HEC
HAYES ENVIRONMENTAL CONSULTING

ABN 32 295 203 367

STAGE 1
PRELIMINARY ENVIRONMENTAL SITE INVESTIGATION (CONTAMINATION ASSESSMENT)

7 ELLAMATTA AVENUE, MOSMAN NSW 2088

Hayes Environmental Consulting Pty Ltd
Report No. EP1126 AC

26 September, 2013

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HEC Ref: *EP1126 AC*
Date: *26 September, 2013*

Mrs Jennifer Berry
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RE: STAGE 1 PRELIMINARY ENVIRONMENTAL SITE INVESTIGATION (CONTAMINATION ASSESSMENT); 7 ELLAMATTA AVENUE, MOSMAN

1.0 INTRODUCTION

Hayes Environmental Consulting Pty Ltd (HEC) was engaged by Mrs Jennifer Berry (the property owner) to complete a stage 1 preliminary environmental investigation of the site identified as 7 Ellamatta Avenue, Mosman, New South Wales (henceforth referred to as 'the site'). This site was further identified as Lot 11 in Deposited Plan (DP) 875220 and comprised an area of 878.2m^2.

It was understood that the site had formerly been used as an aged care day facility. It was further understood that the property was designated for rezoning for residential purposes and that a preliminary environmental (contamination) investigation was required by Mosman Council, in support of the corresponding application and in accordance with *State Environmental Planning Policy No. 55 - Remediation of Land.*

This preliminary environmental investigation was equivalent to a Tier 1 Risk Assessment, as defined under the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1).* The principal objective was to assess the potential for contamination to exist on the site. This report documents the findings of all related tasks performed by HEC, including a brief review of historical information, field observations, soil profile descriptions, results of laboratory analyses and conclusions regarding the site's suitability for residential use.

The work reported herein followed standard environmental procedures in accordance with the NSW Environment Protection Authority's *Minimum Soil Sampling Protocol* (EPA, 1994), *Sampling Design Guidelines* (EPA, 1995), *Guidelines for the NSW Site Auditor Scheme* (DEC, 2006) and *Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011). Reference was also made to the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)* (NEPC, 2013), which superseded the foundation *National Environment Protection Measure* (NEPC, 1999) on 11 April, 2013.

2.0 SITE CHARACTERISTICS

2.1 Property Identification, Location and Description

The site was located approximately 30m east of the T-intersection of Bradleys Head Road and Ellamatta Avenue, Mosman, in the Parish of Willoughby and County of Cumberland. It was further identified as Lot 11 in DP 875220 and comprised an area of 878.2m^2 (*Ref.* Figure 1 and Attachment A).

Ellamatta Avenue lined the southern boundary. Glengarry Lane and Effingham Street lined the northern boundary. Low-density, residential properties comprised the site surroundings (*Ref.* Figure 1 and Attachment A).

At the time of this investigation, the site contained a large, two storey, brick and timber clad building, with terracotta tile roofing, metal awnings and timber decking. A rendered brick and corrugated metal, double garage was situated in the south eastern corner, while a metal (*Colorbond*) shed was situated in the north eastern corner. Lawns, gardens and concrete paving covered the remaining area (*Ref.* Figure 1 and Attachment A).

2.2 Topography

The local topography was gently undulating, with a distinct down slope in a north westerly direction (2-5°). Information on regional topographic conditions, referenced from the Central Mapping Authority of NSW *Parramatta River 9130-3-N Topographic Map 1:25,000* (CMA, 1986), was consistent with this description and indicated that the property's elevation was 80-90m above sea level (i.e. 80-90m AHD). Based on the site survey plan prepared by PK Surveys Pty Ltd (*Ref.* Attachment A), the elevations ranged from 97.65m AHD (south east corner) to 93.91m AHD (north west corner).

2.3 Regional Geology and Soil Landscape

Information on regional sub-surface conditions, referenced from the Geological Survey of NSW / Department of Mineral Resources *Sydney 1:100,000 Geological Series Sheet 9130* (GS NSW / DMR, 1983), indicated that the site overlies a Hawkesbury Sandstone (*Rh*) formation. Hawkesbury Sandstone is characterised by "medium to coarse-grained quartz sandstone, very minor shale and laminite lenses", and forms the local bedrock materials.

The Soil Conservation Service of NSW *Soil Landscapes of the Sydney 1:100,000 Sheet* (Chapman and Murphy, 1989), indicated that the site overlies a Lambert (*la*) landscape. The Lambert landscape is characterised by "undulating to rolling low hills on Hawkesbury Sandstone". The natural soils for this site were therefore expected to be shallow to moderately deep (<1m), sand-dominated materials, which display seasonally perched water tables, high permeability and very low fertility.

Review of the *Prospect / Parramatta River Acid Sulfate Soil Risk Map* (1:25,000 scale; Murphy, 1997), in conjunction with the *Guidelines for the Use of Acid Sulfate Soil Risk Maps* (Naylor *et al.*, 1998), indicated that the site lies within the class description of *No Known Occurrence*. In such cases, acid sulfate soils (ASSs) are not known or expected to occur and "land management activities are not likely to be affected by ASS materials".

3.0 REGULATORY COMPLIANCE

On 10 September, 2013, an on-line search of the *Contaminated Land - Record of EPA Notices* was conducted, this being a database that is maintained by the NSW Environment Protection Authority (EPA). This search confirmed that the EPA had no involvement, or regulation, under Section 58 of the *Contaminated Land Management Act 1997* for any property in the New South Wales suburb of Mosman. Section 58 of the *CLM Act 1997* relates to the investigation, remediation and management of sites where contamination poses a significant risk of harm, and includes Sections 35 and 36 of the *Environmentally Hazardous Chemicals Act 1985*.

On 10 September, 2013, an on-line search of the public register for licences, applications, notices, audits, pollution studies and reduction programs under the *Protection of the Environment Operations Act 1997* (*POEO Act 1997*) was conducted, this being another database that is maintained by the EPA. This search confirmed that the EPA had no involvement, or regulation, under the *POEO Act 1997* for 7 Ellamatta Avenue, Mosman NSW.

4.0 FIELD OBSERVATIONS

The site was inspected by HEC on 9 September, 2013, at which time the following observations were made (*Ref.* Figure 1 and Attachment A).

- The site was irregular in shape, comprising a total area of 878.2m^2. Low-density, residential properties comprised the site surroundings.

- A two storey, brick, timber and terracotta building (with metal awnings and timber decking) was located roughly in the middle of the site. A rendered brick and corrugated metal, double garage was situated in the south eastern corner. A metal (*Colorbond*) shed was situated in the north eastern corner. All building footings and support posts were in good condition and displayed no visual evidence of chemical staining or corrosion.

- Concrete paving formed a driveway from Ellamatta Avenue up to the building frontage. Additional concrete paving formed paths and steps along the western and northern sides of the building. Apart from some surface cracking (due to aging), all paving was in good condition and displayed no visual evidence of chemical staining or corrosion.

- Sandstone, metal (wire mesh) and timber fencing lined the site boundaries. All fencing was in good condition and displayed no visual evidence of chemical staining or corrosion.

- The remainder of the site was comprised of lawn and garden areas. A diverse range of plants was present, including small to large (native) trees (e.g. eucalypts, palms, conifers and citrus), flowering shrubs, succulents, climbers, groundcovers, grasses and weeds. The diversity of vegetation was sufficient to suggest that phytotoxicity was not a concern for site soils.

- The site topography (slope and elevation) was generally consistent with that of its surroundings, except for the northern boundary, which appeared as though a cut operation had previously taken place in that area. It was considered that minimal amounts of imported filling were present on the property.

- No suspicious odour or visual sign of contamination, including fragments of fibre cement sheeting (FCS), was encountered on any part of the site at the time of the inspection.

- No chemical container of environmental significance was observed on the site at the time of the inspection. There was no evidence to suggest that an underground storage tank (UST) was present on the site.

Additional Historical Information

The following additional information was communicated to HEC during the course of this investigation:

- The site had previously been used as a day care facility for the aged (i.e. dementia sufferers), being formerly recognised as the *Mosman Cay Centre*.

- The main building was estimated as being at least 50 years old.

- The site did not have a recorded history of any contaminating activity taking place (including the importation of fill material).

5.0 SOIL SAMPLING

Sampling Methodology and Observations

The field work component of this investigation included soil sampling at six, separate borehole locations (HA1, HA2, HA3, HA4, HA5 and HA6; *Ref.* Figure 1). This number of locations (6) complied with the minimum density requirement recommended under the EPA (1995) *Sampling Design Guidelines* for a site area of 878.2m^2.

The locations were selected using a mixed judgemental - systematic, triangular sampling pattern, with allowance for structural obstacles (e.g. underground and overhead services, buildings, decking and paving). HA1 was situated in the front yard, HA2 was adjacent to the main building and garage, while HA3-HA6 were situated in the rear yards (all down slope of the buildings).

The boreholes were drilled on 9 September, 2013 using manual (i.e. hand) auger techniques. The drilling depths were 0.3m, 0.3m, 0.4m, 0.4m, 0.5m and 0.4m below ground level (BGL), respectively, with refusal on coarse gravel (ironstones) and/or firm clay being encountered at each location.

Borehole logs were maintained for the test holes and included layer descriptions and other field observations. This information is presented in the form of graphic borehole logs in Attachment B.

The following additional notes were made during the sampling program.

- On the basis of observations made during the borehole drilling works, site sub-surface conditions were generalised as:

  - dark brown, fine grained, (gravelly) silty sand, topsoil fill (0.1-0.3m thickness), overlying

  - (light) brown, clayey silty sand and/or (dark) orange and red brown, silty sandy clay with ironstones, consistent with the natural soils derived from weathered Hawkesbury Sandstone.

- Groundwater was not encountered at any of the sampling locations.

- No visual sign of contamination, including ash, oily filming and fragments of metal or FCS, was observed in any of the examined soils.

- No suspicious odour (including hydrogen sulfide (H_2S)) was detected in any of the examined soils.

- No soils containing pale yellow deposits/coatings of jarosite, indicative of actual ASSs, were observed at any of the sampling locations.

- No dark blue grey or dark greenish grey muds or sands, indicative of potential ASSs, were observed at the sampling locations.

- White marine shell fragments and/or grit were not observed in any of the examined soils.

- It was not possible to gain access to the ground surfaces beneath the existing buildings and paving. Consequently it was not possible to assess the soils in these areas.

Soil samples for laboratory submission were collected from all six borehole locations, as follows:

- HA1-1 (0.05-0.15m BGL) and HA1-2 (0.2-0.3m BGL);
- HA2-1 (0-0.1m BGL) and HA2-2 (0.2-0.3m BGL);
- HA3-1 (0.05-0.1m BGL) and HA3-2 (0.3-0.4m BGL);
- HA4-1 (0.1-0.2m BGL) and HA4-2 (0.3-0.4m BGL);
- HA5-1 (0.05-0.2m BGL) and HA5-2 (0.4-0.5m BGL); and
- HA6-1 (0.05-0.2m BGL) and HA6-2 (0.3-0.4m BGL).

Sample Handling & Transportation

A stainless steel, hand trowel was used to transfer soil from the auger bucket into 250g laboratory-supplied, glass jars or 18cm by 17cm, clear, plastic (polyethylene), snap-lock bags (in the case of the asbestos screening samples). Each jar was filled, capped with a Teflon-lined, screw-on lid and stored immediately in an insulated chest containing ice. For the asbestos screening samples, each plastic, snap-lock bag was half filled, sealed and stored in an insulated chest. The auger bucket and hand trowel were decontaminated between sampling locations in accordance with best industry practice.

All samples were transported under refrigerated conditions to Eurofins | mgt Pty Ltd (Eurofins | mgt), using strict chain-of-custody procedures. Sample Receipt Advice was provided by Eurofins | mgt to indicate the condition of the samples upon receipt and a copy of this is presented, along with a copy of the completed Chain-of-Custody Certificate, in Attachment C.

6.0 LABORATORY ANALYSES

The samples HA2-1 (0-0.1m BGL), HA3-1 (0.05-0.1m BGL) and HA5-1 (0.05-0.2m BGL) were considered to be representative of the near surface (fill) soils on the site and were thus initially assigned to be analysed for the following parameters:

- the heavy metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn);

- total recoverable hydrocarbons (TRHs);

- the monocyclic aromatic hydrocarbons benzene, toluene, ethyl benzene and xylenes (BTEX);

- polycyclic aromatic hydrocarbons (PAHs);

- organochlorine pesticides (OCPs);
- organophosphate pesticides (OPPs);
- polychlorinated biphenyls (PCBs);
- asbestos;
- pH; and
- electrical conductivity (EC).

This analytical program included the standard parameters recommended by the EPA under the EPA (1994) *Table 1 Minimum Soil Sampling Protocol* and DEC (2006) *Guidelines for the NSW Site Auditor Scheme*, as well as the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*.

On the basis that elevated benzo(a)pyrene concentrations were detected in HA2-1 (0-0.1m BGL), HA3-1 (0.05-0.1m BGL) and HA5-1 (0.05-0.2m BGL), additional soil analyses were subsequently commissioned, as follows:

HA1-1 (0.05-0.15m BGL)	total PAHs;
HA2-2 (0.2-0.3m BGL)	total PAHs;
HA3-2 (0.3-0.4m BGL)	total PAHs;
HA4-1 (0.1-0.2m BGL)	total PAHs;
HA5-2 (0.4-0.5m BGL)	total PAHs; and
HA6-1 (0.05-0.2m BGL)	total PAHs .

Leachable (weak acid - extractable) PAH concentrations were also determined on HA2-1, using the *Toxicity Characteristics Leaching Procedure* (TCLP).

Further analyses for other volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), creosotes and cyanides were not included in the analytical program, since there was no indication of the use of such materials on the site and/or no unusual odours or visual signs suggesting the presence of these contaminants were detected during the field work.

All laboratory analyses were conducted using NATA-registered methods. The subsequent results are summarised in Table 1 and presented in detail in copies of the laboratory analytical reports, which are provided in Attachment D. Note that each soil EC result reported by Eurofins | mgt was converted to extract electrical conductivity (EC_e; having units of dS/m), by multiplying it by the appropriate soil texture conversion factor. For this site, a texture conversion factor of 17 was assumed for the sand-dominated soils (Hazelton and Murphy, 1992; DLWC, 2002; NEPC, 2013).

Quality control (QC) was monitored with the use of intra-laboratory QC testing, which comprised surrogate and matrix spikes, control samples, certified reference materials, duplicates and method blanks (*Ref.* Attachment D). In summary, internal laboratory surrogate / matrix spike, control, reference material and duplicate recovery results were within the pre-determined acceptance limits and method blanks did not identify any detectable levels of the tested analytes. It was therefore concluded that internal laboratory QC was effectively maintained and that the reported soil data were free of systematic, method biases and field sampling errors.

Table 1. Summary of the laboratory analytical results for the tested soil samples.

ANALYTE	HA1-1 (0.05-0.15m BGL)	HA2-1 (0-0.1m BGL)	HA2-1 (TCLP)	HA2-2 (0.2-0.3m BGL)	HA3-1 (0.05-0.1m BGL)	HA3-2 (0.3-0.4m BGL)	HA4-1 (0.1-0.2m BGL)	HA5-1 (0.05-0.2m BGL)	HA5-2 (0.4-0.5m BGL)	HA6-1 (0.05-0.2m BGL)	Soil HILs	Criteria ESLs
Heavy Metals												
arsenic		6.6			4.7			5.2			100	100
cadmium		0.9			1.1			0.4			20	3 [8]
chromium		53			30			19			100 [1]	190 [9]
copper		7.6			110			98			6000	380
nickel		<5			<5			<5			400	530
lead		260			250			**310**			300	1300
zinc		140			170			190			7400	530
mercury		<0.05			0.11			0.11			40	1 [8]
TRHs												
C_6-C_{10} (F1)		<20			<20			<20			45 [2]	180
>C_{10}-C_{16} (F2)		<50			<50			<50			110 [2]	120
>C_{16}-C_{34} (F3)		1100			560			220			5600 [3]	300
>C_{34}-C_{40} (F4)		200			100			<100			56000 [4]	2800
BTEX												
benzene		<0.1			<0.1			<0.1			0.5 [2]	50
toluene		<0.1			<0.1			<0.1			160 [2]	85
ethyl benzene		<0.1			<0.1			<0.1			55 [2]	70
total xylenes		<0.3			<0.3			<0.3			40 [2]	105

Footnotes:
All concentrations are in units of mg/kg, except asbestos is presence identification, pH has no unit (log scale), EC is in dS/m and TCLP is in mg/L
BGL = below ground level (value, in metres, indicates approximate depth that sample was collected from); ND = concentrations of all compounds tested were below corresponding laboratory quantitation limits (*Ref.* Attachment D); NC = no currently available criterion
Blank cells have been used where the test was not performed
HILs are the NEPC (2013) *Residential A* health-based investigation levels for residential settings with gardens and accessible soil, unless otherwise indicated
[1] the 100 mg/kg limit applies to Cr (VI)
[2] NEPC (2013) *Health Screening Level A* for sandy soil (0- <1m BGL); F1 excludes sum BTEX concentration and F2 excludes naphthalene concentration
[3] NEPC (1999) *Health Investigation Level A* for >C_{16}-C_{35} aliphatic hydrocarbons
[4] NEPC (1999) *Health Investigation Level A* for >C_{35} aliphatic hydrocarbons
[5] DEC (2006) *NEHF A Health-based Investigation Level*
[6] criterion for 'moderate' soil pH, derived from Chapman and Murphy (1989) *Rankings for Laboratory Tests*
[7] criteria for 'very low', 'low' and 'moderate' salinity (i.e. non- to slightly saline soil), derived from Chapman and Murphy (1989) *Rankings for Laboratory Tests*
ESLs determined via NEPC (2013) methodology, assuming coarse textured soil of pH 6.5 in an urban residential setting, unless otherwise indicated
[8] NEPC (1999) *Interim Urban Ecological Investigation Level*
[9] the 190 mg/kg limit applies to Cr (III)

Table 1 (continued). Summary of the laboratory analytical results for the tested soil samples.

ANALYTE	HA1-1 (0.05-0.15m BGL)	HA2-1 (0-0.1m BGL)	HA2-1 (TCLP)	HA2-2 (0.2-0.3m BGL)	HA3-1 (0.05-0.1m BGL)	HA3-2 (0.3-0.4m BGL)	HA4-1 (0.1-0.2m BGL)	HA5-1 (0.05-0.2m BGL)	HA5-2 (0.4-0.5m BGL)	HA6-1 (0.05-0.2m BGL)	Soil HILs	Criteria ESLs
PCBs												
total PCBs		<0.5			<0.5			<0.5			1	NC
OPPs												
total OPPs		ND			ND			ND			NC	NC
OCPs												
total OCPs		ND			ND			ND			NC	NC
PAHs												
total PAHs	54	100	0.029	**610**	63	13	**390**	18	<0.5	41	300	NC
naphthalene	<0.5	<0.5	0.023	1.8	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	3 [2]	170
benzo(a)pyrene	**5.8**	**9.9**	<0.001	**65**	**5.7**	**1.4**	**37**	**1.6**	<0.5	**4.4**	1 [5]	0.7
carcinogenic PAHs (as BaP TEQ)	**7.8**	**14**		**92**	**8.0**	2.2	**56**	2.5	0.6	**6.0**	3	NC
Asbestos		ND			ND			ND			ND / 0.001% w/w	NC
pH / EC												
pH		6.3			6.5			6.5			6-7.3 [6]	NC
EC_e (dS/m)		5.1			1.4			1.5			0-2 / 2-4 / 4-6 [7]	NC

Footnotes:
All concentrations are in units of mg/kg, except asbestos is presence identification, pH has no unit (log scale), EC is in dS/m and TCLP is in mg/L
BGL = below ground level (value, in metres, indicates approximate depth that sample was collected from); ND = concentrations of all compounds tested were below corresponding laboratory quantitation limits (*Ref.* Attachment D); NC = no currently available criterion
BaP = benzo(a)pyrene; TEQ = toxicity equivalent quotient
Blank cells have been used where the test was not performed
HILs are the NEPC (2013) *Residential A* health-based investigation levels for residential settings with gardens and accessible soil, unless otherwise indicated
[1] the 100 mg/kg limit applies to Cr (VI)
[2] NEPC (2013) *Health Screening Level A* for sandy soil (0- <1m BGL); F1 excludes sum BTEX concentration and F2 excludes naphthalene concentration
[3] NEPC (1999) *Health Investigation Level A* for $>C_{16}$-C_{35} aliphatic hydrocarbons
[4] NEPC (1999) *Health Investigation Level A* for $>C_{35}$ aliphatic hydrocarbons
[5] DEC (2006) *NEHF A Health-based Investigation Level*
[6] criterion for 'moderate' soil pH, derived from Chapman and Murphy (1989) *Rankings for Laboratory Tests*
[7] criteria for 'very low', 'low' and 'moderate' salinity (i.e. non- to slightly saline soil), derived from Chapman and Murphy (1989) *Rankings for Laboratory Tests*
ESLs determined via NEPC (2013) methodology, assuming coarse textured soil of pH 6.5 in an urban residential setting, unless otherwise indicated
[8] NEPC (1999) *Interim Urban Ecological Investigation Level*
[9] the 190 mg/kg limit applies to Cr (III)

7.0 LABORATORY ANALYTICAL RESULTS

Investigation Criteria

The laboratory results were interpreted with respect to the NEPC (2013) *Residential A Health-based Investigation Levels* for residential settings with garden / accessible soil. These thresholds are presented in Schedule B(1) of the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*. They provided the basis for the Tier 1 Health Risk Assessment.

Note that thresholds for certain parameters are not provided under the NEPC (2013) publication, and for this reason the following documents were referenced for appropriate default criteria (or interpretation):

- NEPC (1999) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, for the $>C_{16}$-C_{35} and $>C_{35}$ aliphatic hydrocarbons;
- DEC (2006) *Guidelines for the NSW Site Auditor Scheme*, specifically the *NEHF A Health-Based Soil Investigation Levels*, for benzo(a)pyrene;
- Chapman and Murphy (1989) *Soil Landscapes of the Sydney 1:100,000 Sheet*, specifically Appendix 7.6, *Rankings for Laboratory Tests*, for the pH and EC data; and
- DEC (2005) *Guidelines for Assessing Former Orchards and Market Gardens*, for pesticide information.

The adopted health investigation levels (HILs) are presented alongside the analytical results in Table 1.

The Tier 1 Ecological Risk Assessment involved *Ecological Screening Levels* (ESLs), which were determined following the methodology (or directly from the tables) presented in Schedules B(1) and B(5b) of the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)* (NEPC, 2013). Where appropriate, the following documents were referenced for default criteria and/ or ambient background concentrations:

- NEPC (1999) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, specifically the *Interim Urban Ecological Investigation Levels* and the *Background Ranges*; and
- DEC (2006) *Guidelines for the NSW Site Auditor Scheme*, specifically the *Provisional Phytotoxicity-Based Investigation Levels*.

The adopted (calculated) ESLs are presented alongside the analytical results in Table 1.

Assessment of Soil Quality with Respect to Residential Land Use

Heavy Metals

Except for lead in HA5-1 (310 mg/kg), heavy metal concentrations in the tested, representative samples (HA2-1, HA3-1 and HA5-1) were all found to comply with the adopted HILs and ESLs.

According to the Contaminated Sites Monograph Series No.4, *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia*, the background range in soil lead for urban settings in Australia is 3-1465 mg/kg (Olszowy *et al.*, 1995). This publication also stated that "in old areas with low traffic flow in Brisbane, Sydney and Melbourne approximately 20% of samples were found to exceed the investigation threshold for lead" (that being 300 mg/kg). In a study of soil heavy metal levels in Glebe (Markus and McBratney, 1996), total lead concentrations ranged from 22-20,278 mg/kg, with fifty percent of the samples (collected from 219 separate sites) being above the 300 mg/kg guideline.

Hence, the elevated lead for HA5-1 (310 mg/kg) was considered to be minor and not of significance with respect to human health. Note that it complied with the adopted ESL.

TRHs and BTEX

No detectable concentration of either of the C_6-C_{10} (F1) and >C_{10}-C_{16} (F2) TRHs was identified in the tested samples (HA2-1, HA3-1 and HA5-1), with all laboratory quantitation limits being below the adopted HILs and ESLs.

Traces of the >C_{16}-C_{34} (F3) and >C_{34}-C_{40} (F4) TRHs were detected in all three samples (F3: 220-1100 mg/kg; F4: <100-200 mg/kg); however, the respective concentrations were below the corresponding HILs. Except for the >C_{16}-C_{34} (F3) TRHs in HA2-1 (1100 mg/kg) and HA3-1 (560 mg/kg), the concentrations were below the corresponding ESLs applicable to coarse textured soil. Note that all TRHs complied with the NEPC (2013) ESLs for fine textured soils.

No detectable concentration of any of the BTEX compounds was identified in the tested samples (HA2-1, HA3-1 and HA5-1), with all laboratory quantitation limits being below the adopted HILs and ESLs.

PCBs, OPPs and OCPs

No detectable concentration of any of the screened PCBs, OPPs and OCPs was identified in the tested samples (HA2-1, HA3-1 and HA5-1), with all laboratory quantitation limits being below the adopted HILs and ESLs (where available).

PAHs

No detectable concentration of any of the screened PAH compounds was identified in HA5-2, with all laboratory quantitation limits being below the adopted HILs and ESLs (where available).

Trace to elevated levels of various PAH compounds (including benzo(a)pyrene) were detected in the remaining samples (HA1-1, HA2-1, HA2-2, HA3-1, HA3-2, HA4-1, HA5-1 and HA6-1). Except for HA2-2 (610 mg/kg) and HA4-1 (390 mg/kg), the sum PAH concentrations were below the corresponding HIL (300 mg/kg), while all naphthalene concentrations (<0.5-1.8 mg/kg) were below the adopted HIL (3 mg/kg) and ESL (170 mg/kg). The benzo(a)pyrene (1.4-65 mg/kg)

concentrations exceeded the corresponding HIL (1 mg/kg) and ESL (0.7 mg/kg). Consequently, for most of these samples (HA1-1, HA2-1, HA2-2, HA3-1, HA4-1 and HA6-1), the sum carcinogenic PAHs (reported as benzo(a)pyrene toxicity equivalent quotient) exceeded the adopted HIL of 3 mg/kg.

The TCLP (weak acid-extractable) components were subsequently determined on sample HA2-1 and for most of the screened compounds (including benzo(a)pyrene), the concentration was below the corresponding quantitation limit (*Ref.* Appendix D), indicating that very low levels of extractable PAHs (<0.000002% by weight) were present in the soil (despite the high totals).

Using *Procedure D* from the EPA (1995) *Sampling Design Guidelines*, the 95% upper confidence limit of the arithmetic average concentration (95% UCL) for soil total PAHs was 275 mg/kg (n=9). This value complied with the adopted HIL (300 mg/kg).

Asbestos

Asbestos was not detected in any of the tested samples(HA2-1, HA3-1 and HA5-1).

pH and EC

The pH and electrical conductivity measurements were both performed on 1:5 soil/water extracts. For the tested samples, the pH readings fell within the 'moderate' (6-7.3) range, based on the rankings defined by Chapman and Murphy (1989). These results indicated that the soils were relatively (slightly) acidic; however, all values well were above 4, the threshold below which is indicative of actual ASSs.

The electrical conductivity readings suggested that the soils were low to moderate in soluble salt content (i.e. non- to slightly saline soil conditions). In combination with the field observations (*Ref.* Sections 4 and 5), these pH and EC results indicated an absence of actual ASSs (i.e. no previous oxidation of sulfides, resulting in acid soil).

8.0 RISK ASSESSMENT

Several (fill) soil samples were found to contain total PAH and benzo(a)pyrene (B(a)P) concentrations that exceeded the corresponding acceptance criterion for residential sites with gardens and accessible soil. In view of such findings, an assessment of the potential risks to human health and the environment, upon exposure to the site soil, was undertaken.

General Comments

1. Total PAH concentrations were generally below the adopted HIL (300 mg/kg). The site 95% UCL for total PAHs was 275 mg/kg, which complied with this threshold.

2. The B(a)P impacts were probably localised (i.e. within the topsoil filling; ≤0.3m BGL). The low levels of this contaminant in samples HA3-2 (0.3-0.4m BGL) and HA5-2 (0.4-0.5m BGL), supported this. Hence, the natural (undisturbed), clay-dominated soils that underlie the site were unlikely to have been significantly impacted by imported filling and previous land uses, and/or have assisted in preventing the migration of contaminants.

3. PAHs (including B(a)P) display strong affinities for soil particulate matter; hence, their mobilities in the environment are highly restricted. Based on the TCLP data for sample HA2-1, the leachable contents are extremely low (<0.000002% by weight), indicating that the bioavailable fractions are negligible.

4. Previous investigations by HEC have found similar (and greater) levels of PAHs in sub-surface soils from sites located in other residential areas of Sydney. PAHs are recognised as being widespread environmental contaminants derived from wood burning, the combustion and discharge of fossil fuels (including automobile exhausts) and industrial emissions (Benlahcen *et al.*, 1997; Van Brummelen *et al.*, 1996).

5. Most of the site is covered by impervious surfacing (e.g. a large building and detached garage, paving materials). Potential exposure is not expected to increase upon formally rezoning the land.

6. Persuant to the provisions in Clause 28 of the *Protection of the Environment Operations (Waste) Regulation 1996*, the EPA has authorised the general approval of the immobilisation of PAHs, including B(a)P, in ash- / coal- contaminated, excavated materials (Approval Number 1999/05). This approval is based on the theory that the residual PAHs will be naturally immobilised (i.e. strongly bound) within a vitrified carbonaceous and siliceous matrix.

   The examined topsoil fill was considered to comply with this waste stream because:

   - its colour (dark brown), texture ((gravelly) silty sand) and use (fill) were consistent with being an ash- / coal- contaminated soil material;
   - it did not contain any free (oily) liquid; and
   - despite elevated concentrations of total benzo(a)pyrene (mg/kg), the TCLP-leachable level was negligible (<0.001 mg/L).

   Therefore, in accordance with the provisions of EPA *General Approval Number 1999/05* and the procedures set out in the DECC (2009) *Waste Classification Guidelines*, the dark brown, fine grained, (gravelly) silty sand, topsoil fill would be classified as *General Solid Waste (Non-Putrescible)*.

Toxicity Assessment

Benzo(a)pyrene

B(a)P has a melting point of 179°C and a boiling point of 310-312°C. It is insoluble in water (ACGIH, 2001). Its toxicity, like most PAHs, is primarily concerned with chronic (carcinogenic) effects.

In terms of laboratory toxicity studies, a great amount of literature exists which conclusively demonstrates the carcinogenity of B(a)P to animals. B(a)P acts locally, as evidenced by tumor development, at the site of administration. It also acts systemically, however, an action best evidenced by pulmonary adenomas in mice resulting from any route of administration (Perera,

1981). B(a)P affects both male and female reproduction capacity and has been shown to cause gonadal dysplasia and reduced fertility in both sexes of mice (Klaassen *et al.*, 1986).

Based on human studies, the primary route of B(a)P exposure to populations as a whole is via inhalation, and the majority of epidemiological studies to date have investigated the correlation between mortality from lung cancer and B(a)P exposure. Although cigarette smoking, air pollution and occupational exposure are all significant means of inhalation exposure, it is generally agreed that cigarette smoking is the overwhelming factor in the causation of lung cancer (Carnow, 1978). Although chronic effects of lung cancer are of greatest concern, skin cancer, dermatitis, photoallergy, non-neoplastic respiratory disease and emphysema have also been implicated from various routes of B(a)P exposure (Carnow, 1978; NAS, 1972). Ingestion is also a potential pathway for exposure, primarily through hand-to-mouth contact.

Occupational exposure standards are derived from two principal sources: the Australian National Occupational Health and Safety Commission (NOHSC) and the American Conference of Governmental Industrial Hygienists (ACGIH).

NOHSC has classified B(a)P as a *Category 2 probable human carcinogen* for which there is sufficient evidence to provide a strong presumption that human exposure might result in the development of cancer. This evidence is generally based on appropriate long term animal studies, limited epidemiological evidence, or other relevant information without an assigned occupational exposure standard (NOHSC, 1995a; NOHSC, 1995b). B(a)P is **not** listed as either a *prohibited carcinogenic substance* or a *notifiable carcinogenic substance* in the NSW Occupational Health and Safety Regulation 2001.

Based on the positive results in animal carcinogenicity studies and the significant correlation between B(a)P exposure and lung cancer in limited studies, the ACGIH has designated B(a)P as a suspected human carcinogen (A2), without an assigned occupational exposure standard (no Threshold Limit Value (TLV)).

Total PAHs

In addition to B(a)P, four of the 15 PAHs screened during the laboratory analytical testing have carcinogenicity classifications assigned to them:

	NOHSC	ACGIH
Naphthalene	None (non-carcinogenic)	A4
Benz(a)anthracene	No data	A2
Chrysene	Category 3	A3
Benzo(b)fluoranthene	No data	A2

Notes:
Category 3 = Substances suspected of having carcinogenic potential are those substances which have possible carcinogenic effect on humans but in respect of which the available information is not adequate for making satisfactory assessment (NOHSC, 1995a)

A2 = suspected human carcinogen
A3 = confirmed animal carcinogen with unknown relevance to humans
A4 = not classifiable as a human carcinogen (ACGIH, 2001)

None of the PAHs is listed as either a *prohibited carcinogenic substance* or a *notifiable carcinogenic substance* in the NSW Occupational Health and Safety Regulation 2001.

Apart from naphthalene, the remaining 13 PAHs have no exposure standards assigned either by NOHSC or ACGIH. The exposure standards for naphthalene, assigned by both NOHSC (1995b) and ACGIH (2001), are 10 ppm for the time-weighted average (TWA; over 8 hrs) and 15 ppm for the short-term exposure limit (STEL; over 15 minutes).

The ACGIH classifies naphthalene and chrysene as substances that can penetrate intact skin and thus become absorbed into the body (ACGIH, 2001); however, none of the screened PAHs is classified as being able to penetrate intact skin by NOHSC (1995b).

Exposure Assessment

PAHs (including B(a)P) display low volatilities and are weakly dispersable/soluble in water. Instead, they display strong affinity towards the surfaces of soil particles. As a result there are two practical means of human exposure with respect to the surface filling at this site - inhalation of airborne soil particles (dusts) and skin contact. Future 'users' of the site represent those that may be exposed.

Based on the TCLP testing (*Ref.* Table 1 and Section 7), the PAH components that are extractable by weak (acetic) acid solution appear to be very low (<0.000002% by weight). This indicates that only minor proportions of the contaminants in this soil are in forms that are readily bioavailable.

Risk Characterisation

In nature, PAHs/B(a)P are considered environmental pollutants, usually bound to small particulate matter present in urban air, soils and industrial and natural combustion emissions. The majority of emissions are produced by combustion engines, coal heating furnaces, refuse burning, soil excavation/disturbance and cigarette smoke (the latter a particular source of PAHs). They are commonly found in the environment and their levels are often used as a rough index of air pollution. Humans are daily exposed to PAHs in air, water and food (PAHs are common in smoked foods).

The surface (topsoil) fill on this site contains elevated levels of B(a)P; however, given that PAHs are commonly detected in everyday materials, the level of potential exposure from the surface filling does not constitute a significant increase in the normal exposure rate.

Summary

The (gravelly) silty sand fill was regarded as being moderately contaminated by PAHs, but not representing a significant risk to human health, or the environment. In its current state, the site does not represent significant hazard, at least with respect to dust release and exposure (via inhalation). The ground surface is mostly covered by buildings, paving and vegetation, resulting in very low potential for soil disturbance/exposure. The PAH contamination is expected to diminish over time through natural attenuation.

The adopted soil investigation values were regarded as unnecessarily conservative, especially since PAHs are recognised as displaying low environmental bioavailabilities. On this basis, the site was

regarded as being suitable for residential use (i.e. residential zoning), in accordance with Clause 7 of *State Environmental Planning Policy No. 55 - Remediation of Land.*

9.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this preliminary environmental investigation (i.e. Tier 1 Risk Assessment), it was concluded that:

- the site was free of statutory notices issued by the EPA under the *Contaminated Land Management Act 1997*;
- the site did not have a recorded history of any contaminating activity taking place;
- no visual sign of contamination was detected in the shallow, sub-surface soils (i.e. ≤0.5m BGL);
- no suspicious odour suggesting the presence of contamination was detected in the shallow, sub-surface soils (i.e. ≤0.5m BGL); and
- except for the moderately elevated concentrations of total PAHs and benzo(a)pyrene in several samples, the representative soils collected from across the site were characterised by laboratory testing as meeting the adopted EPA-endorsed acceptance criteria for residential sites with gardens and accessible soil, for the parameters tested.

It was therefore considered that site soils do not represent a significant risk to human health or the environment. On this basis, the site was regarded as being suitable for rezoning and residential use, in accordance with Clause 7 of *State Environmental Planning Policy No. 55 - Remediation of Land.*

HEC hereby makes the following recommendations in relation to any future site development:

1. All waste materials designated for off-site disposal must be removed to appropriate landfill facilities by a suitably qualified contractor in accordance with the DECC (2009) *Waste Classification Guidelines*.
2. Any soils to be imported onto the site for the purpose of landscaping and/or back-filling excavated areas will require some form of validation which confirms their suitability for the proposed land use.

10.0 STATEMENT OF LIMITATIONS

This report has been prepared in accordance with the proposal between Hayes Environmental Consulting Pty Ltd and its client dated 22 August, 2013 (*HEC Ref.* PN1126). The limitations contained in that proposal apply to this report.

This report relies upon data, surveys, measurements and/or results taken at, or under, the particular times and conditions specified in this report. Any conclusions or recommendations only apply to the findings at that particular time.

Although land use may not be have been specified, the conclusions drawn by HEC are also based on interpretations of anecdotal and visual information that were made available during the course of this investigation.

Numerical data presented in this report are the result of discrete and specific sampling methodologies used in accordance with best industry practices and standards. Due to the site-specific nature of soil sampling from point locations, it is considered likely that all variations in subsurface conditions across a site cannot be fully defined, no matter how comprehensive the field investigation program.

No warranties are made as to the information provided in this report. All conclusions and recommendations made in this report are of the professional opinions of HEC personnel involved with the project and while normal checking of the accuracy of data has been conducted, any circumstances outside the scope of this report or which are not made known to HEC personnel and which may impact on those opinions are not the responsibility of HEC.

Should you require additional information or clarification regarding any aspect of this report, please call the undersigned on (02) 9529 3344 or 0413 356 802.

For and on behalf of,
HAYES ENVIRONMENTAL CONSULTING PTY LTD

WARWICK HAYES
Director
Environmental Chemist / Toxicologist

BSc (Hons), MAppSc (Environmental Toxicology), PhD
MRACI C.Chem, MAPESMA, MEIANZ

CHARTERED CHEMIST No. 9479
Dr Warwick Hayes
MRACI
THE ROYAL AUSTRALIAN CHEMICAL INSTITUTE

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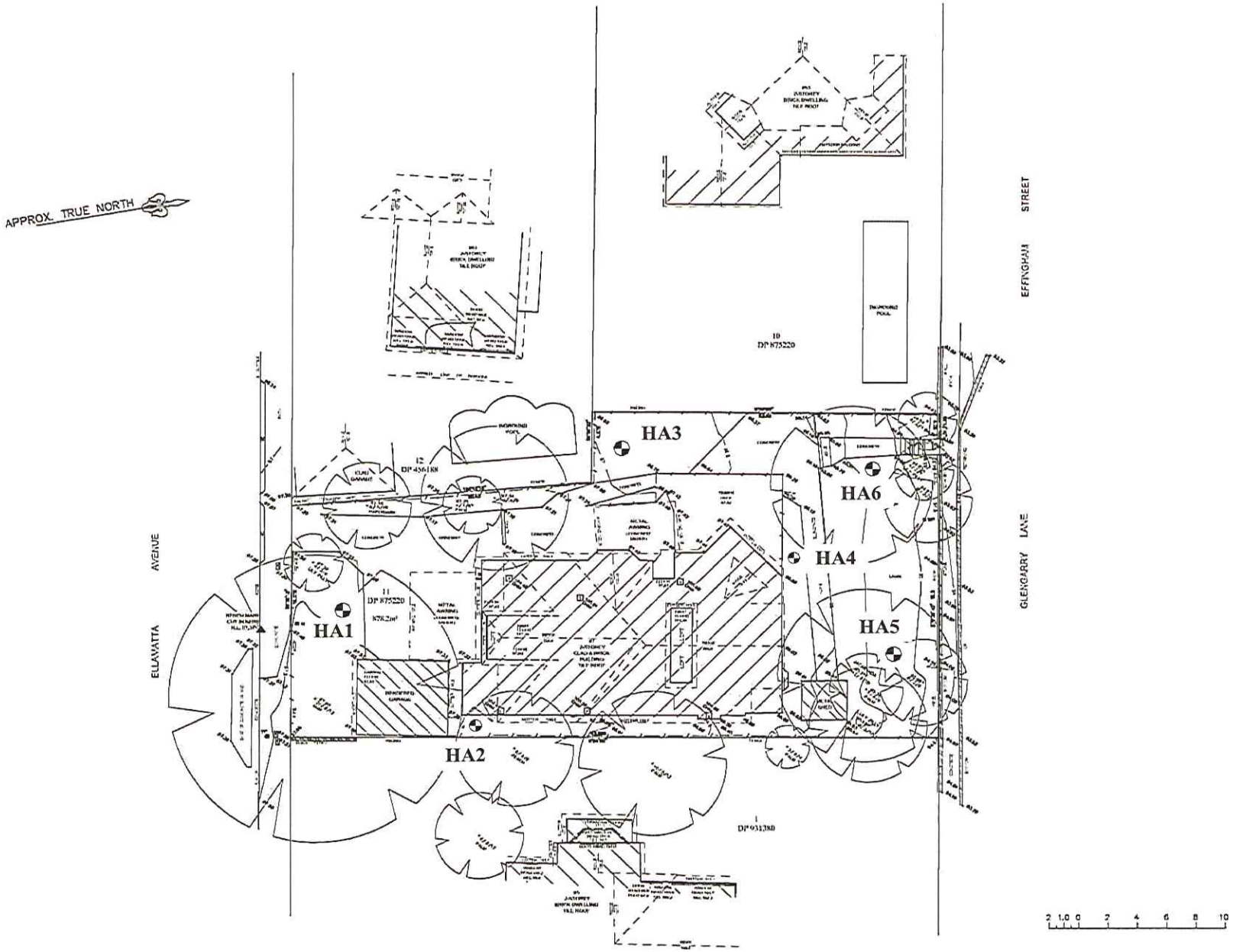
FIGURE



HEC investigation borehole location

Figure 1. Site Plan with Sampling Locations

HEC Project EP1126

Stage 1 Preliminary Environmental Site Investigation

7 Ellamatta Avenue, Mosman NSW 2088

Hayes Environmental Consulting Pty Ltd ABN 32 295 203 367

ATTACHMENT A

PROPERTY INFORMATION

PLAN FORM 2

Plan Drawing only to appear in this space

*OFFICE USE ONLY

DP 875220

SIGNATURE AND SEALS ONLY.

SIGNED BY ME THOMAS DUGGAN
AS DELEGATE OF THE HEALTH ADMINISTRATION CORPORATION, PURSUANT TO SECTION 21 (1) HEALTH ADMINISTRATION ACT, 1982 AND I HEREBY CERTIFY THAT I HAVE NO NOTICE OF THE REVOCATION OF SUCH DELEGATION

Crown Lands Office Approval

PLAN APPROVED ..... Authorised Officer

Land District .....

Paper No. .....

Field Book ..... pages .....

Council Clerk's Certificate

I hereby certify that —

(a) the requirement of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

*(b) the requirements of section 340 of the † Metropolitan Water, Sewerage and Drainage Act, 1924, as amended, † Hunter District Water, Sewerage, and Drainage Act, 1938, as amended

have been complied with by the applicant in relation to the proposed ..... subdivision .....

(Insert "new road", "subdivision" or "consolidated lot") set out hereon

Subdivision No. ..... 97/10 .....

Date ..... 25.8.97 .....

(Signature) .....

Council Clerk

Council File No. ..... FR 038/061 .....

*This part of certificate to be deleted where the application is only for a consolidated lot or the opening of a new road or where the land to be subdivided is wholly outside the areas of operations of the Metropolitan Water, Sewerage and Drainage Board and the Hunter District Water Board.

† Delete if inapplicable.

SURVEYOR'S REFERENCE: 5418 "CHECKLIST" MPD

SURVEY PRACTICE REGULATIONS 1933 - CLAUSE 52(2)

MARK	L.S.G. CO-ORDINATES		ZONE	ACC
	EASTING	NORTHING		
T.S. 10007	322 661·495	1 254 767·833	56/1	2
S.S.M. 20467	322 584·345	1 254 238·197	56/1	2
P.M. 33803	322 558·487	1 254 370·220	56/1	2

COMBINED SEA LEVEL AND SCALE FACTOR 0·99992

SOURCE: L.S.G. CO ORDINATES ADOPTED FROM DEPT OF C.A.L.M 11-9-96

DIAGRAM 1:40

Registered: 12-9-1998

C.A: 11297 /10 OF 25.8.1997.

Title System: TORRENS

Purpose: SUBDIVISION

Ref. Map: U 1852-82 *

Last Plan: DP 102184, DP 102185, DP 930704

PLAN OF SUBDIVISION OF LOT 1 D.P. 102184 & PART LOT 1 D.P. 930704 & LOT A D.P. 102185

Lengths are in metres. Reduction Ratio 1:4000

L.G.A. MOSMAN

Locality: MOSMAN

Parish: WILLOUGHBY

County: CUMBERLAND

This is Sheet 1 of my plan in sheets (Delete if unnecessary)

I, MALCOLM GORDON DRUMMOND of KEOWN & DRUMMOND PTY. LTD. 271A PITT STREET SYDNEY a surveyor registered under the Surveyors Act, 1929, as amended, hereby certify that the survey represented in this plan is accurate and has been made in accordance with the Survey Practice Regulation 1933 and was completed on the 25TH OCTOBER, 1996

Signature .....

Surveyor registered under Surveyors Act, 1929, as amended. Datum Line of Adoption. "D-L" cement date of survey.

Plans used in preparation of survey/compilation.

D.P. 3490	D.P. 102184
D.P. 103484	D.P. 102185
D.P. 355910	D.P. 531038
D.P. 852099	D.P. 852642
D.P. 930704 354990	D.P. 931380

PANEL FOR USE ONLY for statements of intension to dedicate public roads, to create public reserves, drainage reserves, easements, restrictions on the use of land or positive covenants.

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

0270/8 MT

Req:R378923 /Doc:DP 0875220 P /Rev:10-Mar-1998 /Sts:OK.OK /Prt:02-Apr-2013 15:47 /Pgs:ALL /Seq:1 of 1
Ref:NSW Crown Solicitors Office /Src:P

PKSURVEYS PTY LTD

PK SURVEYS PTY LTD
C303, 5 HUNTER STREET
WATERLOO NSW 2017
M: 0415 294 022
F: 02 4744 2460
E: ADMIN@PKSURVEYS.COM.AU

Jennifer Berry
28 Pearl Bay Ave
Mosman 2088

27th May 2013
Ref: 57344

Re: 7 Ellamatta Avenue, Mosman –
Survey of Features and Topography for Design Purposes

Dear Madam,

We have surveyed upon your instruction the Land comprised in Folio Identifier **11/875220,** being Lot **11** in Deposited Plan **875220** locality **Mosman**, Local Government Area of **Mosman**, Parish of **Willoughby**, County of **Cumberland** having frontage to **Ellamatta Avenue, Effingham Street** and **Glengarry Lane** (the subject land).

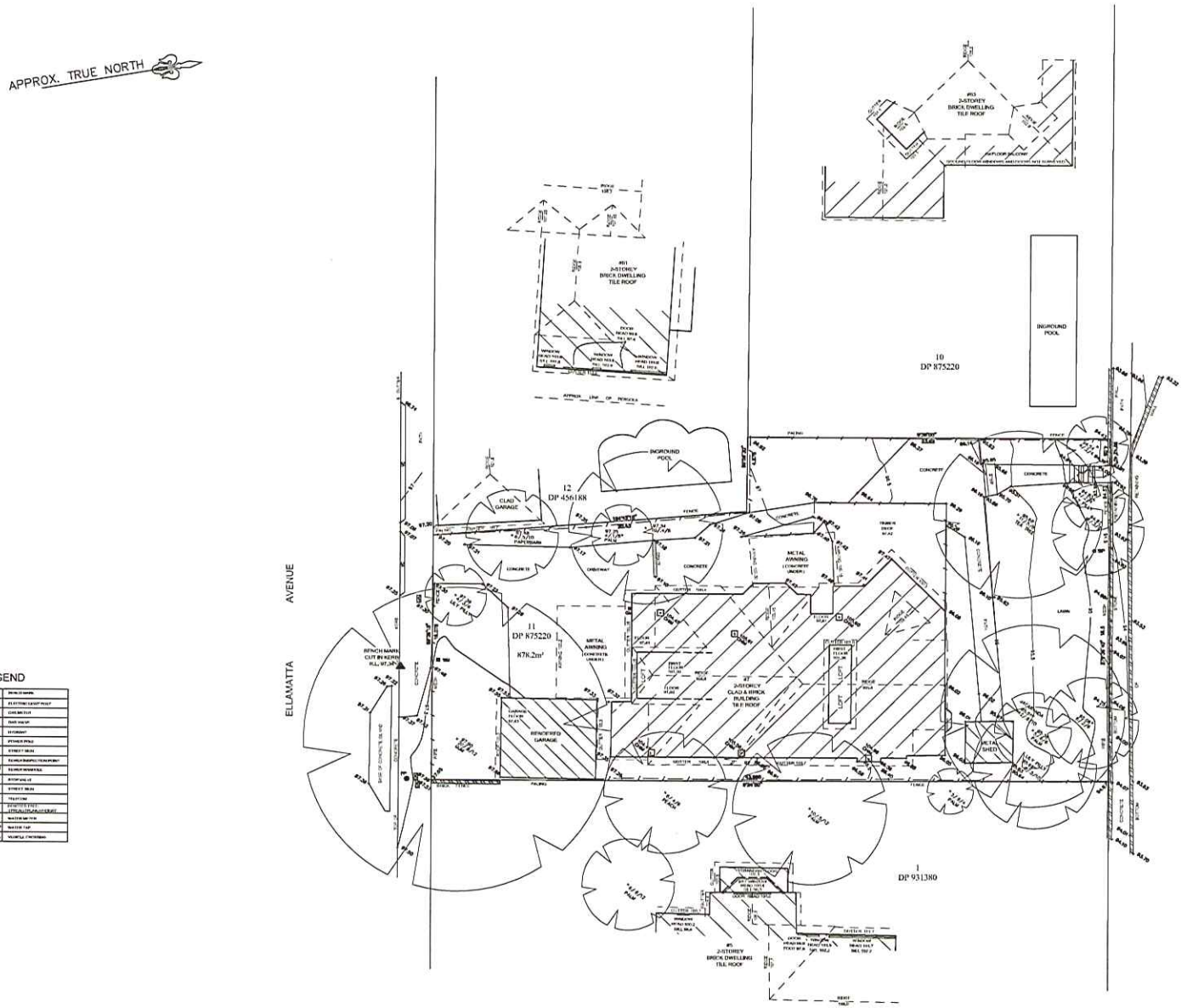
The subject land is not affected by any registered easements or rights of way.

The subject land has an area of 878.2m^2 by Deed.

We report that upon this land stands a two storey Brick and Clad Building with a Tile Roof known as 7 Ellamatta Avenue. Other structures include a Rendered Garage, Timber Deck and a Metal Shed.

This survey is for Design Purposes only and is limited to structures and features visible and accessible at the time of survey. This survey is not to be used to physically locate boundaries of the subject land. If any construction work is proposed it is advised that a Survey and marks are placed for the appropriate purpose.

.....
Paul Kardiasmenos
Director
Registered Surveyor #8381
BE Surv & SIS (Hons)
Member of the Institution of Surveyors (NSW)



LEGEND

▲	BENCH MARK
ELP	ELECTRICITY POST
GM	GAS METER
GV	GAS VALVE
HB	HYDRANT
PP	POWER POLE
SS	STREET SIGN
SP	SEWER INSPECTION PIPE
	SEWER MANHOLE
SV	STOP VALVE
TBM	STREET SIGN
TS	TELSTRA
47.23	SPOT LEVEL (TRAVERSE)
WM	WATER METER
T TAP	WATER TAP
	WATER TANK

NOTES

- THIS PLAN IS REFERRED TO IN OUR REPORT DATED 27 MAY 2013
- BOUNDARIES HAVE NOT BEEN MARKED
- NO SURVEY OF UNDERGROUND SERVICES HAS BEEN CARRIED OUT
- BOUNDARIES HAVE BEEN COMPILED FROM CURRENT PLANS HELD AT THE LAND AND PROPERTY MANAGEMENT AUTHORITY
- CONTOURS ARE INDICATIVE OF TOPOGRAPHY AND CANNOT BE USED TO INTERPOLATE LEVELS AT ANY POINT
- THIS SURVEY IS FOR DESIGN PURPOSES ONLY AND IS NOT TO BE USED FOR ANY CONSTRUCTION
- DATA MAY BE CAPTURED BY INDIRECT MEANS AND IS TO A STANDARD OF ACCURACY APPROPRIATE FOR THIS TYPE OF SURVEY
- ALL FEATURES, LEVELS AND CONTOURS SHOWN ON ADJOINING LOTS ARE INDICATIVE ONLY
- THIS SURVEY IS NOT TO BE USED TO DETERMINE THE LOCATION OF BOUNDARIES
- ORIGIN OF LEVELS WAS OBTAINED FROM SSM 20468 R.L. 93.638 AHD

2 1.0 0 2 4 6 8 10
SCALE 1:100@A0

PK Surveys Pty Ltd
C3035 Hunter Street
Waterloo NSW 2017
M: 0415 294 022
T: (02) 4744 2460
E: admin@pksurveys.com.au
PKSURVEYS

DETAIL AND LEVEL SURVEY OF
7 ELLAMATTA AVE, MOSMAN
LOT 11 IN DEPOSITED PLAN 875220

FOR: JENNIFER BERRY

JOB REF: 57344
DATE: 27 MAY 2013
SCALE: 1:100 @A0
CONTOUR INTERVAL: 0.5m
DATUM: AHD
P1 OF 1

ATTACHMENT B

BOREHOLE LOGS

Project No: EP1126

Log of Borehole: HA1

Project: Stage 1 PESI; 7 Ellamatta Avenue, Mosman NSW 2088

Client: Kevin Taylor / Jennifer Berry

Location: Mid-South Boundary

Engineer: HEC

SUBSURFACE PROFILE			Sample	Volatile Organic Concentration (Field PID) ppm 25 50 75	Lab Analysis
Depth	Symbol	Description			
0		Ground Surface			
		Topsoil Fill dark brown, fine grained, silty sand, organic matter, dry, no odour	HA1-1		
		Clayey Silty Sand brown, fine grained, some ironstone gravel, dry, no odour	HA1-2		
		Refusal on coarse ironstones at 0.3m BGL			
		End of Borehole			

Hole Size: 100mm

Drill Method: Hand Auger

Drill Date: 9 September, 2013

HEC HAYES ENVIRONMENTAL CONSULTING

Hayes Environmental Consulting Pty Ltd
ABN 32 295 203 367
ACN 102 528 192

Checked by: WH

Sheet: 1 of 1

Project No: EP1126

Log of Borehole: HA2

Project: Stage 1 PESI; 7 Ellamatta Avenue, Mosman NSW 2088

Client: Kevin Taylor / Jennifer Berry

Location: South East Boundary

Engineer: HEC

SUBSURFACE PROFILE			Sample	Volatile Organic Concentration (Field PID) ppm 25 50 75	Lab Analysis
Depth	Symbol	Description			
0		Ground Surface			
		Topsoil Fill dark brown, gravelly silty sand, dry, no odour	HA2-1		metals/TPH/BTEX/PAH OCP/OPP/PCB asbestos/pH/EC
		Silty Sandy Clay dark orange/red brown, firm, low to medium plasticity, ironstone gravel, dry, no odour			
		Refusal on firm clay and ironstones at 0.3m BGL	HA2-2		
		End of Borehole			

Hole Size: 100mm

Drill Method: Hand Auger

Drill Date: 9 September, 2013

Hayes Environmental Consulting Pty Ltd
ABN 32 295 203 367
ACN 102 528 192

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Sheet: 1 of 1

Project No: EP1126

Log of Borehole: HA3

Project: Stage 1 PESI; 7 Ellamatta Avenue, Mosman NSW 2088

Client: Kevin Taylor / Jennifer Berry

Location: Mid-West Boundary

Engineer: HEC

SUBSURFACE PROFILE			Sample	Volatile Organic Concentration (Field PID) ppm 25 50 75	Lab Analysis
Depth	Symbol	Description			
0		Ground Surface			
		Topsoil Fill dark brown, fine grained, silty sand, grass roots, dry, no odour	HA3-1		metals/TPH/BTEX/PAH OCP/OPP/PCB asbestos/pH/EC
		Clayey Silty Sand light brown, fine grained, dry, no odour			
		Silty Sandy Clay dark orange/red brown, firm, medium to high plasticity, ironstone gravel, dry, no odour	HA3-2		
		Refusal on firm clay and ironstones at 0.4m BGL			
		End of Borehole			

Hole Size: 100mm

Drill Method: Hand Auger

Drill Date: 9 September, 2013

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Project No: EP1126

Log of Borehole: HA4

Project: Stage 1 PESI; 7 Ellamatta Avenue, Mosman NSW 2088

Client: Kevin Taylor / Jennifer Berry

Location: Site Middle

Engineer: HEC

SUBSURFACE PROFILE			Sample	Volatile Organic Concentration (Field PID)	Lab Analysis
Depth	Symbol	Description		ppm 25 50 75	
0		Ground Surface			
		Topsoil Fill dark brown, fine grained, silty sand with some gravel, dry, no odour	HA4-1		
		Silty Sandy Clay dark orange/red brown, firm, low to medium plasticity, ironstone gravel, dry, no odour			
		Refusal on firm clay and ironstones at 0.4m BGL	HA4-2		
		End of Borehole			

Hole Size: 100mm

Drill Method: Hand Auger

Drill Date: 9 September, 2013

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Project No: EP1126

Project: Stage 1 PESI; 7 Ellamatta Avenue, Mosman NSW 2088

Client: Kevin Taylor / Jennifer Berry

Location: North East Corner

Log of Borehole: HA5

Engineer: HEC

SUBSURFACE PROFILE			Sample	Volatile Organic Concentration (Field PID) ppm 25 50 75	Lab Analysis
Depth	Symbol	Description			
0		Ground Surface			
		Topsoil Fill dark brown, fine grained, silty sand with some gravel, dry, no odour	HA5-1		metals/TPH/BTEX/PAH OCP/OPP/PCB asbestos/pH/EC
		Silty Clayey Sand light yellow/orange brown, medium grained, dry, no odour Refusal at 0.5m BGL	HA5-2		
		End of Borehole			

Hole Size: 100mm

Drill Method: Hand Auger

Drill Date: 9 September, 2013

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Project No: EP1126

Project: Stage 1 PESI; 7 Ellamatta Avenue, Mosman NSW 2088

Client: Kevin Taylor / Jennifer Berry

Location: North West Corner

Log of Borehole: HA6

Engineer: HEC

SUBSURFACE PROFILE			Sample	Volatile Organic Concentration (Field PID) ppm 25 50 75	Lab Analysis
Depth	Symbol	Description			
0		Ground Surface			
		Topsoil Fill dark brown, fine grained, silty sand with some gravel, dry, no odour	HA6-1		
		Silty Sand light brown, medium to coarse grained, some clay and gravel, dry, no odour			
		Refusal at 0.4m BGL	HA6-2		
		End of Borehole			

Hole Size: 100mm

Drill Method: Hand Auger

Drill Date: 9 September, 2013

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