ENVIRONMENTAL INVESTIGATION SERVICES

# REPORT

TO

# CROWN GROUP

ON

# PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT

FOR

# PROPOSED SHOPPING CENTRE RE-DEVELOPMENT

AT

# EASTLAKES SHOPPING CENTRE GARDENERS ROAD, EASTLAKES

DECEMBER 2011

REF: E25302Krpt

AS/NZS ISO 9001
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# TABLE OF CONTENTS

1 INTRODUCTION 1
  1.1 Proposed Development Details 1
  1.2 References to the State Body for Environmental Regulation 1

2 OBJECTIVES AND SCOPE OF WORK 2
  2.1 Objectives 2
  2.2 Scope of Work 2
  2.3 Previous Geotechnical Site Investigation 3

3 SITE INFORMATION 3
  3.1 Site Identification 3
  3.2 Site Description 4
  3.3 Regional Geology 4
  3.4 Acid Sulfate Soil (ASS) 5
  3.5 Hydrogeology 5

4 SITE HISTORY ASSESSMENT 6
  4.1 Aerial Photographs 6
  4.2 NSW EPA Records 8
  4.3 Summary of Site Information and Historical Use 8

5 POTENTIAL CONTAMINATION SOURCES 9
  5.1 Potential Off-Site Contamination 9
  5.2 Site Specific Contaminants of Concern 10
  5.3 Potential Receptors 10
  5.4 Contaminant Laydown and Transport Mechanisms 10

6 ASSESSMENT CRITERIA DEVELOPMENT 11
  6.1 Regulatory Background 11
  6.2 Soil Contaminant Threshold Concentrations 12
  6.3 Evaluation of Soil Analysis Data and Contaminant Threshold Concentrations 17
  6.4 Groundwater Contaminant Trigger Values 17
  6.5 Acid Sulfate Soils Action Criteria 20

7 ASSESSMENT PLAN 20
  7.1 Soil Sampling Density 20
  7.2 Groundwater Sampling 21
  7.3 Data Quality Objectives (DQOs) 21
  7.4 Data Quality Indicators (DQIs) and Quality Assurance 21

8 INVESTIGATION PROCEDURE 22
  8.1 Soil Sampling Methods 22
  8.2 Photoionisation Detector (PID) Screening 23
  8.3 Groundwater Monitoring Well Installation 24
  8.4 Monitoring Well Development 24
  8.5 Groundwater Sampling 25
  8.6 Laboratory Analysis 26

9 RESULTS OF INVESTIGATION 27
  9.1 Subsurface Conditions 27
  9.2 Laboratory Results 27

10 ASSESSMENT OF ANALYTICAL QA/QC 30

11 DISCUSSION 32
  11.1 Summary of Soil Contamination Conditions 32
  11.2 Summary of Groundwater Conditions 32
  11.3 Summary of Acid Sulfate Soil Conditions 33

12 CONCLUSIONS AND RECOMMENDATIONS 34
  12.1 Regulatory Requirement 34

13 LIMITATIONS 34

**Abbreviations**
**Important Information About Your Environmental Site Assessment**

**LIST OF TABLES:**

**Table A:** Summary of Laboratory Test Data – Soil Characterisation Assessment
**Table B:** Summary of Laboratory Test Data – Groundwater
**Table C:** Summary of Laboratory Test Data – Acid Sulfate Soil
**Table D:** Summary of Laboratory Test Data – QA/QC Duplicate RPD Results - Soil
**Table E:** Summary of Laboratory Test Data – QA/QC Duplicate RPD Results - Groundwater
**Table F:** Summary of Laboratory Test Data – QA/QC - Rinsate

**LIST OF FIGURES:**

**Figure 1:** Site Location Plan
**Figure 2:** Borehole Location Plan

**LIST OF APPENDICES:**

**Appendix A:** Borehole Logs and Geotechnical Explanatory Notes
**Appendix B:** Laboratory Reports and Chain of Custody Documents
**Appendix C:** Sampling Protocols and QA/QC Definitions
**Appendix D:** EPA Voluntary Remediation Agreement No. 26115

# 1 INTRODUCTION

Crown Group commissioned Environmental Investigation Services (EIS), a division of Jeffery & Katauskas Pty Ltd (J&K), to undertake a preliminary environmental site assessment for the proposed shopping centre re-development at Gardeners Road, Eastlakes.

The site is identified as the Eastlakes Shopping Centre and at the time of this investigation was occupied by a one and two storey commercial facilities and an open air car park. The site location is shown on Figure 1 and the investigation was confined to the proposed development area as shown on Figure 2.

The screening was undertaken generally in accordance with an EIS proposal (Ref: EP5501K) of 22 March 2011 and written email acceptance from Crown Group of 13 October 2011.

A geotechnical investigation was undertaken in conjunction with the environmental site screening by J&K and the results are presented in a separate report (Ref. Ref: 25302Vrpt-EASTLAKES, dated 14 November 2011).

This report has been prepared to assist in submission of a major development application under Part 3A of the Environmental Planning and Assessment Act 1979.

## 1.1 Proposed Development Details

Preliminary concept information was available at the time of this assessment. Based on this information, EIS understand that the proposed development includes demolition of the existing shopping centre, and construction of a ten storey building with residential apartments above a new shopping centre. The proposed development also includes construction of two basement levels, landscaping and pedestrian arrangements.

## 1.2 References to the State Body for Environmental Regulation

Over the past few years the environmental regulatory body has undergone a number of name changes, including:

- Environmental Protection Authority (EPA);
- Department of Environment and Conservation (DEC);
- Department of Environment and Climate Change (DECC); and
- Department of Environment, Climate Change and Water (DECCW).

The department is currently known as the Environmental Protection Authority (EPA).

## 2 OBJECTIVES AND SCOPE OF WORK

### 2.1 Objectives

The primary objectives of the investigation were to:

- Assess the soil and groundwater contamination conditions at the site in relation to the proposed commercial and residential land use;
- Assess the soil for potential acid sulfate soil conditions;
- Prepare a report presenting the results of the assessment generally in accordance with the *NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (1997[1])* and *State Environmental Planning Policy No.55 – Remediation of Land (1998[2])*.

### 2.2 Scope of Work

The scope of work undertaken to achieve the objective included:

1. Limited review of historical aerial photographs;
2. Search of the NSW EPA public register for notices on the site under Section 58 of the *Contaminated Land Management Act* (1997[3]);
3. Search of the NSW EPA public register (POEO) for licences, applications or notices for the site;
4. Search of the NSW EPA public register for sites notified to the NSW OEH under the *Guidelines on the Duty to Report Contamination[4]*;
5. Search of WorkCover databases for licenses to store dangerous goods, including underground fuel storage tanks (USTs);
6. Review of regional geological/hydro-geological data in the vicinity of the site;
7. Review of the acid sulfate soil risk map for the site;
8. Walkover inspection of the site and immediate surrounds to identify potential contamination sources;
9. Design and implementation of a field sampling program;
10. Laboratory analysis of selected soil and groundwater samples; and
11. Preparation of a report presenting the results of the assessment together with recommendations and comments on the suitability of the site for the proposed development.

Field work for this investigation was undertaken on the following dates:

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

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

[3] *Contaminated Land Management Act,* NSW Government Legislation, 1997 (CLM Act 1997)

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

- Drilling, soil sampling and installation of the groundwater monitoring wells was undertaking on 20 and 21 October 2011; and
- The groundwater monitoring well was developed and sampled on 26 October 2011.

### 2.3 Previous Geotechnical Site Investigation

J&K have previously undertaken a geotechnical investigation for the proposed development at the site:

- *"Report to Crown International Holdings Group on Preliminary Geotechnical Investigation for Proposed BKK Shopping Centre Re-Development at Evans Ave, Eastlakes, NSW"*, Ref: 18602VBrpt, dated May 2004.

The geotechnical investigation included drilling four boreholes and installing two groundwater standpipes. The relevant information obtained from this investigation has been incorporated into this report.

## 3 SITE INFORMATION

### 3.1 Site Identification

The site identification details are summarised in the following table:

| | |
|---|---|
| **Site Address, Lot & Deposited Plan:** | • Lot 3 DP 248832 (Eastlakes Shopping Centre and car park south of Evans Avenue);<br>• Lot 41 DP 601517; and<br>• Lot 100 DP 700822 (913A Gardeners Rd, Eastlakes, car park north of Evans Ave and shops fronting Gardeners Rd) |
| **Current land Use:** | B2 Local Centre (Botany Bay LEP 2011 Sheet LZN_004) |
| **Proposed Land Use:** | Mixed use – commercial and residential |
| **Local Government Authority:** | Botany Bay City Council |
| **Area of Proposed Development:** | Approximately 23,200m$^2$ |
| **AHD:** | Approximately 17m |
| **Geographical Location (MGA):** | N: 6244698, E: 334686 (approximately) |
| **Site Locality Plan:** | Refer to Figure 1 |
| **Borehole Location Plan:** | Refer to Figure 2 |

## 3.2 Site Description

The site is referred to as Eastlakes Shopping Centre and is located to the south of Gardeners Road and to the east of Racecourse Place / Eastlakes Reserve. The site is situated in gently sloping topography of Botany Basin that gradually falls towards the south-west at approximately 2-3° towards Lachlan swamps/Mill Pond, a tributary to Botany Bay.

The site is divided by Evans Avenue into two separate portions. The northern portion is bounded to the north by Gardeners Road, to the south by Evans Avenue, to the east and west by three and four storey residential unit blocks. The southern portion of the site is bounded by Evans Avenue to the north, Barber Avenue to the east and south, and Eastlakes Reserve to the west.

The north portion of the site was occupied by of a row of single storey shops adjacent to Gardeners Road, a ground level open air, asphaltic concrete carpark and several large trees throughout the area. The southern portion of the site was occupied by a single level retail complex and a two level car parking structure. Grease traps were identified on the east and west sides of the southern portion of the site. An electrical substation was situated at the south section of the site adjacent to the concrete ramp and the south-west corner of Woolworths.

The surrounding areas were generally occupied by residential unit blocks and Eastlakes Reserve to the west of the site. EIS understand that the vacant property located to the south of Gardeners Road and to the west of Racecourse Place was formerly occupied by a Shell Service Station.

## 3.3 Regional Geology

The geological map of Sydney (1983[5]) indicates the site to be underlain by Holocene aged deposits of medium to fine-grained marine sands with podsols (alluvial) found within the Botany Basin region.

This geological profile does not take into account the soils derived from earthworks (fill) that have previously been undertaken at the site.

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[5] *1:100,000 Geological Map of Sydney (Series 9130),* Department of Mineral Resources (1983)

## 3.4 Acid Sulfate Soil (ASS)

The ASS risk map for the Eastlakes area prepared by Department of Land and Soil Conservation (1997[6]) indicates that the site is located within an area of "no known occurrence of acid sulfate soil materials".

## 3.5 Hydrogeology

NSW Office of Water[7] records were researched for the investigation and indicated that several registered groundwater bores lie within approximately 300m of the site.

One domestic bore was located approximately 230m to the north-west and up gradient of the site. The bore was drilled to a depth of 5.8m

One domestic bore was located approximately 220m to the south-east and down gradient of the site. The bore was drilled to a depth of 6m and indicated a standing water level of 3m.

Several monitoring wells were located in the vicinity of the former Shell Service Station located to the west and up gradient of the site. These wells were drilled to a depth range of 4m to 7m and indicated standing water levels of between 2m and 2.8m.

Two monitoring wells were located approximately 120m to the west and cross gradient of the site. These wells were drilled to a depth of 7m and indicated standing water levels of 2.8m.

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

The site is located within an embargo zone under the Botany Bay groundwater management plan. All domestic bore water use is banned in Zone 2. This includes using groundwater for drinking, watering gardens, irrigation, washing cars and other domestic purposes.

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[6] *1:25,000 Botany Bay Acid Sulfate Soil Risk Map (Series 9130S3, Ed 2),* Department of Land and Soil Conservation (1997)

[7] http://www.waterinfo.nsw.gov.au/gw/, visited on 24 November 2011

# 4 SITE HISTORY ASSESSMENT

## 4.1 Aerial Photographs

Aerial photographs of the site taken in 1930, 1951, 1961, 1978 and 1986 were obtained from the Department of Lands and were reviewed as part of the assessment of the site history. EIS has also reviewed the 1943 historical aerial photograph available for the site on the NSW Department of Lands SIX Viewer[8]. The information obtained from the photographs are summarised in the following table:

| Year | Details |
|---|---|
| 1930 | The central section of the site (in the vicinity of the existing Evans Ave and open-air car park) appeared to be a road/track which formed the north-central section of a large oval shaped track (presumed to be a pony training track). The south section of the site appeared to be a construction zone positioned in the centre of the pony training track. Significant earthworks and possibly sand mining had been undertaken in this area. The north section of the site, adjacent to Gardeners Rd, appeared to be occupied by a large building (surrounded by hardstand) possibly utilised as a stable or other building associated with the pony training track.<br>The surrounding areas to the south, east and west of the site appeared to be part of the above mentioned pony training track and construction site. Areas to the north of the site were occupied by Gardeners Road and low density residential developments beyond. |
| 1943 | The site generally appeared similar to the 1930 aerial photograph which showed the pony training track and associated facilities. In addition, three large buildings (one of which was possibly a tram station) and numerous small structures (possibly stored materials and vehicles) occupied the north section of the site. Construction works had ceased at the south section. Small structures had been placed along the south side of the existing Evans Ave in the central section of the site. These structures were considered to be temporary military structures possibly tents.<br>The immediate surrounds were generally similar to the 1930 aerial photograph with the exception that the central area of the pony training track appeared levelled and grass covered. |

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[8] https://six.maps.nsw.gov.au/wps/portal/SIXViewer, visited on

| Year | Details |
|---|---|
| 1951 | The pony training track and associated facilities continued to occupy the site. One of the large building structures had been removed (possibly demolished). The majority of the smaller structures and all of the temporary structures had been removed from the north section of the site.<br>The surrounding land use was generally similar to the 1943 aerial photograph. |
| 1961 | The site and surrounding land use generally appeared similar to the 1951 aerial photograph. |
| 1978 | The site had undergone significant change since the 1961 aerial photograph with the former pony training track and associated facilities demolished. The north section of the site south of Gardeners Rd was occupied by an open air car park. Evans Road divided the north and south sections of the site. The central and south section of the site was occupied by a large building complex and open air car park. The large building complex generally appeared similar to existing site layout.<br>The surrounding land use to the north generally appeared similar to the 1961 aerial photograph with the addition of commercial properties along Gardeners Rd. The surrounding land use to the east and south had undergone significant change since the 1961 aerial photograph and was occupied by medium density residential developments generally similar to existing developments. Off-site land use to the west had been developed into parkland which was generally consistent with the existing Eastlakes Reserve. |
| 1986 | The general site layout appeared similar to the 1978 aerial photograph with the exception of additional buildings at the north section of the site, adjacent to Gardeners Road and extensions to the south and west sides of the main building complex at the site south and central. The site layout appeared generally consistent with the existing 2011 configuration.<br>The surrounding areas generally appeared similar to the existing 2011 configuration. |
| 2005 | The site and surrounding areas generally appeared similar to the existing 2011 configuration with the exception of a commercial property located to the north, north-west of the site on Gardeners Road. This commercial property has been identified as a former Shell Service Station (see Section 4.2). |

### 4.2 NSW EPA Records

A search of the list[9] of contaminated sites notified to the NSW EPA indicates that there were no recorded notices, applications and licenses recorded for the site.

The search however did indicate that two properties were notified as contaminated sites. These properties included the former Shell Service Station located at 279 Gardeners Road, Eastlakes and Eastlakes Reserve located to the north, north-west of the site. Contamination of these properties was regulated under the Contaminated Land Management Act 1997.

Regulatory action associated with the above mentioned properties included several agreed voluntary remediation proposals with The Shell Company of Australia Limited. The notices are indicated on the NSW EPA on-line database[10] and are associated with contamination within the groundwater that has extended southwards from the former service station located on Gardeners Rd, Eastlakes. The contamination identified in the groundwater included elevated levels of total petroleum hydrocarbons (TPH), volatile organic compounds including benzene, toluene, ethyl benzene and xylenes (BTEX) polycyclic aromatic hydrocarbons (PAHs) and lead. The area affected includes the properties to the west of Racecourse Place, Evans Avenue and Eastlakes Reserve. Eastlakes Reserve is located directly adjacent to the west boundary of the site.

The EPA Voluntary Remediation Agreement No. 26115 and associated plan have been included in Appendix D.

### 4.3 Summary of Site Information and Historical Use

The search of historical information has indicated the following:

- The site is currently used for commercial purposes;
- The intended land use for the site is commercial with residential units above;
- The site is located in an area consisting of high permeability alluvial sand overlying deep bedrock with relatively shallow ground water;
- Acid sulfate soils are not considered to be present in the vicinity of the site;
- The site is considered to have been used as a pony training facility from at least 1930 to approximately the late 1960s;
- During the 1930s significant earthworks and possibly sand mining had been undertaken at the south and central section of the site;
- The 1943 aerial photograph indicates that the site may have been utilised by the military armed forces;

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[9] http://www.environment.nsw.gov.au/clm/publiclist.htm, visited on 24 November 2011
[10] http://www.environment.nsw.gov.au/prclmapp/searchregister.aspx, visited on 24 November 2011

- A large building formerly located at the north section of the site had been demolished;
- By at least 1978 the site had been developed to a large building complex and car park that generally resembled the existing site configuration;
- From the 1970s to present day, minor additions and alterations had been undertaken at the site; and
- There are contamination issues associated with a former service station to the north-west of the site.

Based on the available historical data obtained during this assessment EIS consider there to be a moderate potential of contaminating activities having been carried out on the site. EIS note that there were data gaps in the site history including title records and aerial photographs during the 1960s and early to mid 1970s. As such the risk of the potential of contaminating activities having been carried out on the site cannot be eliminated.

## 5 POTENTIAL CONTAMINATION SOURCES

Based on the scope of work undertaken for the assessment, the following potential contamination sources or potentially contaminating activities have been identified at the site:

- Potentially contaminated, imported fill material;
- Potential asbestos contamination associated with demolition of the former site buildings; and
- Historical use of the site for commercial purposes.

### 5.1 Potential Off-Site Contamination

Contamination of the adjacent properties to the west and north-west of the site was listed on the NSW EPA on-line records of contaminated sites. The contamination is recorded as a groundwater plume associated with the Shell Service Station formerly located at 279 Gardeners Road, Eastlakes. The NSW EPA records indicate that the affected area is currently being remediated and monitored.

Due to the high permeability alluvial sandy soil in the vicinity of the site and the up gradient location of the groundwater plume, the risk of contamination migrating onto the site is considered to be relatively high.

## 5.2 Site Specific Contaminants of Concern

The assessment has identified a number of potential soil contaminants of concern that may be associated with the potential contamination sources and/or potentially contaminating activities. The potential soil and groundwater contaminants of concern are listed below:

- Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn);
- Total Petroleum Hydrocarbons (TPHs);
- Monocyclic Aromatic Hydrocarbons (BTEX compounds);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Organochlorine and Organophosphorus pesticides (OCPs and OPPs);
- Polychlorinated Biphenyls (PCBs); and
- Asbestos

## 5.3 Potential Receptors

The main potential contamination receptors are considered to include:

- Lachlan swamps/Mill Pond located approximately 600m to the south 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; and
- Future site occupants.

## 5.4 Contaminant Laydown and Transport Mechanisms

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

# 6 ASSESSMENT CRITERIA DEVELOPMENT

## 6.1 Regulatory Background

In 1997 the NSW Government introduced the CLM Act. This Act has been amended by the *Contaminated Land Management Amendment Act* (2008[11]).

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

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

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

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

The consent authority may request that a site audit be undertaken during, or following the completion of the site assessment process. Under the terms of the CLM Act 1997 the NSW 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 1997 states that specific notation relating to contaminated land issues must be included on Section149 (s149) planning certificates prepared by Council where the land to which the certificate relates is:

- Within an investigation or remediation area;

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

- Subject to an investigation or remediation order by the OEH;
- The subject of a voluntary investigation or remediation proposal; and/or
- The subject of a site audit statement.

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

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

## 6.2 Soil Contaminant Threshold Concentrations

The soil investigation levels adopted for this investigation are derived from the NSW DEC document *Guidelines for the NSW Site Auditor Scheme, 2nd Edition* (2006[12]) and the National Environmental Protection Council document *National Environmental Protection (Assessment of Site Contamination) Measure* (1999[13]). 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) 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.

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

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

Threshold concentrations for petroleum hydrocarbon contaminants including total TPH and BTEX compounds have previously been established in the *NSW EPA Contaminated Sites: Guidelines for Assessing Service Station Sites* (1994[14]) publication and this document is referenced in the Site Auditor Guidelines 2006. Heavy fraction petroleum hydrocarbon aliphatic/aromatic component threshold concentrations have also been introduced in NEPM 1999.

Soil samples for this investigation have been analysed for total recoverable hydrocarbons (TRH) rather than TPH. TRH analysis is undertaken without a preliminary silica gel clean-up of the sample. Consequently the TRH result may include other compounds such as phthalates, humic acids, fatty acids and sterols (if present).

### 6.2.1 Provisional Phyto-toxicity Investigation Levels (PPILs)

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

### 6.2.2 Asbestos in Soil

NEPM 1999 does not provide numeric guidelines for the assessment of asbestos in soil. NSW OEH 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 EPA have not published numerical guidelines for the assessment of asbestos in subsurface soils.

The WorkCover publication *Working with Asbestos Guide* (2008[15]) 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*

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

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

*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*[16] and WorkCover requirements all necessary disturbance works associated with friable asbestos containing materials must be conducted by a licensed AS-1 Asbestos Removal Contractor.

### 6.2.3 Acid Sulfate Soils

Assessment of ASS conditions and the impacts of the proposed development are based on information provided in the ASS Assessment Guidelines presented in the ASS Manual 1998. The guidelines include information on assessment of the likelihood that the site lies within an ASS area, the need for an ASSMP, and the development of mitigation methods for the proposed development.

The assessment guidelines include recommendations for the density of sampling locations within the site. A minimum of 4 sampling locations should be undertaken for a site with an area up to 1ha in size to assess development constraints with a reduced density for sites greater than 4ha of 2 locations per hectare. For lineal investigations, sampling every 50-100m is recommended.

The sampling locations should include all areas where significant disturbance of soils will occur and/or areas with a high environmental sensitivity. In some instances a varied sampling plan may be more suitable, particularly for sites less than 1,000m$^2$ in area.

The depth of investigation should extend to at least 1m beyond the depth of proposed excavation/disturbance or estimated drop in watertable height, or to a minimum of 2m below existing ground level, whichever is greatest.

Standard methods for the laboratory analysis of samples are presented in the Australian Standard AS4969-2008/09[17] (part 1 to 14). The principal analytical method is suspension Peroxide Oxidation Combined Acidity and Sulfur (sPOCAS).

The sPOCAS method specified in AS4969-2008/09 has superseded the POCAS method specified in the ASS Manual 1998. When $S_{POS}$ (peroxide oxidisable sulfur) values are close to the action criteria confirmation of the result can be undertaken by the chromium reducible sulfur ($S_{CR}$) method.

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[16] *Occupational Health and Safety Regulation,* NSW Government, 2001 (NSW OH&S Regulation 2001)

[17] *Analysis of acid sulfate soil – Dried samples – Methods of test, Parts 1 to 14,* Standards Australia, 2008/2009 (AS4969-2008/09)

ASSMAC present 'action criteria' for the assessment of laboratory analysis results. These 'action criteria' define the need to prepare a management plan and are based on the percentage of oxidisable sulfur (or equivalent Total Potential Acidity [TPA]) for broad categories of soil types. Where disturbance of greater than 1,000 tonnes of ASS is proposed, the action criteria for 'coarse textured soils' apply to all soil types.

### 6.2.4 Site Assessment Criteria (SAC) for Soil Contaminants

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

| **Contaminant** | **SAC - HILs Column D (mg/kg)** | **PPILs (mg/kg)** |
|---|---|---|
| **Heavy Metals** | | |
| Arsenic (total) | 400 | 20 |
| Cadmium | 80 | 3 |
| Chromium (III) | 48% | 400 |
| Copper | 4000 | 100 |
| Lead | 1200 | 600 |
| Mercury (inorganic) | 60 | 1 |
| Nickel | 2400 | 60 |
| Zinc | 28000 | 200 |
| **Petroleum Hydrocarbons** | | |
| TPH ($C_6$-$C_9$) | 65 [a] | - |
| TPH ($C_{10}$-$C_{36}$) | 1000 [a] | - |
| Benzene | 1 [a] | - |
| Toluene | 1.4 [a] | - |
| Ethylbenzene | 3.1 [a] | - |
| Total Xylenes | 14 [a] | - |
| **PAHs** | | |
| Total PAHs | 80 | - |
| Benzo(a)pyrene | 4 | - |
| **Pesticides (OCPs & OPPs)** | | |
| Aldrin + Dieldrin | 40 | - |
| Chlordane | 200 | - |
| DDT+ DDD + DDE | 800 | - |
| Heptachlor | 40 | - |
| Total OPPs | 0.1 [b] | - |
| **Others** | | |
| PCBs (Total) | 40 | - |
| Asbestos | NDLR [c] | - |

**Note:**

[a] Service Station Guidelines 1994

[b] Due to the absence of locally endorsed guideline criteria, the laboratory practical quantitation limit (PQL) has been adopted.

[c] Not Detected at Limit of Reporting (NDLR)

## 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 NEPM 1999 Schedule 7(a).

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

- For a site to be considered suitable for the proposed land use each individual contaminant concentration should be less than the SAC; and
- Where the concentration of each contaminant is less than the SAC in all samples, the suitability of the site for the proposed use may be assessed based solely on individual analytical results.

Where contamination results exceed the SAC, 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 SAC. Validation of the remediated site is generally required to demonstrate that the site is suitable for the proposed land use.

## 6.4 Groundwater Contaminant Trigger Values

Groundwater resources in NSW are managed and regulated by environmental and planning legislation which include the POEO Act 1997, *Environmental Planning and Assessment Act* (1979[18]) and the *Water Management Act* (2000[19]).

In 2000, Australian and New Zealand Environment Conservation Council (ANZECC) released the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000[20]) which superseded the previous guideline documents.

The ANZECC 2000 guidelines include a complete framework for the development of appropriate guidelines for aquifer assessment. The above guidelines provide water quality parameters at the point of use including aquatic ecosystems (fresh and marine waters), drinking water, industrial and agricultural/irrigation uses.

The National Health and Medical Research Council (NHMRC) released the *Australian Drinking Water Guidelines* (2011[21]). These guidelines are predominantly used to assess drinking water quality and have been referenced in some cases.

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[18] *Environmental Planning and Assessment Act,* NSW Government, 1979 (EP&AA 1979)

[19] *Water Management Act*, NSW Government, 2000 (Water Act 2000)

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

The appropriate settings for current and potential uses of groundwater should be identified in establishing applicable groundwater trigger values:

- raw drinking water source;
- agricultural use – stock watering;
- agricultural and domestic use – irrigation;
- protection of aquatic ecosystems – freshwater; and
- protection of aquatic ecosystems – marine.

The presence of elevated contaminant concentrations in groundwater triggers further investigation of aquifer conditions to assess the source(s) of contamination and the lateral and vertical extent of the contamination.

Guidance on the remediation and management of contaminated groundwater is presented in the document *NSW DECCW Guidelines for the Assessment and Management of Groundwater Contamination (2007[22])*.

### 6.4.1 Petroleum Hydrocarbons in Groundwater

In the absence of locally endorsed guidelines for petroleum hydrocarbon compounds in water, the 'intervention value' concentration for mineral oil specified in the *Circular on Target Values and Intervention Values for Soil Remediation* (2000[23]) has been adopted as the trigger value for TPH ($C_{10}$-$C_{36}$ fractions only).

It is noted that these guidelines have not been endorsed by NSW EPA and are used only as a preliminary screening tool.

### 6.4.2 Site Assessment Criteria (SAC) for Groundwater Contaminants

The fresh groundwater trigger values have been adopted along with other guideline values for this investigation as outlined in the table:

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[21] *Australian Drinking Water Guidelines*, National Health and Medical Research Council, 2011 (NHMRC 2004)

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

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

| Contaminant | Units | Fresh Water Criteria[1] | Drinking Water Criteria[2] | USEPA[5] |
|---|---|---|---|---|
| **Metals** | | | | |
| Arsenic (total)[6] | µg/L | 24 | 7 | - |
| Cadmium | µg/L | 0.2 | 2 | - |
| Chromium (III) | µg/L | 3.3[a] | 50 | - |
| Copper | µg/L | 1.4 | 2000 | - |
| Lead | µg/L | 3.4 | 10 | - |
| Mercury | µg/L | 0.6 | 1 | - |
| Nickel | µg/L | 11 | 20 | - |
| Zinc | µg/L | 8 | 3000[d] | - |
| **Petroleum Hydrocarbons** | | | | |
| TPH $C_{10}$-$C_{36}$ | µg/L | 600[b] | nsl | - |
| Benzene | µg/L | 950[a] | 1 | - |
| Toluene | µg/L | 180[a] | 800 | - |
| Ethylbenzene | µg/L | 80[a] | 300 | - |
| o-Xylene | µg/L | 350[a] | nsl | - |
| m+p Xylene | µg/L | 75[a*] | nsl | - |
| **PAHs** | | | | |
| Naphthalene | µg/L | 16[a] | nsl | 0.14 |
| Anthracene | µg/L | 0.01[c] | nsl | 11000 |
| Phenanthrene | µg/L | 0.6[c] | nsl | - |
| Fluoranthene | µg/L | 1[c] | nsl | 1500 |
| Benzo(a)pyrene | µg/L | 0.1[c] | 0.01 | - |
| **Others** | | | | |
| Oil and grease | mg/L | 10[h] | - | - |
| pH | - | 6.5 – 8.5[i] | 6.5 – 8.5[d] | nsl |
| EC | mS/cm | nsl | nsl | nsl |

**Notes:**

[1] 95% Trigger Values for Fresh Water (ANZECC 2000)

[1] 95% Trigger Values for Marine Water (ANZECC 2000)

[2] Australian Drinking Water Guidelines (NHMRC 2011)

[5] Due to the absence of locally endorsed criteria, the USEPA Region 9 PRGs for Tap water have been adopted

[6] The Arsenic (III) trigger value has been quoted

[a] Low or Moderate Reliability Trigger Values have been quoted (ANZECC 2000)

[b] In the absence of locally endorsed guidelines, the Dutch investigation levels have been quoted

[c] 99% trigger values have been adopted due to the potential for bioaccumulation effects

[d] The aesthetic guideline concentration has been quoted

[a*] Low or Moderate Reliability Trigger Values (ANZECC 2000) for m-Xylenes have been quoted. We note that m-Xylene guideline value is 75µg/L and the p-Xylene guideline value is 200µg/L. However, these two isomers cannot currently be distinguished analytically

nsl – No set limit

## 6.5 Acid Sulfate Soils Action Criteria

The following action criteria are presented in the ASS Manual 1998:

***Coarse Textured Soils (sands to loamy sands)***

- pH - less than 5.
- Total Actual Acidity (TAA) / Total Sulfide Acidity (TSA) / TPA (pH5.5) – greater than 18mol $H^+$/tonne.
- $S_{pos}$ – greater than 0.03% sulfur oxidisable.

The above criteria are also adopted where disturbance of greater than 1,000 tonnes of ASS is proposed.

It should be noted that the endpoint for the pH titration in AS4969-2008/09 is pH6.5 as opposed to pH5.5 adopted in the ASS Manual 1998. Therefore the values for TAA, TSA and TPA will more conservative when analysed using the sPOCAS method specified in AS4969-2008/09.

# 7 ASSESSMENT PLAN

## 7.1 Soil Sampling Density

The *NSW EPA Contaminated Sites Sampling Design Guidelines* (1995[24]) for contaminated site investigations state that samples should be obtained from a minimum of 34 evenly spaced sampling points for a site of this size (approximately 23,200m$^2$).

Samples were obtained from 5 sampling locations for this investigation. This density is approximately 15% of the minimum sampling density.

The boreholes were drilled on a judgemental sampling plan in accessible areas of the site.

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

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

## 7.2 Groundwater Sampling

The assessment included the installation of two groundwater monitoring wells in selected boreholes (BH109 and BH110). Two groundwater standpipes were previously installed during the 2004 geotechnical investigation (BH1 and BH4). Groundwater sampling was undertaken from BH110, BH109 and BH1. The location of the groundwater monitoring wells is shown on Figure 2.

## 7.3 Data Quality Objectives (DQOs)

The DQOs for the assessment were developed with reference to the US EPA document *Data Quality Objectives Process for Hazardous Waste Site Investigations* (2000[25]). The document includes seven steps as follows:

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

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

## 7.4 Data Quality Indicators (DQIs) and Quality Assurance

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

Review of QA criteria was based on laboratory data including surrogate recovery, repeat analysis, laboratory control sample (LCS) and method blanks.

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

- approximately 13% of field soil samples as intra-laboratory duplicates; and
- rinsate sample of field equipment

Success of field DQIs is based on the following criteria:

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[25] *Data Quality Objectives Process for Hazardous Waste Site Investigations,* US EPA, *2000* (US EPA 2000)

- Relative percentage differences (RPDs) were calculated for the 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.
- Field rinsate sample free of analyte concentrations above the PQLs.

## 8 INVESTIGATION PROCEDURE

### 8.1 Soil Sampling Methods

Subsurface investigation was undertaken using a truck 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. Details of the decontamination procedure adopted during sampling are presented in Appendix C.

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

All samples were placed in glass jars with plastic caps and teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. Sampling personnel used disposable nitrile gloves during sampling activities.

During the investigation, soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with AS 4482.1-2005[26] and AS 4482.2-1999[27] 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, OCP, OPP & PCBs | | |
| Asbestos | Sealed plastic bag | None |

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

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

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

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

PID screening of detectable volatile organic compounds (VOCs) was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly

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

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

filled zip-lock plastic bags following equilibration of the headspace gases. The PID headspace data is presented on the COC documents.

## 8.3 Groundwater Monitoring Well Installation

Two standpipes were installed during the 2004 geotechnical investigation in boreholes BH1 and BH4. In addition to this, two groundwater monitoring wells were installed in geotechnical boreholes BH109 and BH110 during the 2011 assessment. The location of all four wells is indicated on Figure 2. The well construction details are documented on appropriate borehole logs presented in Appendix A. A summary of the well construction details are included in the following table:

| Well No. | Final Depth | Surface R.L[1] | Machine Slotted PVC[2] Screen | Sand Filter Pack | Bentonite Seal | Well Finishing Details[3] |
|---|---|---|---|---|---|---|
| BH1 | 6m | ≈16.7m | ✓ | ✓ | ✓ | Gatic cover |
| BH4 | 6m | - | ✓ | ✓ | ✓ | Gatic cover |
| BH109 | 4.5m | ≈16.5m | ✓ | ✓ | ✓ | Gatic cover |
| BH110 | 5.0m | ≈17.5m | ✓ | ✓ | ✓ | Gatic cover |

**Notes:**

[1] RL: Reduced Level (AHD)

[2] 50mm diameter Class 18 PVC has been used for the wells

[3] Concrete grout was used to seal the monitoring well

## 8.4 Monitoring Well Development

Groundwater was purged from the monitoring wells using a submersible electric pump.

The monitoring wells were allowed to recharge prior to sampling. The pump and hose were flushed between monitoring wells with potable water followed by a pulse of demineralised water. Details of the decontamination procedure adopted during sampling are presented in Appendix C.

Groundwater removed from the wells during purging was transported to EIS, where the water is stored in a holding drum prior to collection by licensed waste water contractors. When the drum is filled a sample is analysed to classify the water for disposal.

## 8.5 Groundwater Sampling

Groundwater samples were obtained from the monitoring wells using both a new disposable polyethylene bailer and low flow/micro-purge sampling equipment to reduce the disturbance of the water column and loss of volatiles.

During use of the micro-purge the pH, temperature, EC, DO and Eh were monitored during sampling using calibrated field instruments to assess the development of steady state conditions.

Once steady state conditions were considered to have been achieved, groundwater samples were obtained directly from the pump tubing and placed in appropriate glass bottles, BTEX vials or plastic bottles.

Duplicate samples were obtained by alternate filling of sample containers. This technique was adopted to minimise disturbance of the samples and loss of volatile contaminants associated with mixing of liquids in secondary containers, etc.

The samples were preserved in accordance with water sampling requirements detailed in NEPM 1999 and placed in an insulated container with ice. During the investigation, groundwater samples were preserved by immediate storage in an insulated sample container with ice in accordance with AS/NZS 5667.1:1998[28] as summarised in the following table:

| Analyte | Preservation | Storage Period |
|---|---|---|
| Heavy metals | 45μm Filter, acidify with nitric acid to pH 1-2. | Store at <4°, analysis within 30 days |
| VOCs (TPH) | Zero headspace, teflon seal | Store at <4°, analysis within 7 days |
| VOCs (BTEX + Light TPH) | Zero headspace, Teflon seal, acidify with HCl to pH 1-2. | Store at <4°, analysis within 7 days |
| sVOCs (PAHs) | nil | Store at <4°, analysis within 7 days |

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.

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[28] *Water Quality – Part 1: Sampling, Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples,* Standards Australia, 1998 (AS/NZS 5667.1:1998)

## 8.6 Laboratory Analysis

Laboratory analysis (including quality control duplicate sample analysis) was undertaken by Envirolab Services Pty Ltd (NATA Accreditation No. 2901).

### 8.6.1 Soil Samples

Soil samples were analysed using the following analytical methods detailed in Schedule B(3) of NEPM (1999[29]):

- Heavy metals – Nitric acid digestion. Analysis by ICP/AES;
- Low level mercury – cold vapour AAS;
- OC and OP pesticides and PCBs – Extracted with dichloromethane/acetone. 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/MS;
- TPH – Soil extracted with dichloromethane/acetone. Analysis by GC/FID;
- BTEX – Soil extracted with methanol. Analysis by P&T GC/MS; and
- Asbestos – Polarizing light microscopy.

### 8.6.2 Groundwater Samples

Groundwater samples were analysed using the following analytical methods endorsed by the NSW DECCW (EPA) (Schedule B(3) does not apply to water samples):

- Heavy metals – Direct injection. Analysis by ICP-AES;
- Low level mercury – Direct injection. Analysis by flow injection AAS;
- PAHs – Triple solvent (dichloromethane) extraction. Analysis by GC/MS;
- TPH (volatile) – P&T. Analysis by GC/MS;
- TPH – Solvent (dichloromethane) extraction. Analysis GC/FID;
- VOCs including BTEX – Direct P&T. Analysis by GC/MS; and
- Oil & Grease – Gravimetric. Hexane Extractable.

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[29] *Guideline on Laboratory Analysis of Potentially Contaminated Soils*, Schedule B(3), NEPM, 1999 (Schedule B(3))

# 9 RESULTS OF INVESTIGATION

## 9.1 Subsurface Conditions

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

***Pavement***

Asphaltic concrete was identified at all five boreholes drilled for this investigation. The asphalt was approximately 50mm thick in all of the boreholes.

***Fill***

Fill material was encountered at all five borehole locations to a depth range of 0.5m to 1.8m below existing site levels. The fill generally consisted of gravelly sand and silty sand containing igneous gravel, brick, concrete, plastic and metal fragments.

***Natural Soils***

The natural soil was present beneath the fill at all five borehole locations and continued to depths of approximately 10m at the termination of the boreholes. The natural soil generally consisted of residual fine to medium grained silty sand.

***Groundwater***

Groundwater monitoring wells were installed in boreholes BH1 and BH4 for the 2004 J&K investigation and in BH109 and BH110 for this investigation. Standing Water Level (SWL) measured in BH1 and BH109 was 2.14m and 1.76m below existing ground levels respectively.

## 9.2 Laboratory Results

The laboratory reports are presented in Appendix A. The results have been assessed against the SAC adopted for this investigation.

### 9.2.1 Soil Samples

The soil laboratory results are presented in Table A. The results of the analyses are summarised below.

***Heavy Metals***

Five fill and three natural soil samples were analysed for heavy metals. The results of the analyses were below the SAC.

***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.

Five fill and three natural soil samples were analysed for TPH and BTEX compounds. The results of the analyses were below the SAC.

***Polycyclic Aromatic Hydrocarbons (PAHs)***

Five fill and three natural soil samples were analysed for a range of PAHs including Benzo(a)pyrene. The results of the analyses were below the SAC.

***Organochlorine (OCPs) and Organophosphorous (OPPs) Pesticides***

Five fill and three natural soil samples were analysed for a range of OCPs and OPPs. The results of the analyses were below the laboratory PQL and less than the SAC.

***Polychlorinated Biphenyls (PCBs)***

Five fill and three natural soil samples were analysed for a range of PCBs. The results of the analyses were below the laboratory PQL and less than the SAC.

***Asbestos***

Five fill and three natural soil samples were analysed for asbestos fibres. The results of the analyses were below the laboratory PQL and less than the SAC.

### 9.2.2 Groundwater Samples

The groundwater laboratory results are presented in Table B. The results of the analysis are summarised below:

***Heavy Metals***

Two groundwater samples obtained from borehole BH109 and BH110 were analysed for heavy metals, borehole BH109 was analysed for lead only. The results of the analyses were below the SAC.

***Petroleum Hydrocarbons (TPH)***

Two groundwater samples obtained from borehole BH109 and BH110 were analysed for TPH compounds. The results of the analyses were below the laboratory PQL and less than the SAC.

***Monocyclic Aromatic Hydrocarbons (BTEX)***

Three groundwater samples obtained from borehole BH1, BH109 and BH110 were analysed for BTEX compounds. The results of the analyses were below the laboratory PQL and less than the SAC.

***Polycyclic Aromatic Hydrocarbons (PAHs)***

One groundwater sample obtained from borehole BH109 was analysed for a range of PAHs including Benzo(a)pyrene. The results of the analyses were below the laboratory PQL and less than the SAC.

***Volatile organic Compounds (VOCs)***

One groundwater sample obtained from borehole BH110 was analysed for a range of PAHs including Benzo(a)pyrene. The results of the analyses were below the laboratory PQL and less than the SAC.

***Other Parameters***

Two groundwater samples obtained from BH110 and BH109 were analysed for a range of parameters including oil and grease, pH, hardness and electrical conductivity. The results were as follows:

Borehole BH109

- Hardness: 81mg$CaCO_3$/L

Borehole BH110

- Oil and grease: less than 5mg/L
- pH: 6.6 units
- EC: 250 $\mu$S/cm;

### 9.2.3 Acid Sulfate Soil Samples

The acid sulfate soil laboratory results are presented in Table C. The results of the analyses obtained from one fill and three natural soil samples are summarised below.

***pH***

- The $pH_{KCl}$ results for the soil ranged from 5 to 5.0. The results indicate that prior to oxidation the pH values of the soil suspended in potassium chloride solution were acidic; and

- Following oxidation, the $pH_{ox}$ results for the samples ranged from 3.4 to 5.4. The pH of the samples dropped by up to 1.6 units following oxidation and all results were acidic.

***Acid Trail***

- TAA results indicated that the soils were generally non-acidic prior to oxidation;
- TPA results were all less than 5mol $H^+$/tonne and were below the site assessment criteria of 18 mol $H^+$/tonne; and
- TSA results were all less than 5mol $H^+$/tonne and were below the site assessment criteria of 18 mol $H^+$/tonne.

***Sulfur Trail***

- The $S_{pos}$% results were all less than 0.005% and were below the site assessment criteria of 0.03%.

***Liming Rate***

Based on the above results, the liming rate calculated for neutralisation was estimated at less than 750g$CaCO_3$/tonne.

## 10 ASSESSMENT OF ANALYTICAL QA/QC

The DQOs and DQIs established for the investigation have been assessed in this section of the report. The assessment includes a review of the laboratory QA/QC procedure to assess whether the sample data is reliable.

The laboratory reports for this investigation have been checked and issued as final by Envirolab Services Pty Ltd, NATA Accreditation No. 2901, Report numbers: 64045, 64046, 64047 and 65939.

The RPD results for the field QA/QC duplicate samples are summarised in Tables D, E1 and E2. An assessment of the DQIs adopted for this investigation is summarised in the following table. A brief explanation of the individual DQI is presented in Appendix C.

| DQO | Number of Samples | DQI |
|---|---|---|
| **Precision:** | | |
| Intra-laboratory duplicate<br>Sample Reference:<br>Dup01 is a duplicate of soil sample BH106 (0.8-1.0m)<br>Dup1 is a duplicate of groundwater sample BH10 | Soil x 1<br>Groundwater X 1 | The intra-laboratory RPD values indicated that field precision was acceptable. |
| Field Rinsate (sample ref: R1) | Soil x 1 | The field rinsate sample was found to be free of analyte concentrations above the PQLs. |
| Laboratory duplicate RPD values | Soil x 7 | Laboratory duplicate RPD results for the soil analysis were generally within the acceptance criteria adopted by the laboratory. |
| **Accuracy:** | | |
| Surrogate Spikes | All organic analytes | Laboratory accuracy was good and no outliers were reported. |
| Laboratory Control Sample (LCS) | Soil x 13<br>Groundwater X 6 | Laboratory accuracy was good and that no outliers were reported.<br>The percentage recovery was not possible due to the high concentration of the element in sample 64047-7. |
| **Representativeness:** | | |
| Samples extracted and analysed within holding time | All Samples | All samples were extracted and analysed within the appropriate holding times outlined in the investigation procedure. |
| Analysis of Laboratory Blanks | Soil x 9<br>Groundwater x 10 | All laboratory blanks were found to be free of analyte concentrations above the PQLs. |
| **Comparability:** | | |
| EIS sampling protocols | All Samples | Sampling was undertaken in accordance with the EIS sampling protocols outlined in Appendix C. |
| Standard laboratory analytical methods used | All Samples | All Samples |
| Samples obtained by qualified staff | All Samples | All Samples |
| **Completeness:** | | |
| Documentation (including site notes, borehole logs and COC etc) was correctly maintained | All Samples | All Samples |
| Samples obtained were analysed for the contaminants of concern | All Samples | All Samples |
| Appropriate analytical methods used by the laboratory. | All Samples | All Samples |

## 11 DISCUSSION

The preliminary environmental site assessment undertaken for the proposed shopping centre re-development was designed to assess the suitability of the site for the proposed land use.

### 11.1 Summary of Soil Contamination Conditions

Samples were obtained from 5 sampling locations for this investigation which was approximately 15% of the minimum sampling density.

Soil samples obtained for the investigation were analysed for the potential contaminants of concern identified at the site.

Elevated concentrations of contaminants were not encountered in the soil samples analysed for the investigation. All results were below the site assessment criteria (SAC).

#### 11.1.1 PPILs

One fill soil sample encountered an elevated concentration of copper above the PPILs.

The PPIL criteria are principally concerned with phytotoxicity (i.e. adverse effects on plant growth in established and proposed areas of landscaping) and are described in NEPM 1999 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 includes landscaped areas and therefore elevated contaminant levels in these areas may influence plant growth. During development of the landscaping plan for the proposed development an experienced landscape architect should be consulted.

### 11.2 Summary of Groundwater Conditions

Groundwater monitoring wells were installed in boreholes BH1 and BH4 for the 2004 J&K investigation and in BH109 and BH110 for this investigation. Standing Water Level (SWL) measured in BH1 and BH109 was 2.14m and 1.76m below existing ground levels respectively.

Groundwater flow was not evaluated, however based on the topography of the site and surrounds groundwater would be expected to generally flow to the south and west.

Three groundwater samples were analysed for the potential contaminants of concern identified at the site. Elevated concentrations of contaminants were not encountered in the groundwater samples analysed for the investigation. All results were below the SAC.

Based on the SWL measured in the boreholes dewatering will be required during basement excavation.

As outlined in Section 4.2, the NSW EPA online records indicate groundwater contamination associated with the properties located directly adjacent to the west site boundary. EIS consider that there is a probability that contaminated groundwater on the adjacent site may be drawn onto the site during de-watering. Further groundwater investigation is recommended prior to developing the site to assess this possibility. If there is a risk of contaminated groundwater migrating onto the site this will impact on the basement design and groundwater disposal options during de-watering.

The site is located within an embargo zone under the Botany Bay groundwater management plan and restrictions apply to the use of groundwater.

### 11.3 Summary of Acid Sulfate Soil Conditions

The assessment included soil sampling from four boreholes and the analysis of four samples for ASS characteristics.

The sPOCAS results for the four samples identified one result of acidic conditions greater than the assessment criteria. This result, however, was considered to be indicative of mildly acidic soils associated with organic/humic material rather than potential ASS (PASS) as no significant concentrations of oxidisable sulfur were encountered in the samples.

As such, PASS conditions are not considered to be present at the site to a maximum depth of approximately 3.0m below existing site levels. In the event that excavation works including piling below this level are required additional sPOCAS testing will be required.

## 12 CONCLUSIONS AND RECOMMENDATIONS

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 recommendations are implemented:

- A Stage 2 detailed environmental assessment is undertaken which includes the following:
    - Soil sampling from an additional 29 locations in order to meet the NSW EPA 1995 recommended sampling density;
    - The sampling locations should include areas beneath the existing buildings, in the vicinity of the electrical substation and grease traps;
    - Installation of several additional groundwater monitoring wells particularly along the west boundary of the site; and
- Prior to demolition works an asbestos inspection should be undertaken of all buildings and structures;

On finalisation of the proposed site development plans the conclusions outlined on this report should be re-evaluated. This specifically includes the potential for de-watering in reference to contaminated off-site groundwater and potential acid sulfate soils below 3.0m depth. A more detailed proposal of the above recommendations can be prepared when the proposed development plans have been finalised.

### 12.1 Regulatory Requirement

The requirement to report to the OEH under Section 60 and *Guidelines on the Duty to Report Contamination*[30] under the CLM Amendment Act 2008 should be assessed once the results of the additional investigation works have been reviewed and a remedial strategy has been selected.

## 13 LIMITATIONS

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

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

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.

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

The investigation 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-1990 constructed buildings or fill material at the site.

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

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

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.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. Copyright in this report is the property of EIS. EIS has used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report.

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

Yours faithfully
For and on behalf of
ENVIRONMENTAL INVESTIGATION SERVICES

Cameron Hollands
Environmental Scientist

Adrian Kingswell
Senior Associate

## ABBREVIATIONS

| | |
|---|---|
| AAS | Atomic Absorption Spectrometry |
| AGST | Above Ground Storage Tank |
| AHD | Australian Height Datum |
| ANZECC | Australian and New Zealand Environment Conservation Council |
| ASS | Acid Sulfate Soil |
| B(a)P | Benzo(a)pyrene |
| BH | Borehole |
| BTEX | Benzene, Toluene, Ethyl benzene, Xylene |
| COC | Chain of Custody documentation |
| CLM | Contaminated Land Management |
| DECCW | Department of Environment, Climate Change and Water (formerly DECC, DEC and EPA) |
| DNR | NSW Department of Natural Resources (now split between DWE and DECCW) |
| DWE | NSW Department of Water and Energy |
| DP | Deposited Plan |
| DQO | Data Quality Objective |
| EC | Electrical Conductivity |
| EPA NSW | Environment Protection Authority, New South Wales (now part of DECCW) |
| GC-ECD | Gas Chromatograph-Electron Capture Detector |
| GC-FID | Gas Chromatograph-Flame Ionisation Detector |
| GC-MS | Gas Chromatograph-Mass Spectrometer |
| HIL | Health Based Investigation Level |
| HM | Heavy Metals |
| ICP-AES | Inductively Couple Plasma – Atomic Emission Spectra |
| NATA | National Association of Testing Authorities, Australia |
| NEPC | National Environmental Protection Council |
| NHMRC | National Health and Medical Research Council |
| OEH | Office of Environment and Heritage |
| 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 |
| SAC | Site Assessment Criteria |
| SEPP | State Environmental Planning Policy |
| sPOCAS | suspension Peroxide Oxidation Combined Acidity and Sulfate |
| SPT | Standard Penetration Test |
| SWL | Standing Water Level |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TP | Test Pit |
| TPH | Total Petroleum Hydrocarbons |
| USEPA | United States Environmental Protection Agency |
| UCL | Upper Confidence Limit |
| UST | Underground Storage Tank |
| VOC | Volatile Organic Compounds |

## IMPORTANT INFORMATION ABOUT THE SITE ASSESSMENT REPORT

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

***An Environmental Assessment Report is Based on a Unique Set of Project Specific Factors:***

This report has been prepared in response to specific project requirements as stated in the EIS proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

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

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

***Changes in Subsurface Conditions***

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

### *This Assessment is Based on Professional Interpretations of Factual Data*

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

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

### *Environmental Site Assessment Limitations*

Although information provided by an environmental site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

### *Misinterpretation of Environmental Site Assessments by Design Professionals*

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

### *Logs Should not be Separated from the Environmental Assessment Report*

Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problems, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the test of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

***Read Responsibility Clauses Closely***

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

## TABLE A
## SUMMARY OF LABORATORY RESULTS
## SOIL ASSESSMENT

All data in mg/kg unless stated otherwise

| ANALYTE | | | HEAVY METALS | | | | | | | | PAHs | | ORGANOCHLORINE PESTICIDES | | | | OP | PCBs | PETROLEUM HYDROCARBONS | | | | | | | | | PID VALUES | ASBESTOS FIBRES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Cadmium | Chromium | Copper | Lead | Mercury | Nickel | Zinc | Total PAHs | B(a)P | Aldrin & Dieldrin | Chlordane | DDT, DDD & DDE | Heptachlor | PESTICIDES | | Petroleum Hydrocarbons | | | | | Benzene | Toluene | Ethyl benzene | Total Xylenes | | |
| | | | | | | | | | | | | | | | | | | | $C_6$-$C_9$ | $C_{10}$-$C_{14}$ | $C_{15}$-$C_{28}$ | $C_{29}$-$C_{36}$ | $C_{10}$ - $C_{36}$ | | | | | | |
| PQL - Envirolab Services | | | 4 | 0.5 | 1 | 1 | 1 | 0.1 | 1 | 1 | - | 0.05 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 25 | 50 | 100 | 100 | 250 | 0.5 | 0.5 | 1 | 3 | | 100 |
| Site Assessment Criteria ^ | | | 400 * | 80 * | 48% * | 4000 * | 1200 * | 60 * | 2400 * | 28000 * | 80 * | 4 * | 40 * | 200 * | 800 * | 40 * | 0.1 ^^ | 40 * | 65 $^{\#}$ | nsl | nsl | nsl | 1000 $^{\#}$ | 1 $^{\#}$ | 1.4 $^{\#}$ | 3.1 $^{\#}$ | 14 $^{\#}$ | | 100^^ |
| PPILs | | | 20 ** | 3 ** | 400 ** | 100 ** | 600 ** | 1 ** | 60 ** | 200 ** | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | nsl | | - |
| **Sample Reference** | **Sample Depth** | **Sample Description** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BH106 | 0.3-0.5 | Fill | LPQL | LPQL | 1 | 3 | 14 | LPQL | LPQL | 29 | 0.62 | 0.12 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| BH106 | 0.8-1.0 | Silty Sand | LPQL | LPQL | 2 | 4 | 16 | LPQL | LPQL | 11 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| BH107 | 0.3-0.5 | Fill | LPQL | LPQL | 35 | ***220*** | 52 | LPQL | 35 | 160 | 6.87 | 0.67 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| BH108 | 1.3-1.5 | Fill | LPQL | LPQL | 1 | 9 | 34 | LPQL | LPQL | 6 | 1.28 | 0.18 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| BH108 | 1.8-2.0 | Silty Sand | LPQL | LPQL | 2 | LPQL | 1 | LPQL | 2 | 13 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| BH109 | 0.1-0.2 | Fill | LPQL | LPQL | 9 | 41 | 76 | 0.3 | 8 | 82 | 29.1 | 3 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 150 | 250 | 400 | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| BH109 | 1.9-2.0 | Silty Sand | LPQL | LPQL | 2 | LPQL | 1 | LPQL | 1 | 1 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| BH110 | 0.3-0.5 | Fill | LPQL | LPQL | 9 | 12 | 1 | LPQL | 36 | 16 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |
| **Total Number of samples** | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| **Maximum Value** | | | LPQL | LPQL | 35 | 220 | 76 | 0.3 | 36 | 160 | 29.1 | 3 | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | LPQL | 150 | 250 | 400 | LPQL | LPQL | LPQL | LPQL | 0 | LPQL |

***EXPLANATION:***

^ Site Assessment Criteria: Guideline concentrations adopted for the investigation as outlined below:

* National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC Guidelines)
Health Investigation Levels (HIL) - Column D, Residential with minimal soil access

** Provisional Phyto-toxicity Investigation Levels (PPILs)

$^{\#}$ NSW DECC Guidelines for Assessing Service Station Sites (1994)

^^ In the absence of Australian guidelines, the laboratory PQL has been adopted as the site assessment criteria

$^{+}$ NSW DECCW Waste Classification Guidelines (2009)

| | |
|---|---|
| Concentration above the Site Assessment Criteria | **VALUE** |
| Concentration above PPILs | ***VALUE*** |

***ABBREVIATIONS:***

PAHs: Polycyclic Aromatic Hydrocarbons
B(a)P: Benzo(a)pyrene
PQL: Practical Quantitation Limit
LPQL: Less than PQL
OP: Organophosphorus Pesticides
PID: Photoionisation Detector
PCBs: Polychlorinated Biphenyls

UCL: Upper Level Confidence Limit on Mean Value
na: Not Analysed
nc: Not Calculated
nsl: No Set Limit

TABLE B
GROUNDAWATER SAC MASTER FILE
All results in µg/L unless stated otherwise.

| ANALYTE | PQL Envirolab Services | SAC | SAC | SAC | SAC | SAC | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ANZECC 2000 Fresh Waters[1] | US EPA[5] | Drinking Water[2] | Trade Waste[3] | Sydney Water[4] Acceptance Standards | BH110 26.10.11 | BH1 2.12.11 | BH109 2.12.11 |
| **Inorganic Compounds and Parameters** | | | | | | | | | |
| Oil and Grease (mg/L) | 5 | $10^{h}$ | nsl | nsl | $200^{g}$ | 50 | LPQL | na | na |
| pH | 0.1 | $6.5 - 8.5^{i}$ | nsl | $6.5 - 8.5^{d}$ | $6 - 10^{g}$ | 7-10 | 6.6 | na | na |
| Hardness (mgCaCo3/L) | 1.0 | nsl | nsl | 200d | nsl | nsl | na | na | 81 |
| Electrical Conductivity (mS/cm) | 0.001 | nsl | nsl | nsl | nsl | nsl | 250 | na | na |
| **Heavy Metals** | | | | | | | | | |
| Arsenic (As III) | 1 | 24 | - | 10 | 5000 | 1000 | LPQL | na | na |
| Cadmium | 0.1 | 0.2 | - | 2 | 2000 | 1000 | 0.1 | na | na |
| Chromium (VI) | 1 | $3.3^{a}$ | - | 50 | 20000 | 3000 | LPQL | na | na |
| Copper | 1 | 1.4 | - | 2000 | 10000 | 5000 | LPQL | na | na |
| Lead | 1 | 3.4 | - | 10 | 10000 | 2000 | LPQL | na | LPQL |
| Mercury (inorganic) | 0.5 | 0.6 | - | 1 | 50 | 30 | LPQL | na | na |
| Nickel | 1 | 11 | - | 20 | 10000 | 3000 | LPQL | na | na |
| Zinc | 1 | 8 | - | $3000^{d}$ | 10000 | 5000 | LPQL | na | na |
| **Petroleum Hydrocarbons** | | | | | | | | | |
| Hydrocarbons C6-C9 | 10 | nsl | - | nsl | 30000 | 10000 | LPQL | na | LPQL |
| Hydrocarbons C10-C14 | 50 | nsl | - | nsl | | nsl | LPQL | na | LPQL |
| Hydrocarbons C15-C28 | 100 | nsl | - | nsl | | nsl | LPQL | na | LPQL |
| Hydrocarbons C29-C36 | 100 | nsl | - | nsl | | nsl | LPQL | na | LPQL |
| Total Hydrocarbons C10-C36 | - | $600^{b}$ | - | nsl | see above | nsl | LPQL | na | LPQL |
| **BTEX** | | | | | | | | | |
| Benzene | 1 | $950^{a}$ | - | 1 | nsl | 100 | LPQL | LPQL$^{r}$ | LPQL |
| Toluene | 1 | $180^{a}$ | - | 800 | nsl | 500 | LPQL | LPQL$^{r}$ | LPQL |
| Ethylbenzene | 1 | $80^{a}$ | - | 300 | nsl | 1000 | LPQL | LPQL$^{r}$ | LPQL |
| m+p-xylene | 2 | $75^{a*}$ | - | nsl | nsl | See total xylenes | LPQL | LPQL$^{r}$ | LPQL |
| o-xylene | 1 | $350^{a}$ | - | nsl | nsl | See total xylenes | LPQL | LPQL$^{r}$ | LPQL |
| Total xylenes | 1 | nsl | - | 600 | nsl | 1000 | LPQL | LPQL$^{r}$ | LPQL |
| **VOCs list** | | | | | | | | | |
| Dichlorodifluoromethane | 10 | nsl | 390 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Chloromethane | 10 | nsl | 190 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Vinyl Chloride | 10 | $100^{a}$ | - | 0.3 | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Bromomethane | 10 | nsl | 8.7 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Chloroethane | 10 | nsl | nsl | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Trichlorofluoromethane | 10 | nsl | 1300 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,1-Dichloroethene | 1 | $700^{a}$ | - | 30 | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Trans-1,2-dichloroethene | 1 | nsl | 110 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,1-dichloroethane | 1 | $90^{a}$ | 2.4 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Cis-1,2-dichloroethene | 1 | nsl | 73 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Bromochloromethane | 1 | nsl | 0.12 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Chloroform | 1 | $370^{a}$ | 0.19 | nsl | $5000^{L}$ | 100 | LPQL | na | na |
| 2,2-dichloropropane | 1 | nsl | nsl | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,2-dichloroethane | 1 | $1900^{a}$ | - | 3 | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,1,1-trichloroethane | 1 | $270^{a}$ | 9100 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,1-dichloropropene | 1 | nsl | nsl | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Cyclohexane | 1 | nsl | 13000 | nsl | nsl | See total VOCs | LPQL | na | na |
| Carbon tetrachloride | 1 | $240^{a}$ | nsl | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Benzene | 1 | see BTEX | see BTEX | see BTEX | nsl | See total VOCs | LPQL | na | na |
| Dibromomethane | 1 | nsl | 8.2 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,2-dichloropropane | 1 | $900^{a}$ | 0.39 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Trichloroethene | 1 | $330^{a\wedge}$ | nsl | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Bromodichloromethane | 1 | nsl | 0.12 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| trans-1,3-dichloropropene | 1 | $0.1^{a\wedge\wedge}$ | 0.43 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| cis-1,3-dichloropropene | 1 | $0.1^{a\wedge\wedge}$ | 0.43 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,1,2-trichloroethane | 1 | 6500 | 0.24 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Toluene | 1 | see BTEX | see BTEX | see BTEX | nsl | See total VOCs | LPQL | na | na |
| 1,3-dichloropropane | 1 | $1100^{a}$ | 730 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Dibromochloromethane | 1 | nsl | 0.15 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,2-dibromoethane | 1 | nsl | 0.0065 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Tetrachloroethene | 1 | $70^{a}$ | 0.11 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,1,1,2-tetrachloroethane | 1 | $400^{a\wedge\wedge\wedge}$ | 0.52 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Chlorobenzene | 1 | $55^{a}$ | - | 300 | nsl | See total VOCs | LPQL | na | na |
| Ethylbenzene | 1 | see BTEX | see BTEX | see BTEX | nsl | See total VOCs | LPQL | na | na |
| Bromoform | 1 | nsl | 8.5 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| m+p-xylene | 2 | see BTEX | see BTEX | see BTEX | nsl | See total VOCs | LPQL | na | na |
| Styrene | 1 | nsl | 1600 | nsl | nsl | See total VOCs | LPQL | na | na |
| 1,1,2,2-tetrachloroethane | 1 | $400^{a}$ | 0.067 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| o-xylene | 1 | see BTEX | see BTEX | see BTEX | nsl | See total VOCs | LPQL | na | na |
| 1,2,3-trichloropropane | 1 | nsl | 0.00072 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| Isopropylbenzene | 1 | 30 | nsl | nsl | nsl | See total VOCs | LPQL | na | na |
| Bromobenzene | 1 | nsl | 88 | nsl | nsl | See total VOCs | LPQL | na | na |
| n-propyl benzene | 1 | nsl | 1300 | nsl | nsl | See total VOCs | LPQL | na | na |
| 2-chlorotoluene | 1 | nsl | 730 | nsl | nsl | See total VOCs | LPQL | na | na |
| 4-chlorotoluene | 1 | nsl | 2600 | nsl | nsl | See total VOCs | LPQL | na | na |
| 1,3,5-trimethyl benzene | 1 | nsl | 370 | nsl | nsl | See total VOCs | LPQL | na | na |
| Tert-butyl benzene | 1 | nsl | nsl | nsl | nsl | See total VOCs | LPQL | na | na |
| 1,2,4-trimethyl benzene | 1 | nsl | 15 | nsl | nsl | See total VOCs | LPQL | na | na |
| 1,3-dichlorobenzene | 1 | $260^{a}$ | - | $20^{d}$ | nsl | See total VOCs | LPQL | na | na |
| Sec-butyl benzene | 1 | nsl | nsl | nsl | nsl | See total VOCs | LPQL | na | na |
| 1,4-dichlorobenzene | 1 | $60^{a}$ | - | 400 | nsl | See total VOCs | LPQL | na | na |
| 4-isopropyl toluene | 1 | nsl | nsl | nsl | nsl | See total VOCs | LPQL | na | na |
| 1,2-dichlorobenzene | 1 | $160^{a}$ | - | 1500 | nsl | See total VOCs | LPQL | na | na |
| n-butyl benzene | 1 | nsl | nsl | nsl | nsl | See total VOCs | LPQL | na | na |
| 1,2-dibromo-3-chloropropane | 1 | nsl | 0.00032 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,2,4-trichlorobenzene | 1 | 85 | 2.3 | nsl | nsl | See total VOCs | LPQL | na | na |
| Hexachlorobutadiene | 1 | nsl | 0.86 | nsl | $5000^{L}$ | See total VOCs | LPQL | na | na |
| 1,2,3-trichlorobenzene | 1 | 3 | 29 | nsl | nsl | See total VOCs | LPQL | na | na |
| Total VOCs | - | | | | nsl | 1000 | LPQL | na | na |
| **Polycyclic Aromatic Hydrocarbons (PAHs)** | | | | | | | | | |
| Naphthalene | 0.1 | $16^{a}$ | 0.14 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Acenaphthylene | 0.1 | nsl | nsl | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Acenaphthene | 0.1 | nsl | 2200 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Fluorene | 0.1 | nsl | 1500 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Phenanthrene | 0.1 | $0.6^{c}$ | nsl | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Anthracene | 0.1 | $0.01^{c}$ | 11000 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Fluoranthene | 0.1 | $1^{c}$ | 1500 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Pyrene | 0.1 | nsl | 1100 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Benzo(a)anthracene | 0.1 | nsl | 0.029 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Chrysene | 0.1 | nsl | 2.9 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Benzo(b,k)fluoranthene | 0.2 | nsl | nsl | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Benzo(a)pyrene | 0.1 | $0.1^{c}$ | - | 0.01 | see total PAHs | see total PAHs | na | na | LPQL |
| Indeno(1,2,3-c,d)pyrene | 0.1 | nsl | 0.029 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Dibenzo(a,h)anthracene | 0.1 | nsl | 0.0029 | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Benzo(g,h,i)perylene | 0.1 | nsl | nsl | nsl | see total PAHs | see total PAHs | na | na | LPQL |
| Total PAHs | - | nsl | nsl | nsl | 5000 | 5000 | na | na | LPQL |

***EXPLANATION:***

1 - ANZECC Australian Water Quality Guidelines for Fresh Waters, 2000 - Trigger Values for protection of 95% of species
2 - NHMRC Australian Drinking Water Guidelines (2004)
3 - ANZECC Guidelines for Sewerage Systems, Acceptance of Trade Waste (Industrial Waste), 1994
4 - Sydney Water Industrial Customers, Acceptance Standards and Charging Rates for 2010-11 (reference should be made to the *Notes to Acceptance Standards* presented in this document)
5 - In the absence of Australian guidelines, the USEPA (2010) Region 9 Screening Levels for tapwater have been adopted as a preliminary screening tool
a - In the absence of a high reliability guideline concentration, the moderate or low reliability guideline concentration has been quoted
b - In the absence of locally endorsed guidelines, the Dutch intervention levels specified in *'Circular on target values and intervention values for soil remediation' (Ministry of Housing and the Environment 2000)* have been quoted
c - 99% trigger values adopted due to the potential for bioaccumulation effects
d - In the absence of a health guideline the aesthetic guideline concentration has been quoted
g - Guideline value only. The guideline criteria for this analyte should be checked with the local authority
h - NSW EPA (DECCW) Guidelines for Assessing Service Station Sites (1994)
i - ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters, 2000 - Level for NSW Lowland Rivers
L - Total concentration for halogenated aliphatic compounds marked 'l' must be below 5000ug/L
a* - Guideline value adopted for m-Xylene. We note that the m-Xylene guideline value is 75ug/L and the p-Xylene guideline value is 200ug/L. However these two isomers cannot be distinguished analytically. Therefore EIS have adopted the more conservative guideline value
a^ - In the absence of a guideline value for Trichloroethene, the guideline concentration for 1,1,2 Trichloroethylene has been adopted
a^^ - In the absence of a guideline value for cis or trans 1,3 Dichloropropene, the guideline concentration for 1,3 Dichloropropene has been adopted
a^^^ - In the absence of a guideline concentration for 1,1,1,2 Tetrachloroethane, the guideline concentration for 1,1,2,2 Tetrachloroethane has been adopted
r - PQL raised to 20µg/L due to the sample matrix requiring dilution

Concentration above the SAC **value**

***ABBREVIATIONS:***

na: Not Analysed
nsl: No Set Limit
PQL: Practical Quantitation Limit
LPQL: Less than Practical Quantitation Limit
ALPQL: All results less than the PQL
(-) : Not Applicable

## TABLE C
## SUMMARY OF LABORATORY RESULTS
## ACID SULFATE SOILS ANALYSIS (POCAS)

| **Sample Reference** | **Sample Depth (m)** | **Sample Description** | **pH$_{KCL}$** | **TAA pH 6.5** | **pH$_{ox}$** | **TPA pH 6.5** | **TSA pH 6.5** | **S$_{POS}$ %w/w** | **Ca $_A$ %w/w** | **Mg $_A$ %w/w** | **Liming Rate kg CaCO$_3$/tonne** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BH106 | 3.8-4.0 | Silty sand | 5.9 | LPQL | 5.4 | LPQL | LPQL | LPQL | LPQL | LPQL | <0.75 |
| BH108 | 1.0-1.3 | Fill: silty sand | 5 | LPQL | **3.4** | LPQL | LPQL | LPQL | LPQL | LPQL | <0.75 |
| BH109 | 1.5-1.95 | Silty sand | 5.5 | LPQL | 5.1 | LPQL | LPQL | LPQL | LPQL | LPQL | <0.75 |
| BH110 | 2.8-3.0 | Silty sand | 6 | LPQL | 5.3 | LPQL | LPQL | LPQL | LPQL | LPQL | <0.75 |

***EXPLANATION:***

Action criteria are defined as follows:

- coarse textured soils (sands to loamy sands):
  $pH < 5$
  TAA/TSA/TPA (pH 5.5) > 18mol $H^+$/tonne
  $S_{pos}$ > 0.03% sulfure oxidisable

TAA or S $_{POS\ \%}$ Values Exceeding Action Criteria **VALUE**

pH$_{KCL}$ : pH of filtered 1:20, 1M KCL extract, shaken overnight
TAA pH 6.5 : Total Actual Acidity in 1M KCL extract titrated to pH6.5
pH$_{ox}$ : pH filtered 1:20 1M KCl after peroxide digestion
TPA : Total Potential Acidity, 1M KCL peroxide digest titrated to pH6.5
TSA: Total Sulfide Acidity
S$_{POS}$: Peroxide oxidisable Sulfur (SP - SKCL)
Ca $_A$/Mg $_A$: Calcium/Magnesium reacted with acid generated by peroxide digest
Calcium and Magnesium values used to estimate additional Ca/Mg from acid-shell/carbonate/dolomite reaction

Reference: ASSMAC (Acid Sulfate Soils management Advisory Committee - **Acid Sulfate Soil Manual**, August 1998).

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

All results in mg/kg unless stated otherwise

| SAMPLE | ANALYSIS | Envirolab PQL | INITIAL | REPEAT | MEAN | RPD % |
|---|---|---|---|---|---|---|
| Intra-laboratory<br>Soil<br>Sample ID = BH106 (0.8-1.0m)<br>Dup ID = Dup01<br>Envirolab Report: 64047 | Arsenic | 4 | LPQL | LPQL | NC | NC |
| | Cadmium | 0.5 | LPQL | LPQL | NC | NC |
| | Chromium | 1 | 2 | 2 | 2 | 0 |
| | Copper | 1 | 4 | 3 | 3.5 | 29 |
| | Lead | 1 | 16 | 13 | 14.5 | 21 |
| | Mercury | 0.1 | LPQL | LPQL | NC | NC |
| | Nickel | 1 | LPQL | 1 | 1 | NC |
| | Zinc | 1 | 11 | 8 | 9.5 | 32 |
| | Naphthalene | 0.1 | LPQL | LPQL | NC | NC |
| | Acenaphthylene | 0.1 | LPQL | LPQL | NC | NC |
| | Acenaphthene | 0.1 | LPQL | LPQL | NC | NC |
| | Fluorene | 0.1 | LPQL | LPQL | NC | NC |
| | Phenanthrene | 0.1 | LPQL | LPQL | NC | NC |
| | Anthracene | 0.1 | LPQL | LPQL | NC | NC |
| | Fluoranthene | 0.1 | LPQL | LPQL | NC | NC |
| | Pyrene | 0.1 | LPQL | LPQL | NC | NC |
| | Benzo(a)anthracene | 0.1 | LPQL | LPQL | NC | NC |
| | Chrysene | 0.1 | LPQL | LPQL | NC | NC |
| | Benzo(b)&(k)fluorant | 0.2 | LPQL | LPQL | NC | NC |
| | Benzo(a)pyrene | 0.05 | LPQL | LPQL | NC | NC |
| | Indeno(123-cd)pyrene | 0.1 | LPQL | LPQL | NC | NC |
| | Dibenzo(ah)anthracene | 0.1 | LPQL | LPQL | NC | NC |
| | Benzo(ghi)perylene | 0.1 | LPQL | LPQL | NC | NC |
| | Total PAHs | 1.55 | LPQL | LPQL | NC | NC |

***EXPLANATION:***

The RPD value is calculated as the absolute value of the difference between the initial and repeat results divided by the average value expressed as a percentage. The following acceptance criteria will be used to assess the RPD results:

- Results > 10 times PQL = RPD value < 50% are acceptable
- Results between 5 & 10 time PQL = RPD value < 75% are acceptable
- Results < 5 times PQL = RPD value < 100% are acceptable

***ABBREVIATIONS:***

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

## TABLE E
## GROUNDWATER INTRA-LABORATORY DUPLICATE RESULTS
## QA/QC - RELATIVE PERCENTAGE DIFFERENCES

All results in µg/L unless stated otherwise

| SAMPLE | ANALYSIS | Envirolab PQL | INITIAL | REPEAT | MEAN | RPD % |
|---|---|---|---|---|---|---|
| Intra-laboratory<br>Water<br>Sample ID = MW10<br>Dup ID = Dup1<br>Envirolab Report: 64045 | Dichlorodifluoromethane | 10 | LPQL | LPQL | NC | NC |
| | Chloromethane | 10 | LPQL | LPQL | NC | NC |
| | Vinyl Chloride | 10 | LPQL | LPQL | NC | NC |
| | Bromomethane | 10 | LPQL | LPQL | NC | NC |
| | Chloroethane | 10 | LPQL | LPQL | NC | NC |
| | Trichlorofluoromethane | 10 | LPQL | LPQL | NC | NC |
| | 1,1-Dichloroethene | 1 | LPQL | LPQL | NC | NC |
| | Trans-1,2-dichloroethene | 1 | LPQL | LPQL | NC | NC |
| | 1,1-dichloroethane | 1 | LPQL | LPQL | NC | NC |
| | Cis-1,2-dichloroethene | 1 | LPQL | LPQL | NC | NC |
| | Bromochloromethane | 1 | LPQL | LPQL | NC | NC |
| | Chloroform | 1 | LPQL | LPQL | NC | NC |
| | 2,2-dichloropropane | 1 | LPQL | LPQL | NC | NC |
| | 1,2-dichloroethane | 1 | LPQL | LPQL | NC | NC |
| | 1,1,1-trichloroethane | 1 | LPQL | LPQL | NC | NC |
| | 1,1-dichloropropene | 1 | LPQL | LPQL | NC | NC |
| | Cyclohexane | 1 | LPQL | LPQL | NC | NC |
| | Carbon tetrachloride | 1 | LPQL | LPQL | NC | NC |
| | Benzene | 1 | LPQL | LPQL | NC | NC |
| | Dibromomethane | 1 | LPQL | LPQL | NC | NC |
| | 1,2-dichloropropane | 1 | LPQL | LPQL | NC | NC |
| | Trichloroethene | 1 | LPQL | LPQL | NC | NC |
| | Bromodichloromethane | 1 | LPQL | LPQL | NC | NC |
| | trans-1,3-dichloropropene | 1 | LPQL | LPQL | NC | NC |
| | cis-1,3-dichloropropene | 1 | LPQL | LPQL | NC | NC |
| | 1,1,2-trichloroethane | 1 | LPQL | LPQL | NC | NC |
| | Toluene | 1 | LPQL | LPQL | NC | NC |
| | 1,3-dichloropropane | 1 | LPQL | LPQL | NC | NC |
| | Dibromochloromethane | 1 | LPQL | LPQL | NC | NC |
| | 1,2-dibromoethane | 1 | LPQL | LPQL | NC | NC |
| | Tetrachloroethene | 1 | LPQL | LPQL | NC | NC |
| | 1,1,1,2-tetrachloroethane | 1 | LPQL | LPQL | NC | NC |
| | Chlorobenzene | 1 | LPQL | LPQL | NC | NC |
| | Ethylbenzene | 1 | LPQL | LPQL | NC | NC |
| | Bromoform | 1 | LPQL | LPQL | NC | NC |
| | m+p-xylene | 2 | LPQL | LPQL | NC | NC |
| | Styrene | 1 | LPQL | LPQL | NC | NC |
| | 1,1,2,2-tetrachloroethane | 1 | LPQL | LPQL | NC | NC |
| | o-xylene | 1 | LPQL | LPQL | NC | NC |
| | 1,2,3-trichloropropane | 1 | LPQL | LPQL | NC | NC |
| | Isopropylbenzene | 1 | LPQL | LPQL | NC | NC |
| | Bromobenzene | 1 | LPQL | LPQL | NC | NC |
| | n-propyl benzene | 1 | LPQL | LPQL | NC | NC |
| | 2-chlorotoluene | 1 | LPQL | LPQL | NC | NC |
| | 4-chlorotoluene | 1 | LPQL | LPQL | NC | NC |
| | 1,3,5-trimethyl benzene | 1 | LPQL | LPQL | NC | NC |
| | Tert-butyl benzene | 1 | LPQL | LPQL | NC | NC |
| | 1,2,4-trimethyl benzene | 1 | LPQL | LPQL | NC | NC |
| | 1,3-dichlorobenzene | 1 | LPQL | LPQL | NC | NC |
| | Sec-butyl benzene | 1 | LPQL | LPQL | NC | NC |
| | 1,4-dichlorobenzene | 1 | LPQL | LPQL | NC | NC |
| | 4-isopropyl toluene | 1 | LPQL | LPQL | NC | NC |
| | 1,2-dichlorobenzene | 1 | LPQL | LPQL | NC | NC |
| | n-butyl benzene | 1 | LPQL | LPQL | NC | NC |
| | 1,2-dibromo-3-chloropropane | 1 | LPQL | LPQL | NC | NC |
| | 1,2,4-trichlorobenzene | 1 | LPQL | LPQL | NC | NC |
| | Hexachlorobutadiene | 1 | LPQL | LPQL | NC | NC |
| | 1,2,3-trichlorobenzene | 1 | LPQL | LPQL | NC | NC |

***EXPLANATION:***

The RPD value is calculated as the absolute value of the difference between the initial and repeat results divided by the average value expressed as a percentage. The following acceptance criteria will be used to assess the RPD results:

- Results > 10 times PQL = RPD value < 50% are acceptable
- Results between 5 & 10 time PQL = RPD value < 75% are acceptable
- Results < 5 times PQL = RPD value < 100% are acceptable

***ABBREVIATIONS:***

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

## TABLE F
## LABORATORY RESULTS
## QA/QC - RINSATE

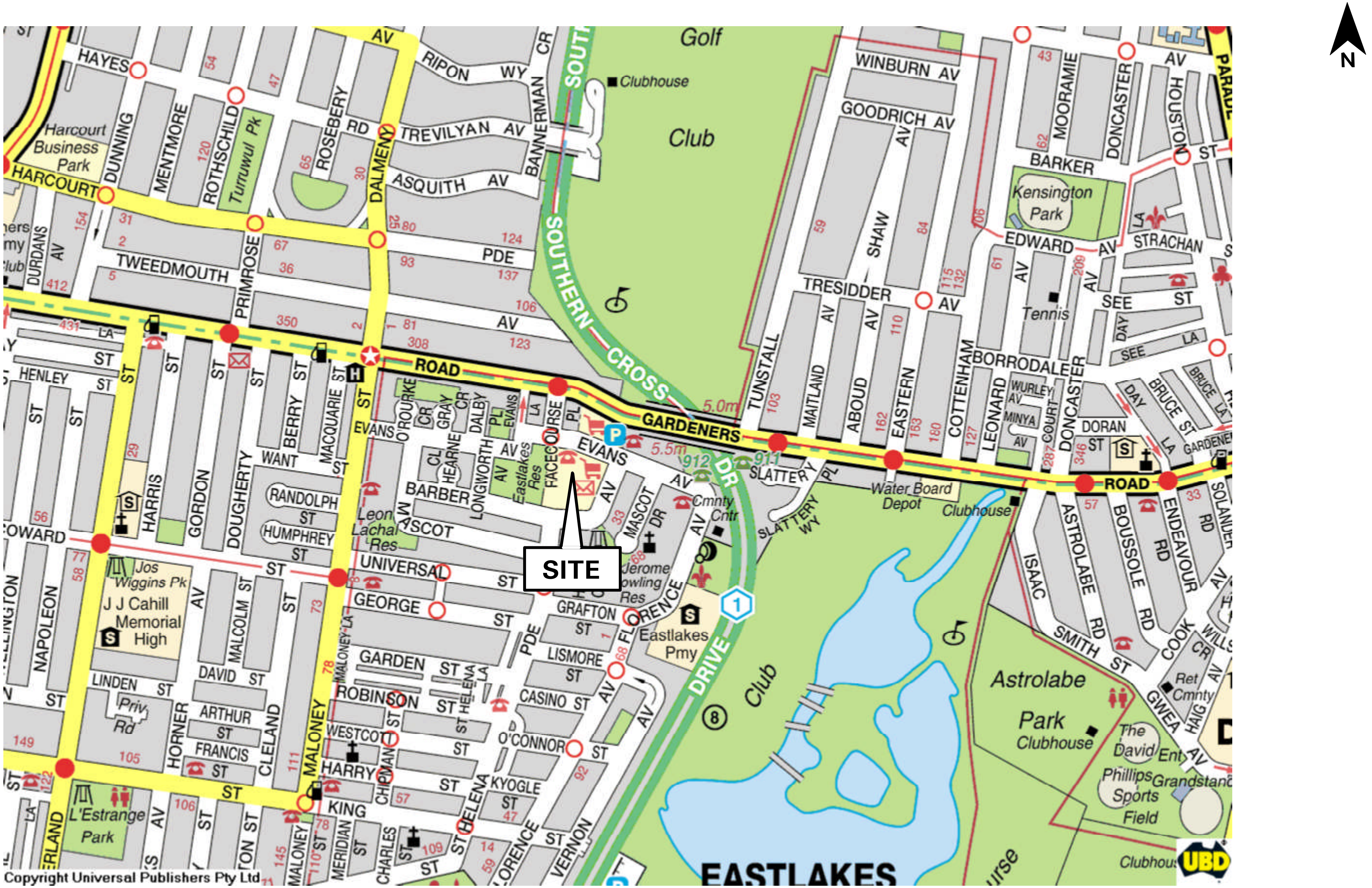
| **ANALYSIS** | **Envirolab PQL** | | R1$^{w}$<br>20.10.11<br>Rpt N. 64047<br>µg/L |
|---|---|---|---|
| | **mg/kg** | **µg/L** | |
| Benzene | 1 | 1 | LPQL |
| Toluene | 1 | 1 | LPQL |
| Ethylbenzene | 1 | 1 | LPQL |
| Total Xylenes | 1 | 1 | LPQL |

***EXPLANATION:***

$^{W}$ Sample type (water)

***ABBREVIATIONS:***

PQL: Practical Quantitation Limit
LPQL: Less than PQL



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

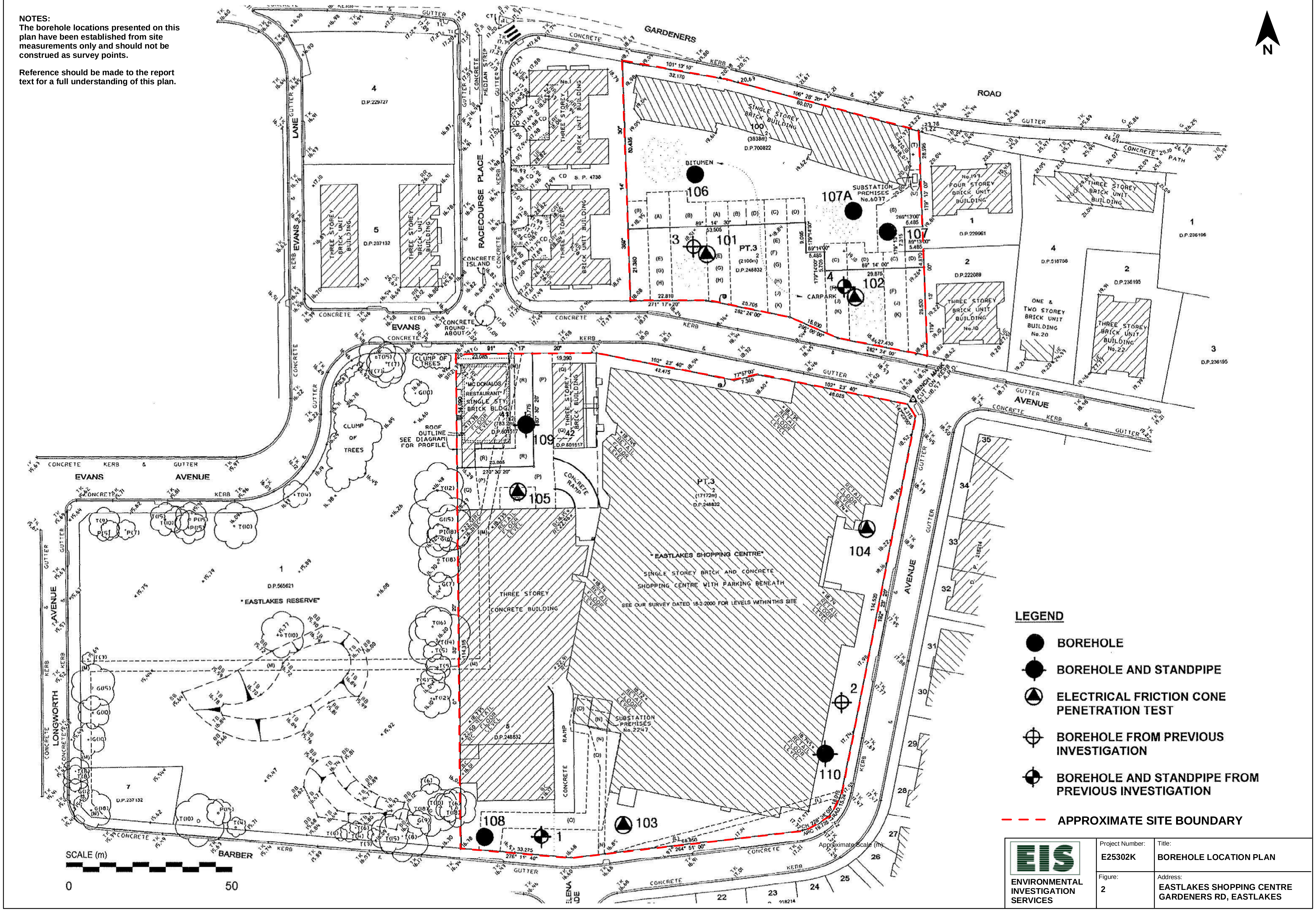
**UBD Map ref: 276 F2**

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

| | | |
|---|---|---|
| EIS<br>**ENVIRONMENTAL INVESTIGATION SERVICES** | Project Number:<br>**E25302K** | Title:<br>**SITE LOCATION PLAN** |
| | Figure:<br>**1** | Address:<br>**EASTLAKES SHOPPING CENTRE GARDENERS RD, EASTLAKES** |

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

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



## LEGEND

| | |
|---|---|
| ● | **BOREHOLE** |
| ● | **BOREHOLE AND STANDPIPE** |
| ▲ | **ELECTRICAL FRICTION CONE PENETRATION TEST** |
| ⊕ | **BOREHOLE FROM PREVIOUS INVESTIGATION** |
| ⊕ | **BOREHOLE AND STANDPIPE FROM PREVIOUS INVESTIGATION** |
| — — | **APPROXIMATE SITE BOUNDARY** |

Approximate Scale (m):

| | | |
|---|---|---|
| EIS<br>ENVIRONMENTAL INVESTIGATION SERVICES | Project Number:<br>**E25302K** | Title:<br>**BOREHOLE LOCATION PLAN** |
| | Figure:<br>**2** | Address:<br>**EASTLAKES SHOPPING CENTRE GARDENERS RD, EASTLAKES** |