CONSULTING EARTH SCIENTISTS

ENVIRONMENTAL SITE ASSESSMENT:

161 SUSSEX STREET REDEVELOPMENT, SYDNEY, NSW

PREPARED FOR GL INVESTMENT CO PTY LTD ATF GL No1 TRUST

c/o CADENCE AUSTRALIA PTY LTD

CES REFERENCE: CES111206-CA-AE

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1 INTRODUCTION

Consulting Earth Scientists Pty Ltd (CES) has been commissioned by Cadence Australia Pty Ltd (Cadence) on behalf of GL Investment Co Pty Ltd ATF GL No1 Trust (the Client) to undertake an Environmental Site Assessment for the Four Points Sheraton Hotel Expansion, at 161 Sussex Street, Sydney NSW, (herein referred to as the site). The site location map is shown on Figure 1. This ESA includes a supplementary soil and groundwater sampling and testing programme.

The ESA has been prepared to assess contamination issues at the site that may have arisen from past and/or present land uses or activities undertaken on and/or adjacent to the site. The results of the ESA will be used as part of a project for a proposed hotel expansion involving the construction of a 25 storey tower over Slip Street in the south of the site.

The site is roughly rectangular shaped and occupies approximately 1.2 ha The site includes two separate lots; Lot 101 and Lot 102 both contained in Deposited Plan (DP) Number 1009697.
The ESA is a requirement of the Director General's Requirements ((DGRs) - Planning and Infrastructure reference 11/18985 dated 24 November 2011), Key Issue 1 - *Contamination.*

This report has been prepared in general accordance with the requirements specified for a Stage 1 and Preliminary Site Investigation, as published by the Department of Environment, Climate Change and Water (DECCW), incorporating the NSW Environment Protection Authority (EPA) in the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 1997).

2 OBJECTIVES AND SCOPE

2.1 STAGE 1 ESA

The objectives of the Stage 1 ESA were to:

- Assess whether the site, with particular focus on the areas of proposed development, had been contaminated from past and/or present activities undertaken on and/or adjacent to the site; and
- If present, assess whether the contamination represents a risk to human health or the environment considering the site's proposed development.

To achieve these objectives, CES undertook the following scope of works:

- Stage 1 ESA involving a review of available information and a site inspection; and
- Preparation of a report with recommendations, outlining the findings from the Stage 1 ESA.

2.2 SUPPLEMENTARY SOIL AND GROUNDWATER TESTING PROGRAMME

The objectives of the soil and groundwater testing programme were as follows:

- Conduct an investigation to assess the contamination status of the site;
- Perform a soil and groundwater sampling and analysis programme;
- If contamination is identified, assess whether the contamination represents a risk to human health or the environment considering the site's proposed development; and
- Outline recommended remediation options based on the results of the investigations.
- Assess the physical and chemical characteristics of the groundwater.
- Assess whether the proposed development will not have a detrimental impact on groundwater quality.

To achieve these objectives, CES undertook the following scope of works:

- Drilling of 4 boreholes on the site to a maximum depth of 14 to 15 mbgl;
- Logging of boreholes;
- Collection of soil samples from regular intervals throughout each borehole and from any near surface 'grab' sampling points;
- Laboratory analysis of soil samples for heavy metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc), Total Recoverable Hydrocarbons (TRH), Monocyclic Aromatic Hydrocarbons (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine and Organophosphorus Pesticides (OCP/OPP) and Polychlorinated Biphenyls (PCB);

- Development of three groundwater wells on the site, purging and sampling of groundwater;
- Laboratory analysis of groundwater samples for dissolved heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn), hydrocarbon compounds (TRH, BTEX, PAH), pesticides (OCP/OPPs) and Polychlorinated Biphenyls (PCBs);
- Submission of soil and groundwater samples for laboratory analysis to a laboratory accredited by the National Association of Testing Authorities (NATA) for all tests described above;
- Implementation of a quality control programme to ensure the integrity of data obtained;
- Comparison of the results of chemical analyses from the soil and groundwater investigation to investigation levels published guidelines prepared or endorsed by the NSW OEH, to assess the contamination status of the site and to assess possible risks to site occupants or the environment; and
- Preparation of a report in accordance with EPA NSW (1997) guidelines detailing the works undertaken and results of the investigation incorporating the Stage 1 ESA.

3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

CES were not provided with any reports pertaining to environmental investigations or assessments conducted on the Four Points Sheraton Hotel site. It is understood that no reports pertaining to ground conditions or potential contamination at these locations within the site exist or are available.

4 SITE INFORMATION

The site information presented below is based on a review of readily available government information sources.

4.1 SITE IDENTIFICATION

The site is located at 161 Sussex Street, Sydney NSW, 2000 within the Local Government Area (LGA) of City of Sydney Council. The legal description for this site includes two separate lots; Lot 101 and Lot 102 both contained in Deposited Plan (DP) Number 1009697. The site is roughly rectangular shaped and occupies approximately 1.2 ha. The site location is shown on Figure 1.

4.2 SITE ZONING AND LANDUSE

The site comprises two lots, as mentioned above and is currently occupied by the Four Points Sheraton Hotel and associated shops and facilities.

From the Planning Certificate under Section 149 (2) of the Environmental Planning and Assessment Act 1979, the site is affected by the Darling Harbour Development Plan No. 1. This is deemed to be a Regional Environmental Plan under Schedule 6, Part 7, clause 23 of the *Environmental Planning and Assessment Act, 1979*, as amended. No development or demolition may be carried out without a Development Application and purposes for which a development may be carried out consist of a variety of commercial, residential and tourism based exemption.

In the Section 149 (5) Certificate, Sydney City Council state that they "do not have sufficient information about the uses (including previous uses) to confirm that the land has not been used for a purpose which would be likely to have contaminated the land."

4.3 TOPOGRAPHY AND DRAINAGE

The Parramatta River 1:25 000 Topographic Map 9130-3-N (Central Mapping Authority NSW, 1987) indicates that the site has an elevation that ranges from approximately 3 m AHD on Slip Street, to 3.5 m ADH on the northern end of Wheat Street and 2 m AHD on the southern end of Wheat Street.

The site drains westwards by way of stormwater drains to Darling Harbour, part of Stdney Harbour.

4.4 GEOLOGY

The Sydney 1:250 000 Geological Series Sheet S1 56-5 (Geological Survey of NSW Department of Minerals and Energy, 1966) indicates that the site is underlain with Triassic Hawkesbury Sandstone.

4.5 SOILS

The Sydney 1:100 000 Soil Landscape Series Sheet 9130 (Soil Conservation Service of NSW, 1983) indicates that the soils underlying the site (where they have not been removed by excavation) belong to either of two soil landscape groups. The first being the Gymea soil landscape group. These soils are found on undulating to rolling low hills on Hawkesbury Sandstone. Soils are shallow to moderately deep (30-100cm) *Yellow Earths (Gn.2.24)* and *Earthy Sands (Uc5.11, Uc5.23)* on crests and inside of benches; shallow (<20cm) *Siliceous Sands (Uc1.21)* on leading edges of benches; localised *Gleyed Podzolic Soils (Dg4.21)* and *Yellow Podzolic Soils (Dy4.11, Dy5.11, Dy5.41)* on shale lenses; shallow to moderately deep (<100cm) *Siliceous Sands (Uc1.2)* and *Leached Sands (Uc2.21)* along drainage lines. The limitations of this soil are localised steep slopes, high soil erosion hazard, rock outcrop, shallow highly permeable soil and very low soil fertility.

The second is the Disturbed Terrain soil landscape group. These soils are found on level plain to hummocky terrain, extensively disturbed by human activity (including complete disturbance, removal or burial of soil and vegetation). Soils are turfed fill areas commonly capped with up to 40cm of sandy loam or up to 60cm of compacted clay over fill or waste materials. The limitations of this soil are dependent on nature of fill material. They can be any of the following; mass movement hazard, unconsolidated low wet-strength materials, impermeable soil, poor drainage, localised very low fertility and toxic materials.

4.6 ACID SULFATE SOIL RISKS

The Department of Land and Water Conservation (DLWC 1997) 1:25 000 Prospect/Parramatta River Acid Sulphate Soil (ASS) Risk Map was reviewed and indicates that the site consists of the Disturbed Terrain landform process class. For this site, this refers to areas which have been mined or dredged, or have undergone heavy ground disturbance through general urban development or construction of dams or levees. The elevation levels are recorded to be approximately 2-4 metres however, it is important to note that the elevation levels refer to the gorund surface at the time of mapping. Depending on the nature of the disturbance, these elevation levels may or may not represent the original ground surface elevation. Soil investigations are required to assess these areas for acid sulphate potential.

4.7 HYDROGEOLOGY

Based on the site's extensive development and levelling, it can be concluded that the terrain has been highly disturbed. This implies that the hydrogeology of the site area has also been disturbed.

The closest waterway is Darling Harbour, part of Sydney Harbour, and this would be the primary receptor for groundwater migrating from the site.

4.8 SITE HISTORY

Several sources were investigated to determine the history of land use at the site. The following list details the sources of historical information and a summary of information provided by each source:

- NSW Department of Lands, Land and Property Information Division (LPI): Title Search - Historical title information;
- NSW Department of Lands LPI: Historical aerial photographs (1930 to 2004);
- City of Sydney Council: Planning Certificate;
- NSW Office of Environment & Heritage (EPA): Contaminated Site Register;
- WorkCover NSW: Searches of Dangerous Goods licensing records;
- Department of Natural Resources: Licensed Groundwater Bore Database
- NSW Department of Trade and Investment Division of Resources and Energy: Corrosive Protection Search

4.9 HISTORICAL TITLE INFORMATION

A title deeds search was conducted through Land and Property Information NSW. A summary of the results is provided in Table 1. Where available, the original title and lease documents are provided in Appendix E. A search of the most recent lease holders was also conducted with all current lease holders summarised in Table 2.

<table>
<tr><th colspan="5">Table 1: Summary of Proprietors</th></tr>
<tr><th>Lot</th><th>Year</th><th>Proprietor</th><th colspan="2">Source</th></tr>
<tr><td rowspan="2">Lots 101 and 102 DP1009697</td><td>2002-To date</td><td>Sydney Harbour Foreshore Authority</td><td colspan="2">Current certificate of Title
Document 8554459 (not purchased)</td></tr>
<tr><td>1988-2002</td><td>The Darling Harbour Authority</td><td colspan="2">Document 8554459
Vol. 10809 Fol. 71,
Vol. 14054 Fol. 16,
Vol 14054 Fol. 15</td></tr>
<tr><td colspan="5">Prior Titles for Lots 101 and 102 DP1009697</td></tr>
<tr><td rowspan="7">Lot 1 DP 775101</td><td rowspan="3">Vol. 10809 Fol. 71 (Lot 1 DP 110333)</td><td>1974- 1988</td><td>The Darling Harbour Authority</td><td>Vol. 10809 Fol. 71, Vol. 4900 Fol. 60</td></tr>
<tr><td>1936- 1974</td><td>Tooth & Co Limited</td><td>Vol. 4900 Fol. 60, Vol. 2050 Fol. 103</td></tr>
<tr><td>1910-1936</td><td>The Sydney Harbour Trust Commissioners</td><td>Vol. 2050 Fol. 103</td></tr>
<tr><td rowspan="4">Vol. 14054 Fol. 15 (Lot 100 DP 577366)</td><td>1988</td><td>The Darling Harbour Authority</td><td>Vol. 14054 Fol. 15, Vol. 5018 Fol. 1</td></tr>
<tr><td>1975-1988</td><td>The Commissioner For Main Roads</td><td>Vol. 14054 Fol. 15, Vol. 5018 Fol. 1</td></tr>
<tr><td>1936-1975</td><td>The Maritime Services Board of New South Wales</td><td rowspan="2">Vol. 5018 Fol. 1, Vol. 2050 Fol. 103</td></tr>
<tr><td>1910-1936</td><td>The Sydney Harbour Trust Commissioners</td></tr>
</table>

	Vol. 14054 Fol. 16 (Lot 101 DP 577366)	1988	The Darling Harbour Authority	Vol. 14054 Fol. 15, Vol. 5018 Fol. 1	
		1975-1988	The Commissioner For Main Roads	Vol. 5018 Fol. 1	
Prior Titles for Vol. 14054 Fol. 16: Vol.					
Lot 1 DP 775101	Vol. 14054 Fol. 16: Vol.	Lot 9 DP 55	1975	The Commissioner for Main Roads	Vol. 9 Fol. 55
			1970-1975	The Council of The City of Sydney	Vol. 9 Fol. 55
			1936-1970	The Maritime Services Board o f New South Wales	Vol. 9 Fol. 55
			1923-1936	The Sydney Harbour Trust Commissioners	Vol. 9 Fol. 55
			1864-1923	James Cox (timber merchant)	Vol. 9
			1864	FrancisMitchell, George Wigram Allen	Vol. 6 Fol. 228
			1864	Reclaimed Crown Land	Vol. 6 Fol. 228
		Lot 17 DP 218	1975	The Commissioner for Main Roads	Vol. 17 Fol. 218
			1936-1975	The Maritime Services Board of New South Wales	Vol. 17 Fol. 218
			1923-1936	The Sydney Harbour Trust Commissioners	Vol. 17 Fol. 218
			1865-1923	John Struth (gentleman)	Vol. 17 Fol. 218
			1865	Reclaimed Crown Land	Vol. 17 Fol. 218
Source: Environmental Legal Searches, 2011.					

Table 1: Summary of Proprietors (continued)

Lot		Year	Proprietor	Source
Lots 2 and 3 DP 775101	Vol. 29 Fol. 126	1988	The Darling Harbour Authority	Vol. 29 Fol. 126
		1940-1988	The Maritime Services Board of New South Wales	Vol. 29 Fol. 126
		1901-1940	The Minister for Public Works	Vol. 29 Fol. 126
		1865-1901	John Struth (engineer)	Vol. 29 Fol. 126, Vol. 28 Fol. 50, Vol. 12 Fol. 169
	Vol. 141 Fol. 126	1988	The Darling Harbour Authority	Vol. 141 Fol. 16
		1940-1988	The Maritime Services Board of New South Wales	Vol. 141 Fol. 16
		1901-1940	The Minister for Public Works	Vol. 141 Fol. 16
		1872-1901	John Struth (engineer)	Vol. 141 Fol. 16, Vol. 30 Fol. 40
		1866-1872	John Campbell (merchant)	Vol. 30 Fol. 40, Vol. 12 Fol. 169
		1865-1866	John Struth (gentleman)	Vol. 12 Fol. 169

Table 2: Summary of Recent Lease Holders	
Lessee	**Source**
Lease to: **GPT Management Limited** Other than parts formerly in Lots 1 & 3 DP7751 01 Dated: 9/7/2001, Expires: 18/5/2087	Document 7750066*
Application affecting lease: Lessee now GPT Funds Management 2 Pty. Limited Dated: 15/12/2005	Document AB885873*
Transfer of lease: Lessee now GL Investmentco Pty. Ltd. Dated: 14/5/2010	Document AF21 3395*
Variation of lease Dated: 14/5/2010	Document AF21 8982*
Source: Environmental Legal Searches, 2010.	

4.10 HISTORICAL AERIAL PHOTOGRAPHS

Historical aerial photographs from the NSW Department of Lands LPI Division were examined for the years; 1942, 1951, 1961, 1972, 1994, 1999 and 2004. Copies of the aerial photographs are provided in Appendix C. The findings of aerial photo investigations are presented in Table 3.

Table 3: Historical Aerial Photograph Interpretation	
Year	**Description**
1942	**Site:** The site is rectangular shaped and comprises numerous buildings along all site boundaries. Due to image resolution, it is hard to accurately define the number of individual buildings present on these sections of the site but there is estimated to more than 15. There are roads running along the eastern, western and southern boundaries **Surrounding Area:** The site is immediately surrounded in all directions by what appear to be other commercial premises, small retail outlets, and perhaps a few residential dwellings. Darling Harbour is located approximately 0.5km west of the site and Pyrmont Bridge approximately 0.5km south-west.
1951	**Site:** The immediate site has changed little since the 1942 aerial photograph with most aspects of the site buildings and boundaries appearing similar. **Surrounding Area:** The surrounding land has become more developed since 1942 with more buildings having been constructed around the site boundaries and extending development over a large part of the surrounding area.
1961	**Site:** The site has changed little since the 1951 aerial photograph. **Surrounding Area:** The surrounding land on the western boundary nearest to Darling Harbour is under the first stage of construction for a charter boat marina. Other than demolition and clearing, little has been developed yet. Little has changed in other surrounding areas since the 1951 aerial photograph.

1972	**Site:** The site has changed little since the 1961 aerial photograph with the exeption of a new road (King Street?) being constructed on the western boundary. The road appears to be built over the existing Western Distributor Freeway with have a slight curvature transforming the north boundary from rectangular to circular. Image resolution has allowed finer analysis of the buildings and structures on the site with at least 20 buildings and structures identified. Changes to the surrounding areas have made the site more visible from the water and Darling Harbour. **Surrounding Area:** The surrounding land immediately bordering the western site boundary has been developed into a small functioning charter boat marina. Slightly north west of the site a large portion of land previously occupied by buildings has been cleared and a large cruise terminal has been constructed.
1994	**Site**: The site has undergone major construction since 1983 with most of the buildings and structures having been cleared for the construction of a new hotel (Four Points Hotel). Whilst the hotel occupies the majority of the site, the western boundary has been cleared and replaced with hotel gardens and the eastern boundary has been replaced with what appear to be hotel amenities. There has also been the construction of a new road/slip street passing through the middle of the site connecting with King Street on the northern boundary. **Surrounding Area:** The surrounding area has changed since 1983. Bordering on the western boundary has become a fully functioning charter boat marina with 3 newly constructed berths. North-west of the site has been developed into a very large open space cruise terminal.
1999	**Site**: There have been extensions to buildings and structures on the eastern boundary of the site, and construction of a circular driveway for the hotel as well as commercial buildings, including what appears to be a shopping plaza on the north eastern boundary. **Surrounding Area:** There has been an extension constructed onto the eastern building of the charter boat marina making the marina more enclosed. North-west of the site the cruise terminals/buildings have been replaced by the construction of an aquarium with four main structures. The Wester Distributor Freeway, running along the western boundary, has been widened at the northern, curved end of the site.
2004	**Site**: The site has changed little since the 1999 aerial photograph with the exception of further garden extensions on the southern boundary of the hotel. **Surrounding Area:** The surrounding area has changed little since 1999 with the exception of the completion of Sydney Aquarium north-west of the site. With the addition of internal roads it appears to be fully functioning.
2010	**Site**: the site has had little change since the 2004 aerial photograph, although Sussex Street parallel to the eastern boundary of the site appears to have been been widened. **Surrounding Area:** The surrounding areas on the western boundary have been redeveloped to form one large joint charter boat marina and aquarium. Addition of three new Sydney Aquarium and Wildlife buildings have joined with the Harbour cruise terminal and extended further into the harbour on a square shaped site. Surrounding areas on all other boundaries have transformed from commercial based buildings to residential (apartments) and entertainment based buildings.
Source: Environmental Legal Searches, 2010.	

4.11 CITY OF SYDNEY COUNCIL PLANNING CERTIFICATE

Additional matters prescribed by section 59 (2) of the Contaminated Land Management Act 1997, and specified in the Planning Certificate are quoted as follows:

"The land to which the certificate relates is not declared to be significantly contaminated land within the meaning of the act as at the date when the certificate is issued."

"The land to which the certificate relates is not subject to a management order within the meaning of the act as at the date when the certificate is issued."

"The land to which the certificate relates is not the subject of an approval voluntary management proposal within the meaning of the act as at the date when the certificate is issued."

"The land to which the certificate relates is not the subject of an ongoing maintenance order within the meaning of the act as at the date when the certificate is issued."

"As at the date when the certificate is issued, Council has not identified that a site audit statement within the meaning of that act has been received in respect of the land subject of the certificate."

The Planning Certificates are contained in Appendix F.

4.12 WORKCOVER NSW RECORDS

A search of the NSW Stored Chemical Information Database and microfiche records pertaining to a Licence to Keep Dangerous Goods maintained by WorkCover has been commissioned. Workcover NSW indicated that no record of licences to keep dangerous goods had been recorded for the site. The Workcover NSW letter is provided in Appendix G.

4.13 EPA CONTAMINATED SITES REGISTER

Neither the subject site nor any of the surrounding properties is listed on the EPA Register of Contaminated Sites.

5 SUPPLEMENTARY SOIL AND GROUNDWATER TESTING PROGRAMME

As described above, the objectives of the sampling and testing programme were as follows:

- Conduct an investigation to assess the contamination status of the site;
- Perform a soil sampling and analysis programme;
- If contamination is identified, assess whether the contamination represents a risk to human health or the environment considering the site's proposed development; and
- Outline recommended remediation options based on the results of the investigations.
- Assess the physical and chemical characteristics of the groundwater.
- Assess whether the proposed development will not have a detrimentally impact on groundwater quality.

The scope of work undertaken to achieve these objectives is as follows:

- Drilling of 4 boreholes on the site to a maximum depth of 14 to 15 mbgl;
- Logging of boreholes;
- Collection of soil samples from regular intervals throughout each borehole and from any near surface 'grab' sampling points;
- Laboratory analysis of soil samples for heavy metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc), Total Recoverable Hydrocarbons (TRH), Monocyclic Aromatic Hydrocarbons (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine and Organophosphorus Pesticides (OCP/OPP) and Polychlorinated Biphenyls (PCB);
- Development of three groundwater wells on the site, purging and sampling of groundwater;
- Laboratory analysis of groundwater samples for dissolved heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn), hydrocarbon compounds (TRH, BTEX, PAH), pesticides (OCP/OPPs) and Polychlorinated Biphenyls (PCBs);
- Submission of soil and groundwater samples for laboratory analysis to a laboratory accredited by the National Association of Testing Authorities (NATA) for all tests described above;
- Implementation of a quality control programme to ensure the integrity of data obtained;
- Comparison of the results of chemical analyses from the soil and groundwater investigation to investigation levels published guidelines prepared or endorsed by the NSW OEH, to assess the contamination status of the site and to assess possible risks to site occupants or the environment; and

- Preparation of a report in accordance with EPA NSW (1997) guidelines detailing the works undertaken and results of the investigation incorporating the Stage 1 ESA.

6 DATA QUALITY OBJECTIVES

The DQO process comprises a seven-step iterative planning approach. The process is used to define the type, quantity and quality of data needed to support decisions relating to the assessment of site contamination. It provides a systematic approach for defining the criteria that a data collection design should satisfy, including when, where and how to collect samples or measurements; determination of tolerable decision error rates; and the number of samples or measurements that should be collected.

Step 1 - State the Problem

The problem is the potential for the site to have contaminant levels in excess of those permissible for commercial (hotel) land use and which could impact upon receiving environments (i.e. Sydney Harbour).

Step 2 - Identify the Decision Statement

Determine if there is any contamination at the site which would pose an unacceptable risk as defined by the NEPM (NEPC, 1999) or NSW EPA (1998) for the continued use of the site for commercial (hotel) use, or that would impact upon receiving environments.

Step 3 - Identify inputs to the decision

The following informational inputs are required to resolve the decision statement:

- The findings from the investigation to be undertaken at the site;
- Health Investigation Levels (HIL) as published in NEPC, 1999 Schedule B1;
- The Soil Investigation Levels (SILs) as published in NSW EPA *Guidelines for Assessing Service Station Sites* (1994) for TRH and BTEX assessment; and
- ANZECC (2000) *Water Quality Guidelines*.

Step 4 - Define the Boundaries of the Study

The subject site consists of the Four Points Sheraton Hotel situated at 161 Sussex Street, Sydney, NSW (herein referred to as the site). A site location map is presented on Figure 1 and a site layout plan showing the site boundary and the two proposed development areas is presented on Figure 2.

Step 5 - Develop a Decision Rule

The purpose of this step is to define the parameter of interest, specify the action level and combine the outputs of the previous DQO steps into an “if…then…” decision rule that defines the conditions that would cause the decision maker to choose alternative actions.

The parameters of interest (or contaminants of concern) have been determined based on potential sources of contamination, including those identified in the Stage 1 investigations. The action level will be used to decide if the parameter represents an unacceptable risk for continued commercial (hotel) land use and/or the receiving environment. If the 95% Upper Confidence Level (UCL) of a measured concentration of a parameter or compound exceeds the action levels in soils, then this is deemed to present an unacceptable risk for the continued commercial land-use.

If the 95% UCL or absolute values of a parameter or compound, whichever is representative for particular area of the sites, are above the nominated action levels, then further sampling will be proposed to determine the extent of contamination.

Step 6 - Specify Acceptable Limits on Decision Errors
There are two types of errors:

a) Deciding that the site is acceptable for commercial and industrial land use and that there is a low risk to receiving environments when it actually is not. The consequence of this error may be unacceptable health risk for current and future users of the sites.
b) Deciding that the site is unacceptable for commercial and industrial land use and that there is a risk to receiving environments when it is acceptable. The consequence of this error is that the client will pay for further investigation / remediation that are not necessary.

The more severe consequences are with decision error (a) since the risk of jeopardising human health outweighs the consequences of paying more for remediation. Unlike soils, it is not generally appropriate to compare guideline levels with Upper Confidence Limits (UCLs) for the mean of measured concentrations in groundwater and subsurface gas. The level of impact on groundwater and subsurface gas (if present) will need to be assessed at each monitoring well.

Step 7 - Optimising the Design for Obtaining Data
The purpose of this step is to identify a resource-effective data collection design for generating data that are expected to satisfy the DQO's. The resource effective data collection design that is expected to satisfy the DQOs is described in detail in Section 8. To ensure the design satisfies the DQOs a comprehensive Quality Assurance and Quality Control Plan will be implemented as detailed in Section 8.

7 SAMPLING AND ANALYTICAL PROGRAMME

7.1 FIELDWORK (DRILLING OPERATIONS)

Fieldwork was undertaken on 26 April and 7 May 2012 and was supervised by a CES experienced environmental scientist, who directed drilling operations, nominated sampling and testing, and logged the encountered sub-surface lithology. Borehole logs are included in Appendix D.

7.2 SOIL SAMPLING PROGRAMME

7.2.1 Sampling Pattern

To quantify the degree of possible contamination across the site, CES undertook a mixed judgemental and systematic sampling pattern. Four boreholes were excavated. The location of the sample locations are provided as Figure 2.

7.2.2 Depth Intervals of Sampling

Each borehole was extended to a maximum depth of 14 to 15 metres below ground level (mBGL), 1 metre into natural soils or to drill rig refusal (whichever is shallower). Augers were advanced through any fill material to intersection with the natural material, refusal or to the limit of the investigation, whichever was shallower. Representative, disturbed environmental samples were then collected.

7.2.3 Method of Sampling Collection

Care was taken to ensure that representative samples were obtained from the depth required and that the integrity was maintained, particularly when dealing with potentially volatile and semi-volatile components. When collecting duplicates, samples to be analysed for volatiles were not mixed, rather they were placed directly into sample jars. Specific sampling procedures for each method of collection is provided below in the following sections.

Where there was sufficient sample volume, part of the sample was placed in a re-sealable polyethylene bag for measurement of volatile soil gases using the closed headspace Photoionisation Detector (PID) method. The procedure for soil screening using a PID is summarised as follows:

1. A corresponding sample to that selected for possible laboratory analysis is placed into a “snap-lock” or re-sealable plastic bag until half filled, then sealed.
2. The bag is then hand warmed (or left in sunlight) for ten minutes with occasional agitation to maximise the release of Volatile Organic Compounds (VOC) into the bag.
3. Calibrate the PID instrument.

4. Measure background VOC concentrations in ambient air prior to each reading in order to account for sensor drift. Record on a field data sheet along with date, location details, depth and method (HS for headspace method).
5. Use the point of the PID or a knife to punch a small hole in the top the plastic bag. Place the tip of the FID in the bag and monitor the readout and note the maximum and minimum concentration during the recording period.
6. Note the concentrations in field data sheets.
7. Repeat process outlined above for each sample (*ie*. background reading followed by sample reading).
8. Check instrument calibration against span gas at the conclusion of monitoring. A check should be undertaken after every 20 samples if more than 20 samples are to be tested. Calibration checks are to be recorded on field data sheets.
9. Check that samples with high concentrations of VOCs in headspace gases have been included for VOC testing at the laboratory.

The PID is a non-specific detector, as such, the instrument provides a measure of concentrations of total combustible and ionisable compounds reported as equivalents of a calibration span gas. Therefore, the data is used to compare Volatile Organic Compounds (VOC) concentrations between samples without an understanding of the specific compounds present. PIDs are generally calibrated using zero (ambient) air and isobutylene (benzene equivalent) span gases.

VOC concentrations detected by PIDs are dependent on a number of factors including:

- The concentration and type of VOCs present in soil samples;
- Soil texture and compaction largely influence the potential for VOCs to be released from samples;
- Time since sample collection; and
- Temperature as this strongly affects the level of volatilisation of VOCs from soil and fills samples. In fact, temperature changes may result in differences of up to one order of magnitude in levels of VOCs detected using PIDs. Consequently, field screening for VOCs should be undertaken at the same time for all samples in order to produce representative results. Generally, it is recommended that samples be stored on ice and returned to base. Screening should be carried out after allowing samples to equilibrate to ambient air temperatures.

In boreholes, all soil samples were collected directly from the auger. Care was taken when collecting auger samples to ensure the most representative sample of the targeted material was sampled. The soil was then transferred to the sample jar using a stainless steel trowel or knife, which was decontaminated in accordance with Section 7.2.4 between each sample, and new latex or nitrile gloves were used for the collection of each sample.

7.2.4 Decontamination Procedures

The following decontamination procedures were adopted for the drilling and sampling equipment.

7.2.4.1 Auger

Samples were collected directly from the auger. The auger was washed between sample locations using Decon 90 followed by adequate rinsing with clean water. To check the adequacy of the decontamination protocol, rinsate samples were collected for analysis. All samples were collected with new disposable latex or nitrile gloves.

7.2.4.2 Sampling Equipment

Sampling equipment, such as trowels and/or knives, were washed between samples using Decon 90 followed by adequate rinsing with clean water. To check the adequacy of the decontamination protocol, rinsate samples were collected for analysis.

7.2.5 Sample Containers

The soil sample jars comprise glass with a Teflon lined lid and were supplied by either the primary laboratory. The jars were completely filled with soil, sealed, labelled with the job number, date, unique sampling point identification and depth.

7.2.6 Method of Sample Storage and Handling

The full soil jars were immediately placed in a cool box in which ice had been added to keep the samples below a temperature of approximately 4^{o}C. At the end of each day the samples in the cool box were transported to our Sydney office where more ice was added until delivered to the laboratory (within one day).

7.2.7 Documentation

While on site, the supervising engineer/scientist filled out a copy of CES “sample register”, which documents:

- Time of sample collection;
- Weather;

- Unique sample identification number; and
- Sample location and depth.

All samples were classified in the field based on soil/fill characteristics and obvious signs of contamination such as discolouration or odour noted on a log. All samples, including QA samples, were transported to the primary and check laboratories under Chain-of Custody procedures and maintained in an ice-filled cooler. The COC forms detail the following information:

- Site identification;
- The sampler's name;
- Nature of the sample;
- Collection time and date;
- Analyses to be performed;
- Sample preservation method;
- Departure time from site; and
- Dispatch courier(s).

During excavation, a borehole log was completed by a qualified environmental engineer/scientist. The log recorded the following data:

- Sample number and depth;
- Soil classification, colour, consistency or density, and moisture content;
- Unusual characteristics such as odour and staining;
- Depth of excavation;
- Drill rig or hand auger refusal;
- Method of drilling/excavation; and
- The depth of first encountered free water.

7.2.8 Reinstatement

Where monitoring instrumentation was not installed, the boreholes were backfilled with soil cuttings and sand and capped with concrete.

7.3 GROUNDWATER

7.3.1 Location and Number of Sampling Points

Three groundwater monitoring wells were developed in borehole location BH1, BH4 and BH5 in order to assess the baseline groundwater quality at the site. Wells were installed into defined borehole locations as shown on Figure 2 and extended to two metres past the intersection with the permanent groundwater table, to approximately 15m depth.

7.3.2 Well Construction

The groundwater investigation comprised the installation of groundwater monitoring wells using a rotary auger drill method. Groundwater wells were constructed using pre-fabricated PVC machine slotted screen sections and blank casings and 2 to 5 mm sand pack, bentonite seal and gatic cover set in a concrete block at the surface.

7.3.3 Well Development and Sample Collection

Fieldwork was undertaken in accordance with documented CES procedures by experienced staff. Well development was undertaken by using a foot valve method. Following development, the wells were allowed to recharge before purging and sampling. The purging process was undertaken using a low-flow method with drawdown control to limit drawdown to less than 0.05 m. This was done using a peristaltic pump with inlet tubing set within a 100 mm sump in the bottom of each well.

A calibrated water quality meter was used during the purging process to assess chemical equilibrium by measuring pH, redox potential (Eh), electrical conductivity, dissolved oxygen and temperature. The parameters were considered stable and at equilibrium when two consecutive readings (during the removal of each well volume) were within ±10 %.

7.3.4 Decontamination Procedures

Dedicated tubing was used for the development of each well. The pumps used to develop each well were decontaminated between sample locations by washing in a solution of phosphate-free detergent followed by rinsing with distilled water.

7.3.5 Sample Containers

Laboratory supplied sample containers were used to contain the groundwater samples. Sample containers were filled in order of the most volatile substances. Care was taken to minimise disturbance of the sample to avoid aeration by minimising the distance between the outlet tubing and the container, tilting the container so that discharge flows gently down the inner walls, and ensuring containers had no airspace, are capped tightly and placed in an ice cooler immediately.

7.3.6 Method of Sample Collection, Storage and Handling

All sample containers were labelled with the sample number, project number, date obtained and site name. This information was repeated on the Chain-of-Custody (COC) record form.

Sample containers were filled in order of the most volatile substances. Care was taken to minimise disturbance of the sample to avoid aeration by minimising the distance between the outlet tubing and the container and tilting the container so that discharge flows gently down the inner walls. Samples for heavy metal analysis were field filtered using a 0.45 micron filter.

Once filled, the caps were checked to ensure that they were secure (and that there was no air bubbles/head space) then placed within an esky/cool box in which a cooling medium had been added to keep the samples below a temperature of approximately 4^{o}C. At the end of each sampling day the samples in the cool box were transported to the CES office where ice was added until delivered to the laboratory (within one day). Custody seals were placed on the esky/cool box for delivery to the laboratory.

7.3.7 Documentation

While on site, the supervising engineer/scientist filled out a copy of the CES “Groundwater Sampling Field Data Sheet” and “Sample Register’, which documented:

- Time of sample collection;
- Weather;
- Unique sample identification number;
- Sample location and depth;
- Static Water Level;
- Water quality screening results (DO, Temperature, Redox potential, pH and conductivity);
- Presence or absence of odour (nature and intensity);
- Colour of the water;
- Presence or absence of sediment in the well; and
- Well condition and purging volumes.

All samples, including QA samples, were transported to the primary and check laboratories under Chain-of Custody procedures and maintained in an ice-filled cooler. The COC detailed the following information:

- Site identification;
- The sampler;
- Nature of the sample;
- Collection time and date;
- Analyses to be performed;
- Sample preservation method;
- Departure time from site; and
- Dispatch couriers.

7.4 ANALYTICAL PROGRAMME

7.4.1 Field Screening

Field screening was carried out on each soil sample collected using a Photo Ionisation Detector (PID) to indicate areas of volatile compounds and assist in selection of samples for laboratory analysis. Given the limits of a PID, site conditions such as odour and staining were also factors in determining what samples are selected for analysis.

The PID screening process is described in Section 7.2.3.

7.4.2 Number of Samples for Analysis

Selected samples were submitted for analysis based on field screening results, odour, colour, the presence of unusual substances or liquids, etc and to provide adequate statistical coverage. The number of fill/soil and groundwater samples to be analysed from the site are summarised in the tables. A summary of the preservation, containers and maximum holding times for the samples is provided in Tables 4 and 5.

7.4.3 Laboratory

CES engaged Envirolab Services Pty Ltd (Envirolab) as the primary lab and Australian Laboratory Services Pty Ltd (ALS) as the secondary or 'check' laboratory for all chemical testing. Both laboratories are NATA registered for the proposed chemical testing.

7.4.4 Analytical Methods

The soil/fill and groundwater samples were analysed in accordance with ANZECC (1996) *Guidelines for the Laboratory Analysis of Contaminated Soils* using US EPA and APHA approved analytical methods as described in Tables 6 and 7. The corresponding laboratory Practical Quantitation Limits for the respective samples are also summarised in Tables 6 and 7.

7.4.5 Analytes

The choice of chemical analytes was determined based on knowledge of the history of the site and to provide information on baseline conditions.

8 QA/QC DATA EVALUATION

All soil samples were collected by experienced CES environmental scientists, under established CES protocols. CES personnel have been trained in sample collection and handling techniques outlined in the Sampling Program section above.

For the purpose of assessing the quality of data presented in this report, CES collected and analysed various Quality Control (QC) samples (field QC samples), while the laboratory completed their own QC. The current section of this report is focused on the presentation of results of these QC samples and discussion of deviations from the Data Acceptance Criteria (DAC).

Additionally, in accordance with the NSW EPA (2006) *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition)*, Data Quality Indicators (Completeness, Comparability, Representativeness, Precision and Accuracy) have also been considered (where appropriate).

8.1 FIELD QA/QC

The results of the field QA/QC analysis and resulting data assessment is presented as Appendix B.

8.1.1 Blind Replicates

Two blind replicate samples (one soil and one groundwater) were analysed for metals, TRH, BTEX and PAH, OCP, OPP and PCB, to assess the quality control during the field sampling programme. This exceeds and therefore conforms to the NSW EPA (1994) Guidelines and the Data Acceptance Criteria requirement of 10%. The RPDs for all analytes for the blind replicate conformed to the DAC.

8.1.2 Split Sample

Two split replicate samples (one soil and one groundwater) were analysed for metals, TRH, BTEX and PAH, OCP, OPP and PCB, to assess the quality control during the field sampling programme. This exceeds and therefore conforms to the NSW EPA (1994) Guidelines, and the Data Acceptance Criteria requirement of 5%. With the exceptions outlined below, the RPDs for all analytes for the blind replicate conformed to the DAC:

- RPD for arsenic (183%) at location FP-BH5;
- RPD for nickel (198%) at location FP-BH5;
- RPD for zinc (190%) at location FP-BH5;
- RPD for copper (21%) at location FP-BH1;
- RPD for nickel (61%) at location FP-BH1; and

- RPD for zinc (74%) at location FP-BH1.

CES considers these outliers to be a result of the heterogeneity of the surface soils from which the samples were collected and the method of sampling (samples were not homogenised in order to preserve volatile characteristics). Furthermore, given the relatively low concentrations of heavy metals, RPD values are greatly exaggerated. CES considers that these outliers will not affect the outcome of the assessment.

8.1.3 Trip Blank

The rate of trip blank analysis was one trip blank per batch of samples submitted to the laboratory for analysis. The concentrations of all parameters (TRH and BTEX) analysed in the trip blank sample (TRIP BLANK) prepared by ALS were below the respective laboratory LORs and therefore conformed to the DAC.

8.1.4 Trip Spike

The rate of trip spike analysis was one trip spike per batch of samples submitted to the laboratory for analysis. The recoveries for the trip spike sample (TS) in comparison to the laboratory trip spike control sample (TSC) conformed to the DAC.

8.2 LABORATORY QA/QC

Laboratory QA/QC data is presented in full in the laboratory certificates in Appendix A.

8.2.1 Laboratory Duplicates

Laboratory duplicate samples conformed to the DAC.

8.2.2 Laboratory Control Samples

Laboratory control samples conformed to the DAC.

8.2.3 Surrogates

Laboratory control samples conformed to the DAC.

8.2.4 Matrix Spikes

All matrix spike data conformed to DAC with the following exceptions:

<u>ALS ES1211407</u>

Percent recovery for cadmium was less than lower data quality control objective.

<u>ALS ES1211111</u>

Percent recovery for zinc was greater than the upper data quality control objective.

8.2.5 Method Blanks

All method blanks conformed to the DAC.

8.2.6 Sample Holding Times

All samples were extracted and analysed within the specified holding times.

8.2.7 Sample Condition

All samples were received by the analytical laboratories in correctly preserved and chilled containers with no reported breakages.

8.3 SITE ASSESSMENT CRITERIA

8.3.1 Soil

To address potential health impacts at the site, CES will compare the analytical testing results against a set of health and ecological based soil investigation levels to be referred to as Soil Investigation Levels (SIL) appropriate for the current land-use. That is, the SIL will be set at a level that provides confidence that contaminant concentrations below the SIL will not adversely affect human health or be phytotoxic to plants.

The sites current land-use is commercial (hotel). Therefore, CES has adopted the lower value from the following criteria:

- NEPC (1999) Health Investigation Levels recommended for exposure setting ‘F’ which includes commercial and industrial land uses; and
- With respect to hydrocarbons (TRH and BTEX), the NSW EPA (1994) Threshold Levels.

The adopted SILs are included in Table 8.

8.3.2 Groundwater

Assessment criteria for groundwater will be derived from the ANZECC (2000) water quality guidelines. The nearest environmental receptors to the site is considered to be the Sydney Harbour, located approximately 100 m to the west of the site. Considering that the marine water ecosystem of the Sydney Harbour is likely to be the most sensitive receptor, trigger values for the protection of marine water ecosystems will be adopted for this study.

The ANZECC (2000) water quality guidelines specify four sets of trigger values corresponding with different levels of protection for ecosystem conditions. Trigger values, derived using the statistical distribution method, relate to the protection of 99%, 95%, 90% and 80% of species in an aquatic ecosystem. Three “categories of ecosystem conditions” are developed in the guidelines. The guidelines advocate that the level of protection afforded to a particular ecosystem should be determined following consideration of site conditions in consultation with key stakeholders. The guidelines recommend that, in most cases, the 80% protection trigger values should be applied to “slightly to moderately disturbed” ecosystems. Consequently, the 80% protection trigger values have been adopted.

In the absence of appropriate fresh water investigation levels, ANZECC (2000) Low Reliability Trigger Values (TRH C_6-C_{36}) have been adopted. In the absence of any appropriate site assessment criteria, the EPA NSW (1994) *Guidelines for Assessing Service Station Site* threshold concentrations for “Waters – Protection of Aquatic Ecosystems” will be adopted for toluene, ethylbenzene and total xylenes.

Assessment criteria for relevant parameters are included in Table 9.

9 RESULTS

Results of the Stage sampling and testing programme are presented below.

9.1 SITE STRATIGRAPHY AND HYDROGEOLOGY

9.1.1 Site Stratigraphy and observations

The ground conditions encountered during the investigation typically comprised fill material underlain by sandstone. For a detailed description of the subsurface conditions encountered at each borehole refer to the borehole logs in Appendix D, together with the explanatory sheets describing the terms and symbols used. Staining or odours were not observed during the investigation.

9.2 SOIL ANALYTICAL RESULTS

Analytical results for the soil samples collected at the site during the investigation are shown in Table 8 and are summarised below. Laboratory certificates of analysis are presented in Appendix A.

9.2.1 Heavy Metals

A total of 7 samples were submitted to the laboratory for metals analysis (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn). The concentrations of heavy metals in samples are presented in Table 8. The concentrations of heavy metals were below the health-based SAC for all samples analysed.

9.2.2 Petroleum Hydrocarbons (TRH) and BTEX Compounds

A total of 7 samples were submitted to the laboratory for TRH C_6-C_{36} and BTEX analysis. The concentrations of TRH and BTEX are presented in Table 8. Concentrations of TRH and BTEX in all samples analysed were below the health-based SAC for all samples analysed.

9.2.3 Polycyclic Aromatic Hydrocarbons (PAHs)

A total of 7 samples were submitted to the laboratory for PAH analysis. The concentrations of benzo(a)pyrene and total PAHs in samples are presented in Table 8. The concentrations of benzo (a)pyrene and total PAHs were below the health-based SAC.

9.2.4 Organochlorine and Organophosphorous Pesticides (OCPs/OPPs)

A total of 7 samples were submitted to the laboratory for OCP and OPP analysis. The concentrations of OCP and OPP are presented in Table 8. Concentrations of OCP and OPP in all samples analysed were below the health-based SAC and laboratory PQLs for all samples analysed.

9.2.5 Polychlorinated Byphenyls (PCBs)

A total of 7 samples were submitted to the laboratory for PCB analysis. The concentrations of OCP and OPP are presented in Table 8. Concentrations of PCB in all samples analysed were below the health-based SAC and laboratory PQLs for all samples analysed.

9.3 GROUNDWATER ANALYTICAL RESULTS

Analytical results for the groundwater samples collected at the site during the site investigations are shown in Table 9 and are summarised below. Laboratory certificates of analysis are presented in Appendix A.

9.3.1 General Parameters

Groundwater was encountered across the site at between 2.60 and 2.83 mBGL. Field pH ranged between 5.0 and 5.99 pH units, field redox values ranged between 17 and 31 mV, Electrical Conductivity (EC) ranged between 13.26 and 740 $\mu S\ cm^{-1}$ and Dissolved Oxygen (DO) concentrations ranged from 0.09 to 0.68 $mg\ L^{-1}$.

9.3.2 Heavy Metals

A total of 3 samples submitted to the laboratory for dissolved metals analysis (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn). The concentrations of heavy metals in samples are presented in Table 9. The concentrations of heavy metals were below the SAC for all samples analysed.

9.3.3 Petroleum Hydrocarbons (TRH) and BTEX Compounds

A total of 3 samples were submitted to the laboratory for TRH C_6-C_{36} and BTEX analysis. The concentrations of TRH and BTEX are presented in Table 9. Concentrations of TRH and BTEX in all samples analysed were below the laboratory PQLs for all samples analysed.

9.3.4 Polycyclic Aromatic Hydrocarbons (PAHs)

A total of 3 samples were submitted to the laboratory for PAH analysis. The concentrations PAHs in samples are presented in Table 9. The concentrations of PAHs in all samples analysed were below the laboratory PQLs for all samples analysed.

9.3.5 Organochlorine and Organophosphorous Pesticides (OCPs/OPPs)

A total of 3 samples were submitted to the laboratory for OCP and OPP analysis. The concentrations of OCP and OPP are presented in Table 9. Concentrations of OCP and OPP in all samples analysed were below the laboratory PQLs for all samples analysed.

9.3.6 Polychlorinated Byphenyls (PCBs)

A total of 3 samples were submitted to the laboratory for PCBs analysis. The concentrations of PCBs are presented in Table 9. Concentrations of PCBs in all samples analysed were below the laboratory PQLs for all samples analysed.

9.4 SUMMARY

The soil results reported no contaminants present at concentrations exceeding the SAC (guidelines for commercial and industrial use). In terms of groundwater, no potential contaminants were found to be present at concentrations that exceed the adopted trigger levels (for marine waters with 80% protection of species). In one or two cases the results were reported as less than the PQL, which is higher than the trigger levels quoted, but none of those contaminants were reported as present in the soils and are therefore unlikely to be present in the groundwater.

9.5 PRELIMINARY WASTE CLASSIFICATION

The soil analytical results indicate that any soil materials to be removed from the site are likely to classify as General Solid Waste under the DECCW (2009) *Waste Classification Guidelines*, subject to TCLP leach testing also being undertaken prior to disposal.

10 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the site investigations (including a review of background information, site observations and the sampling and analysis programme), CES conclude that the site in its present condition satisfies the relevant SAC and the site is suitable for the proposed commercial (hotel) land use.

The Director-General's Requirements specifically identified the need to address any potential impacts on the groundwater regime and quality which could result from the proposal. The only works associated with the construction project which are intrusive and will extend below ground level will be the construction of bored piles (as recommended in the CES geotechnical report CES111206-CA-AD *Geotechnical Investigation Report*, dated 18 May 2012) which will be cased and should have no impact on groundwater quality or movement (due to the adopted spacing). Drilling fluids used in piling are normally inert and will be selected to be environmentally friendly.

11 LIMITATIONS OF THIS REPORT

This report has been prepared for use by the client who commissioned the works in accordance with the project brief and based on information provided by the client. The advice contained in this report relates only to the current project and all results, conclusions and recommendations should be reviewed by a competent person with experience in environmental investigations before being used for any other purpose. Consulting Earth Scientists Pty Ltd (CES) accepts no liability for use or interpretation by any person or body other than the client. This report must not be reproduced except in full and must not be amended in any way without prior approval by the client and CES.

The extent of sampling and analysis of soils has been undertaken targeting areas of environmental concern, targeting specific soil strata from where contamination is considered most likely to occur based on knowledge of site history and visual inspection. This approach has been adopted in order to maximise the probability of identifying contaminants, however the approach may not identify contamination that occurs in unexpected locations or from unexpected sources.

Furthermore, soil, rock and aquifer conditions are variable, resulting in the heterogeneous distribution of contaminants across the site. Contaminants have been identified at discrete locations; however conditions between sample locations have been inferred based on estimated geological and hydrogeological conditions, the nature and extent of identified contamination. Boundaries between zones of variable contamination are generally unclear and have been interpreted based on available data and professional judgement. The accuracy with which subsurface conditions have been characterised depends on the frequency of sampling, field and laboratory methods, the uniformity of the substrate and is therefore limited by the scope of works undertaken.

This report is based on targeted sampling and does not provide a complete assessment of the environmental status of the site and is limited to the scope defined therein. Should information become available regarding conditions at the site including previously unknown sources of contamination, CES reserves the right to review the report in the context of the additional information.

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