volatile organic contaminants.



Four selected fill samples were analysed for petroleum hydrocarbons and BTEX compounds. The results of the analyses were below the site assessment criteria.

The results of all analyses were less than the relevant CT1 and SCC1 criteria outlined in the Waste Classification Guidelines Part 1: Classifying Waste DECC NSW 2008.

Polycyclic Aromatic Hydrocarbons (PAHs)

Four selected fill samples were analysed for a range of PAHs including Benzo(a)pyrene. The results of the analyses were less than the site assessment criteria.

The results of all analyses were less than the relevant CT1 and SCC1 criteria outlined in the Waste Classification Guidelines Part 1: Classifying Waste DECC NSW 2008.

Organochlorine (OC) and Organophosphorus (OP) Pesticides and Polychlorinated Biphenyls (PCBs)

Four selected fill samples were analysed for a range of OC and OP pesticides and PCBs. The results of the analyses were below laboratory practical quantitation limit and less than the site assessment criteria.

The results of all analyses were less than the SCC1 criteria outlined in the Waste Classification Guidelines Part 1: Classifying Waste DECC NSW 2008.

Asbestos

Four selected fill samples were screened for the presence of asbestos fibres. The results of the analyses indicated that asbestos fibres were not encountered within the samples and no respirable fibres were detected.

Toxicity Characteristics Leaching Procedure (TCLP)

TCLP leachates (acid) were prepared for four selected fill samples. The extracts were analysed for heavy metals and PAHs. The results of the analyses were less than the TCLP1 criteria outlined in the Waste Classification Guidelines Part 1: Classifying Waste DECC NSW 2008.



9.3 Assessment of Analytical QA/QC

The objective of the assessment of the laboratory QA/QC is to ensure that the sample data is reliable. All laboratory reports for project E22529KH have been checked and issued as final by Envirolab Services Pty Ltd, NATA Accreditation No. 2901, Report number: 24405.

Chain of custody documentation and/or sample receipt advice notices were signed and dated by Envirolab Services laboratories stating that all samples were received cool, in good order and in suitable containers. Compliance of holding times was met for all analyses undertaken by the above laboratory. EIS and laboratory QA/QC procedures for the site screening are summarised in the following table:

Contaminant	QA/QC Procedure						
	Total no. of Samples	Intra-lab Duplicate	Repeat Analysis	Matrix Spike	LCS	Lab Blank	Surrogate Spike
Heavy metals	4	1	1	-	1	1	-
TPH	4	-		-	1	1	4
BTEX	4	-	1	-	1	1	4
PAH	4	-	1	-	1	1	4
OCP/OPP	4	-	1	-	1	1	4
PCB	4	-	1	-	1	1	4
TCLP PAH	4	-		-	1	1	4
TCLP Metals	4	-	1	1	1	1	-

Field QA/QC samples are specified below:

Intra-laboratory duplicates - Dup 1 is a duplicate of BH16 (0.5-0.7m)

The RPD results for the field QA/QC duplicate samples are summarised in Table D. The following comments are an overall summary of the quality of the analytical component of the project:

1. Sample integrity and container requirements were documented as satisfactory.
2. All sample extraction analyses were performed within the required holding times.
3. Matrix spike, laboratory control sample (LCS) and surrogate recovery values indicated that the laboratory accuracy was very good, and that no outliers were reported.
4. Laboratory duplicate RPD results indicated that the sample precision was acceptable.
5. All method blanks were found to be free of analyte concentrations above the PQLs.



6. The intra-laboratory RPD values indicated that field precision was acceptable.

The QA/QC data reported by Envirolab Services laboratories for the documented soil samples were assessed to be of sufficient quality to be considered acceptable for the environmental assessment of EIS project E22529KH.

The QA/QC data including the RPD results are considered to meet the Data Quality Objectives developed for this project.

10 COMMENTS AND RECOMMENDATIONS

The environmental site assessment undertaken for the proposed new research building development at Barker Street, Randwick was designed to assess the suitability of the site for the proposed land use and provide a preliminary waste classification of the fill material.

The proposed development includes demolition of existing buildings and carpark facilities at the site and construction of a new research building. EIS understand the proposed building will include 9 above ground levels with a two storey basement.

The site assessment included performance of a site inspection, review of historical site use, including examination of regional aerial photographs and review of geology and groundwater conditions. Historical information and inspection of the site and surrounding areas did not indicate any obvious on-site or nearby off-site activity that could be expected to generate significant soil or groundwater contamination apart from potentially contaminated, imported fill material and demolition of former structures. The site soil/fill sampling was subsequently undertaken on the basis of a relatively uniform exploration spacing.

The results of the laboratory tests on selected soils samples covered a range of contaminants commonly encountered in the Sydney region. Elevated levels of contaminants were not detected in the samples analysed. All results were less than the appropriate Health Investigation Levels.

The BH4 (0.15-0.4m) and BH16 (0.5-0.7m) fill samples encountered elevated concentrations of nickel and zinc, respectively, above the Provisional Phyto-toxicity Investigation Levels specified in the *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (NEPC Guidelines)*. The PPIs are principally



concerned with phytotoxicity (i.e. adverse effects on plant growth in established and proposed areas of landscaping) and are described in the *NEPC Guidelines* as "somewhat arbitrary", as the effect of these compounds on plant growth will depend on the soil and plant type. These elevations should be taken into consideration for this site as EIS understand that the proposed development may include landscaped areas and therefore elevated contaminant levels in these areas may influence plant growth.

The investigation undertaken by EIS involved sampling from four accessible locations across the site. This is approximately 17% of the minimum recommended sampling density as outlined in the *NSW EPA (now DECC) Contaminated Sites Sampling Design Guidelines 1995*. Due to the presence of fill material at the site, EIS consider that additional investigation will be required, following demolition of the buildings at the site, to meet the minimum sampling density.

The fill soils are classified as 'General Solid Waste (non-putrescible)' according to the criteria outlined in *NSW DECC (EPA) Waste Classification Guidelines, Part 1: Classifying Waste, 2008*. Any excess excavated soils should be disposed of to a suitable NSW DECC (EPA) licensed landfill. Should significant quantities of fill material require disposal, additional analysis including TCLP testing is recommended to confirm this classification.

The natural silty sand soil and sandstone bedrock at the site can be considered to be virgin excavated natural material (VENM). The material is considered suitable for re-use on-site. The VENM may be suitable for reuse on another site, however the material should be assessed for geotechnical suitability and may not be suitable for some landscaped areas. Where doubt exists about the difference between fill and VENM material an environmental/geotechnical engineer should be contacted. VENM must not be mixed with any fill material (including soil and rubble) as this will invalidate the VENM classification.

Immediate groundwater seepage was not encountered, during augering, in the boreholes drilled for this project (to a maximum depth of 8.1m). Standing groundwater was recorded in all 'cored' boreholes, however, this may be due to introduction of water during the coring process. Groundwater may be a significant resource in the area, however, assessment was not considered to be required as part of this Stage 1 assessment. Long term assessment of groundwater may be warranted at the site to assess the potential impacts on the proposed basement.

The investigation undertaken by EIS included the analysis of four fill soil samples for the presence of asbestos fibres using NATA accredited microscopic screening



techniques. Asbestos, neither apparent to the naked eye nor apparent using microscopic techniques were not detected within the samples. The scope of work undertaken was designed to assess widespread surficial contamination and has not included an exhaustive assessment of the site for the presence of small scale asbestos contamination. EIS adopts no responsibility for small scale or buried asbestos features at the site which may be encountered during future earth or construction works at the site.

The previous investigation undertaken by Pickford and Rhyder (ref: Winton-080521-POWMRI-asbestos survey) encountered surficial fibro cement, that was deemed likely to contain asbestos, in the underfloor spaces in the basements of both villas of the medical research building. The investigation also encountered asbestos containing fibro-cement materials on the walls and eaves of the building.

EIS consider that further assessment of hazardous building materials at the remaining buildings at the site (ambulance depot facilities and 'Black Dog Institute') should be undertaken by experienced personnel.

Following demolition of the buildings and removal of asbestos materials by appropriately licensed contractors, clearance certificates should be provided by an appropriate consultant confirming that asbestos containing materials have been successfully removed from the site. Clearance certificates should be provided prior to disposal of any soil or fill material off-site.

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

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

The boreholes drilled for the investigation have enabled an assessment to be made of the existence of significant, large quantities of contaminated soils. The conclusions based on this investigation are that, while major contamination of the site is not apparent, problems may be encountered with smaller scale features between boreholes. EIS adopts no responsibility whatsoever for any problems such as underground storage tanks, buried items or contaminated material that may be encountered between sampling locations at the site. The proposed construction activities at the site should be planned on this basis, and any unexpected problem



areas that are encountered between boreholes should be immediately inspected by experienced environmental personnel. This should ensure that such problems are dealt with in an appropriate manner, with minimal disruption to the project timetable and budget.

During demolition works, the site should be inspected by experienced environmental personnel to assess any unexpected conditions or subsurface facilities that may be discovered between investigation locations. This should facilitate appropriate adjustment of the works programme and schedule in relation to the changed site conditions.

Based on the scope of work undertaken for this assessment EIS consider that the site can be made suitable for the proposed development provided that the following is undertaken:

- Inspection by experienced environmental personnel during demolition and excavation works at the site;
- Additional investigation at a minimum of 19 sampling locations to meet the minimum sampling density, following demolition of the buildings;
- Hazardous materials assessment of the ambulance depot buildings and the 'Black Dog Institute' building; and
- Production of clearance certificates following removal of all asbestos containing materials at the site.

Normal good engineering site management practice including control of run-off and dust suppression is recommended during earthworks and construction. An appropriate occupational health and safety plan should be prepared for the contaminants (namely asbestos) encountered at this site.

11 LIMITATIONS

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

This investigations for this assessment and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with



reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined previously in this report.

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

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

Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes.

Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work.

EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1970 constructed buildings or fill material at the site.

EIS have not and will not make any determination regarding finances associated with the site.

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

During construction at the site, soil, fill and any unsuspected materials that are encountered should be monitored by qualified environmental and geotechnical engineers to confirm assumptions made on the basis of the limited investigation data, and possible changes in site level and other conditions since the investigation. Soil materials considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa.

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

Yours faithfully
For and on behalf of
ENVIRONMENTAL INVESTIGATION SERVICES

Todd Hore
Senior Environmental Engineer

Adrian Kingswell
Senior Associate



ABBREVIATIONS

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



REFERENCE DOCUMENTS

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