Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

Project 73624.02
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KS:mm

Stockland Developments Pty Ltd
Level 25, 133 Castlereagh Street
Sydney NSW 2000

Attention: Mr Baki Bastepe

Email: baki.bastepe@stockland.com.au

Dear Sirs

Preliminary Stockpile Contamination Investigation
Yennora Distribution Centre,
Dennistoun Avenue, Yennora

1. Introduction

This letter report has been prepared by Douglas Partners Pty Ltd (DP) for the Yennora Distribution Centre, Dennistoun Avenue, Yennora (the 'site') in relation to an existing soil stockpile located at the site, as shown on the attached Drawing 1 (extract from DP, 2013). The investigation was commissioned by Mr Baki Bastepe of Stockland Developments Pty Ltd in support of a development application for a proposed new building (Building 8A at the location of the existing stockpile) and the removal and relocation of the existing stockpiled material as an acoustic mound along the Dennistoun Avenue frontage (near Building 1).

The objective of the investigation was to assess the suitability of the stockpiled material for the proposed use as an acoustic mound within the site. DP previously assessed the stockpile for legal removal off-site (which was the plan at the time) and this was documented in the report entitled *Preliminary Waste Classification Report, Earthen Mound at Yennora Distribution Centre, Dennistoun Avenue, Yennora*, report reference 73624.01, dated 17 October 2013 (DP, 2013). The field and analytical data presented in DP (2013) has been compared against appropriate site assessment criteria to assess the suitability of the stockpile to remain within the site.

2. Site Description and Previous Works

The subject stockpile is located in the north western portion of the Yennora Distribution Centre (the site) and is bounded by Building 2 to the east, Buildings 3 and 8B to the south and west and bushland to the north.

The inspection of the stockpile (as reported in DP, 2013) indicated that the area of the stockpile is approximately 7,500 m^2 and the estimated height varied significantly from a minimum of 2 m in the

southern portion of the stockpile to a maximum of 6 – 7 m in the northern central portion of the stockpile, with an average height of approximately 4.5 m. The estimated volume of the stockpile was approximately or greater than 15,000 m^3.

The stockpile was observed to be overgrown with weeds, and the northern and western edge slopes were steep.

Based on a review of previous aerial photographs and through discussions with site personnel it was noted that much of material at the base of the mound (stockpile) was potentially sourced from natural materials excavated during the development of Buildings 8B and 9 between 2005 and 2007. However, it appeared that since then the site had been used as a storage area for spoil and various construction and demolition waste over the past few years. Subsequent development of Building 10 may have contributed spoil with construction and demolition waste to the eastern edge of the mound.

Sampling of the stockpile was undertaken by an Environmental Scientist from DP on 25 September 2013. A total of 12 test pits (TP1 to TP12) were excavated using an excavator, to a maximum depth of 3 m below the surface of the stockpile. Chemical analysis was conducted on twelve selected soil samples for the following potential contaminants:

- The priority heavy metals arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc;
- Polycyclic aromatic hydrocarbons (PAH);
- Total recoverable hydrocarbons (TRH) (as an estimate for Total Petroleum Hydrocarbons (TPH));
- Benzene, toluene, ethyl benzene and xylenes (BTEX);
- Organochlorine pesticides (OCP);
- Organophosphate pesticides (OPP);
- Total Phenols;
- Polychlorinated biphenyls (PCB); and
- Asbestos.

The test pit locations are shown on the attached Drawing 2 (extract from DP, 2013).

The reported field observations were as follows:

- Soil excavated generally comprised sandy and/or silty clay fill with some gravel;
- Potential asbestos containing material (ACM) was observed in Test Pit 3;
- Construction and demolition waste were observed in Test Pits 1, 2, 7, 8 and 12; and
- Ash and slag were observed in Test Pits 3, 6, 9, 10 and 12.

3. Assessment Criteria

The site assessment criteria (SAC) have been sourced from the National Environment Protection Council (NEPC) *National Environment Protection Measure (Assessment of Site Contamination)* 1999, as amended 2013 (NEPC 2013) and comprise health and ecological investigation and screening levels applicable to an industrial form of development. The laboratory Practical Quantitation Limit (PQL) has also been adopted as a screening level for some contaminants.

3.1 Health Investigation Levels

Table 1 shows the health investigation levels (HILs) that have been adopted by NEPC (2013) Schedule B1, Table 1A (1), for commercial/industrial land uses.

Table 1: Health Investigation Levels (Non-petroleum Chemical Contaminants)

Contaminant	HIL D – Commercial/Industrial (mg/kg)
Metals and Inorganics	
Arsenic	3,000
Cadmium	900
Chromium (IV)	3,600
Copper	240,000
Lead	1,500
Manganese	60,000
Mercury (inorganic)	730
Nickel	6,000
Zinc	400,000
PAH	
Carcinogenic PAH (as benzo(a)pyrene TEQ)	40
Total PAH	4,000
Phenols	
Phenol	240,000
OCP	
DDT + DDD + DDE	3,600
Aldrin + Dieldrin	45
Chlordane	530
Endosulfan (total)	2,000
Endrin	100
Hepatchlor	50
HCB	80
Methoxychlor	2,500

Contaminant	HIL D – Commercial/Industrial (mg/kg)
Other Pesticides	
Chlorpyrifos	2,000
Other Organics	
PCB	7

3.2 Petroleum Contaminants (Health Screening Levels and Management Limits)

Health Screening Levels

Table 2 shows the health screening levels (HSLs) for petroleum hydrocarbon compounds adopted from the *Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) Technical Report no.10 Health screening levels for petroleum hydrocarbons in soil and groundwater* (2011) as referenced by NEPC (2013), for a commercial / industrial land use and well as an intrusive maintenance worker. As the mound will not be supporting a building, only the direct contact pathway has been considered in developing the HSLs,

Table 2: Direct Contact Health Screening Levels

Contaminant	HSL D Commercial/Industrial	Intrusive Maintenance Worker
Toluene	99,000	120,000
Ethylbenzene	27,000	85,000
Xylenes	81,000	130,000
Naphthalene	11,000	29,000
Benzene	430	1,100
C_6-C_{10}	26,000	82,000
>C_{10}-C_{16}	20,000	62,000
>C_{16}-C_{34}	27,000	85,000
>C_{34}-C_{40}	38,000	120,000

Management Limits (TRH Only)

NEPC (2013) Table 1B (7) provides 'management limits' for TRH fractions, which are applied after consideration of relevant HSLs. The management limits have been adopted to avoid or minimise the following potential effects of petroleum hydrocarbons:

- Formation of non-aqueous phase liquids (LNAPL);
- Fire and explosive hazards; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons.

The presence of site TRH contamination at the levels of the management limits does not imply that there is no need for administrative notification or controls in accordance with jurisdictional

requirements. The adopted management limits are shown in Table 3. Management limits for coarse material are presented since variable sand and clay textures were encountered in the samples collected, and coarse texture management limits are the more conservative of the two management limits available.

Table 3: Management Limits for TRH Fractions in Soil

TRH Fraction	Soil Texture	Management Limit: Commercial/Industrial (mg/kg)
C_6-C_9 [F1]	Coarse	700
>C_{10}-C_{16} [F2]	Coarse	1,000
>C_{16}-C_{34} [F3]	Coarse	3,500
>C_{34}-C_{40} [F4]	Coarse	10,000

3.3 Ecological Investigation Levels

Ecological Investigation Levels (EIL) have been derived for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems (NEPC, 2013). EIL depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL). The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required.

The EIL is calculated using the following formula:

EIL = ABC + ACL,

The ABC is determined through direct measurement at an appropriate reference site (preferred) or through the use of methods defined by Olszowy et al *Trace element concentrations in soils from rural and urban areas of Australia*, Contaminated Sites monograph no. 4, South Australian Health Commission, Adelaide, Australia 1995 (Olszowy, 1995) or Hamon et al, *Geochemical indices allow estimation of heavy metal background concentrations in soils*, Global Biogeochemical Cycles, vol. 18, GB1014, (Hamon, 2004). ACL is based on the soil characteristics of pH, CEC and clay content.

EIL (and ACLs where appropriate) have been derived in NEPC (2013) for only a short list of contaminants comprising As, Cu, Cr (III), DDT, naphthalene, Ni, Pb and Zn. An *Interactive (Excel) Calculation Spreadsheet* may be used for calculating site-specific EIL for these contaminants, and has been provided in the ASC NEPM Toolbox available on the SCEW (Standing Council on Environment and Water) website (http://www.scew.gov.au/node/941).

The adopted EIL, derived from Tables 1B (1) to 1B(5), Schedule B1 of NEPC (2013) the *Interactive (Excel) Calculation Spreadsheet* are shown in the following Table 4. The following site specific data and assumptions have been used to determine the EILs:

- The EILs will apply to the top 2 m of the final soil profile;
- Given the likely source of soil contaminants (i.e. historical fill) the contamination is considered as "aged" (>2 years); and
- ABCs have been derived using the *Interactive (Excel) Calculation Spreadsheet* using assumed input parameters of aged soil, average CEC of 10 $cmol_c/kg$, average pH of 6, and clay content of 5%, for low for traffic volumes.

Table 4: Ecological Investigation Levels (EIL) in mg/kg

Analyte		EIL	Comments
Metals	Arsenic	160	Adopted pH of 6, CEC of 10 $cmol_c/kg$; assumed clay content 5%
	Copper	280	
	Nickel	290	
	Chromium III	530	
	Lead	1,800	
	Zinc	620	
PAH	Naphthalene	370	
OCP	DDT	640	

3.4 Ecological Screening Levels – Petroleum Hydrocarbons

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESL apply to the top 2 m of the soil profile as for EIL.

ESL have been derived in NEPC (2013) for petroleum fractions F1 to F4 as well as BTEX and benzo(a)pyrene. Site specific data and assumptions as summarised in Table 5 have been used to determine the ESL. The adopted ESL, from Table 1B(6), Schedule B1 of NEPC (2013) are shown in Table 6.

Table 5: Inputs to the Derivation of ESL

Variable	Input	Rationale
Depth of ESL application	Top 2 m of the soil profile	The top 2 m depth below ground level corresponds to the root zone and habitation zone of many species.
Land use	Commercial and industrial	Continued commercial / industrial use proposed
Soil Texture	Coarse	Sand logged in the test pits

Table 6: Ecological Screening Levels (ESL) in mg/kg

Analyte		ESL	Comments
BTEX	Benzene	75	All ESLs are low reliability
	Toluene	135	
	Ethylbenzene	165	
	Xylenes	180	
PAH	Benzo(a)pyrene	1.4	

3.5 Asbestos

Presence/absence testing for asbestos was conducted as part of DP (2013). As such the laboratory reporting limit of 0.1 g/kg has been adopted as the SAC for asbestos.

4. Analytical Results

Laboratory samples as reported in DP (2013) were sent to a NATA accredited laboratory for analysis of selected contaminants of potential concern (COPC). The report laboratory results are presented in the attached Table 7, together with the adopted SAC.

All analytical results were within the adopted SAC with the exception of asbestos detected in sample TP12/1 m.

5. Conclusion

Based on the data collected in 2013, the stockpile is considered to be suitable to remain on site subject to the following:

- Conduct additional sampling in accordance with NEPC (2013) and the NSW EPA sampling design guidelines, including further more detailed assessment of asbestos in accordance with the

procedure outlined in NEPC (2013) and the WA Department of Health *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, 2009. The supplementary sampling and testing will take place during the construction phase;

- On completion of the environmental sampling a report must be prepared by a suitably qualified environmental consultant outlining the outcomes of the investigation and provision of management recommendations (if required); and
- Implementation of the management recommendations provided in the report.

6. Limitations

Douglas Partners (DP) has prepared this report for this project at Dennistoun Avenue, Yennora NSW for Stockland Developments Pty Ltd, in accordance with Douglas Partners proposal dated 2 February 2016, and acceptance received on 12 February 2016. The work was carried out under DP's conditions of Engagement. This report is provided for the exclusive use of Stockland Developments Pty Ltd for the specific project and purpose as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are considered to be indicative of the sub-surface conditions on the site only to the depths investigated at the specific sampling and/or testing locations, and only at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Please contact either of the undersigned for clarification of the above as necessary.

Yours faithfully
Douglas Partners Pty Ltd

Reviewed by

Kathryne Sargent
Environmental Scientist

PP **Paul Gorman**
Senior Associate

Attachments: Drawings 1 and 2 (from DP, 2013)
Table 7
Notes About this Report

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Stockland Developments Pty Ltd		TITLE: **Locality Map** **Waste Classification Assessment** **Yennora Distribution Centre, Cnr Dennistoun Ave & Byron Rd, Yennora**	PROJECT No:	73624.01
	OFFICE: Sydney	DRAWN BY: WFY		DRAWING No:	1
	SCALE: NTS	DATE: 24.09.13		REVISION:	0

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Stockland Developments Pty Ltd		TITLE: **Location of Test Pits** **Preliminary Waste Classification Assessment** **Yennora Distribution Centre, Cnr Dennistoun Ave & Byron Rd, Yennora**	PROJECT No:	73624.01
	OFFICE: Sydney	DRAWN BY: WFY		Drawing	2
	SCALE: NTS	DATE: 09.10.13		REVISION:	0

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Table 7: Results of Laboratory Testing (All results in mg/kg unless otherwise stated)

Sample Identification	Sample Depth (m)	Type	Heavy Metals								Polycyclic Aromatic Hydrocarbons (PAH)		Total Recoverable Hydrocarbons (TRH)		Monocyclic Aromatic Hydrocarbons (BTEX)				Total Phenol	PCB	OPP_6	OCP^6	Asbestos
			Arsenic	Cadmium	Chromium[5]	Copper	Lead	Mercury	Nickel	Zinc	Benzo(a)pyrene	Total PAH	C6-C9	C10-C36	Benzene	Toluene	Ethyl-benzene	Total Xylene					
			total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	total (mg/kg)	
TP1	1	Fill	<4	<0.4	16	30	25	<0.1	28	47	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP2	3	Fill	10	<0.4	21	32	21	<0.1	24	69	0.07	0.3	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP3	1	Fill	10	<0.4	16	23	22	<0.1	14	47	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP4	1.5	Fill	7	<0.4	15	18	20	<0.1	8	30	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP5	2.5	Fill	6	<0.4	13	11	20	<0.1	5	28	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP6	3	Fill	5	<0.4	10	20	17	<0.1	8	34	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP7	1	Fill	<4	<0.4	32	43	17	<0.1	29	49	0.27	2.7	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP8	1	Fill	7	<0.4	220	25	22	<0.1	11	42	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP9	2.3	Fill	<4	<0.4	4	12	9	<0.1	5	24	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP10	1.5	Fill	6	<0.4	6	32	19	<0.1	29	91	<0.05	<PQL	<25	280	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	NAD
TP11	2.5	Fill	7	<0.4	15	27	18	<0.1	17	38	<0.05	<PQL	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	0.1	NAD
TP12	1	Fill	11	<0.4	22	29	25	<0.1	16	49	0.21	2.1	<25	<250	<0.2	<0.5	<1	<3	<5	<PQL	<PQL	<PQL	Asbestos Detected
Assessment Criteria																							
NEPC (2013) Table 1A(1) HILs Commercial/Industrial D Soil			3,000	900	3,600	240,000	1,500	730	6,000	400,000	40**	4,000	-	-	-	-	-	-	240,000	7	-	-	NAD
NEPC (2013) Direct Contact HSL Comm/Ind D			-	-	-	-	-	-	-	-	-	-	26,000*	-	430	99,000	27,000	81,000	-	-	-	-	-
NEPC (2013) Direct Contact HSL Intrusive Maintenance Worker			-	-	-	-	-	-	-	-	-	-	82,000*	-	1,100	120,000	85,000	130,000	-	-	-	-	-
NEPC (2013) Table 1B(7) Management Limits Commercial/Industrial, Coarse S			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEPC (2013) Tables 1B(1) to 1B(5) EILs commercial / industrial			160	-	670	320	1800	-	460	1,200	-	370[2]	-	-	-	-	-	-	-	-	-	240[3]	-
NEPC (2013) Table 1B(6) ESLs - Commercial and Industrial (Coarse)			-	-	-	-	-	-	-	-	1.4	-	-	-	75	135	165	180	-	-	-	-	-

Notes

1	Intra-laboratory Replicate sample of sample TP11/2.5
1A	Inter-laboratory Replicate sample of sample TP3/1
2	Napthalene
3	DDT
5	All Chromium are assumed to exist in the stable Cr(III) oxidation state, as Cr(VI) will be too reactive and unstable under the normal environment
6	All concentrations below laboratory PQL
7	Some thresholds apply, not detailed herein as all results <PQL
-	Not Tested/Not Applicable/Not Defined
*	Based on C_6-C_{10} in NEPM
**	Based on B(a)P TEQ
a	Default values for aged soil have been used
NAD	No Asbestos Detected at Reporting Limit of 0.1g/kg; Respirable Fibres Not Detected
RPD	Relative percentage difference

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.