Douglas Partners

Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Contamination Investigation

Part Coopers Paddock
Governor Macquarie Drive
Warwick Farm

Prepared for
Stockland Development Pty Ltd

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Abbreviations

ABC	ambient background concentration
ACL	added contaminant limits
AEC	area of environmental concern
ANZECC	Australian and New Zealand Environmental & Conservation
ARCP	asbestos removal control plan
AS	Australian Standard
As	arsenic
B(a)P	benzo(a)pyrene
BaP TEQ	benzo(a)pyrene toxic equivalent
bgl	below ground level
BH	borehole
BTEX	benzene, toluene, ethyl benzene, xylenes
C10-C36	heavy fraction TPH molecules, 10 to 36 carbon atoms
C6-C9	volatile fraction TPH molecules, 6 to 9 carbon atoms
Cd	cadmium
CLM Act	Contaminated Land Management Act
COC	chain of custody
Cr	chromium
Cr(III)	chromium with oxidation state III (stable in normal environments)
Cr(VI)	chromium with oxidation state VI (typically not stable in normal environments)
CRC Care	Co-operative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	conceptual site model
Cu	copper
DA	development application
DCE	dichlororethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DECCW	NSW Department of Environment, Climate Change and Water (now superceded)
DP	Douglas Partners
D.P.	Deposited Plan
DQI	data quality indicator
DQO	data quality objective
DSI	detailed site (contamination) investigation
EIL	ecological investigation levels
ELS	Envirolab Services Pty Ltd
EPA	Environment Protection Authority
ESL	ecological screening level
F1	TPH fraction C6-C10
F2	TPH fraction >C10-C16
F3	TPH fraction >C16-C34
F4	TPH fraction >C34-C40
FA	friable asbestos
Fe	iron
ha	hectares

Hg	mercury
HHRA	human health risk assessment
HIL	heath investigation level
HMTV	hardness modified trigger value
HSL	health screening level
ISO	International Standards Organisation
LOR	limit of reporting
m	metre
mg/kg	milligrams per kilogram
N/A	not applicable
NATA	National Association of Testing Authorities
ND(nd)	not detected above the practical quantitation limit
NHMRC	National Health and Medical Research Council
NEPC	National Environment Protection Council
NEPM	National Environmental Protection (Assessment of Site Contamination) Measure
Ni	nickel
NL	not limiting
NRMMC	National Resource Management Ministerial Council
OCP	organochlorine pesticides
OEH	Office of Environment and Heritage
PAH	polycyclic aromatic hydrocarbons
Pb	Lead
PCB	polychloride biphenyls
pH	unit measure of acidity/ alkalinity
PID	photoionisation detector
POEO Act	Protection of the Environment Operations Act
PSI	preliminary site investigation
PQL	practical quantitation limit
QA	quality assurance
QA/QC	quality assurance/ quality control
QC	quality control
RPD	relative percentage difference
SAC	site assessment criteria
SAQP	sampling and analysis quality plan
SAQP	sampling, analysis and quality plan
TEQ	toxicity equivalency quotient
TPH	total petroleum hydrocarbons
TRH	total recoverable hydrocarbons
US EPA	United States Environmental Protection Agency
VOC	volatile organic compounds
WA DoH	Western Australia Department of Health
Zn	zinc
%	percent
<	less than
≤	equal to or less than
>	greater than
≥	equal to or greater than

Executive Summary

This report details the methodology and results of a contamination investigation undertaken by Douglas Partners Pty Ltd (DP) at part of Coopers Paddock, directly south of Governor Macquarie Drive, Warwick Farm. Coopers Paddock is currently registered as Lot 1 in Deposited Plan 581034 with a total area in the order of 29 hectares. The subject site is of irregular shape and has a total area of approximately 10 hectares, located in the north portion of Coopers Paddock.

It is understood that Stockland propose to purchase the site for a warehouse development comprising several large warehouse buildings, associated loading docks and car parking facilities, surrounded by landscaping.
The contamination investigation was a limited "due diligence" investigation aimed at providing some information on contamination issues that may be present at the site.

DP previously completed a Phase 1 contamination assessment at the site (DP, 2010). The assessment identified potential contamination sources including filling, fly tipping, hazardous building materials and previous agricultural chemical use. However, the potential for contamination was considered overall to be low.

This contamination investigation included soil sampling and testing from eight (8) bores positioned primarily for geotechnical investigation purposes, and groundwater testing from three (3) groundwater monitoring wells. Soil samples were analysed for potential contaminants and screened for acid sulphate soil (ASS) potential.

The bores identified a profile of topsoil / fill overlying variable clays and sands, then sandstone bedrock. Groundwater was found in two of the monitoring wells at depths of greater than 6 m below ground level.

The analyte concentrations in the soil and groundwater samples tested were below the adopted site assessment criteria. Some elevated PAH and TRH in groundwater is attributed to the drilling process and not considered to be representative of groundwater conditions beneath the site.

Based on the field and analytical results presented in this report, it is concluded that the site, as shown on Drawing 1, is compatible, from a contamination standpoint, for the proposed warehouse development as outlined in Section 1, subject to the following:

- Further rounds of groundwater sampling and testing due to the minor concentrations of TRH and PAH detected;
- Additional soil sampling and testing to provide more confidence in the results reported herein. The additional works should include testing for contaminants of concern and ASS conditions and could also be used to waste classify materials destined for off-site disposal;
- A hazardous building materials survey to identified hazardous building materials in the existing buildings (stables) on site;
- Demolition and removal of any hazardous materials by a contractor licensed for such activities, in accordance with WorkCover approved methods;
- Validation of the building footprints by an environmental consultant, once removed; and

- Development and implementation of an "unexpected finds" protocol, incorporated into a site management plan for future civil works, which identifies investigation, remediation and/or management actions to be implemented in the event of a discovery of an unexpected contamination source.

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Report on Contamination Investigation
Part Coopers Paddock
Governor Macquarie Drive, Warwick Farm

1. Introduction

This report details the methodology and results of a contamination investigation undertaken by Douglas Partners Pty Ltd (DP) at part of Coopers Paddock, directly south of Governor Macquarie Drive, Warwick Farm. The contamination investigation was commissioned by Stockland Development Pty Ltd (Stockland) and carried out in general accordance with DP's proposal dated 25 June 2014.

Cooper's Paddock forms part of the Warwick Farm Racecourse land holding to the south of Governor Macquarie Drive. It is understood that Stockland propose to purchase the northern part of Cooper Paddock for a warehouse development comprising several large warehouse buildings, associated loading docks and car parking facilities, surrounded by landscaping. The Masterplan of the propose development at the time of preparing this report is shown on Drawing 4429_SK014 in Appendix A.

At the time of preparing this report, Cooper's Paddock was used by Warwick Farm Racecourse as a training facility for racehorses.

The objectives of the contamination investigation are to:

- Investigate, through intrusive sampling and testing, the potential for contamination identified in the DP *Phase 1 Contamination Assessment* report dated 22 September 2010 (DP, 2010);
- Identify areas of contamination or potential contamination, and affected media;
- Identify potential human and ecological receptors; and
- Provide an opinion on the suitability of the site for the proposed development.

The DSI was conducted and reported with reference to the National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure 1999 as* amended 2013 (NEPC, 2013). Furthermore, soil and groundwater sampling was limited to eight (8) bore locations as requested by Stockland.

The contamination investigation was carried out concurrently with a geotechnical investigation which has been reported separately.

2. Background

The following relevant contamination investigation was previously conducted on the whole of Coopers Paddock, and was reviewed by DP as part of this contamination investigation:

- DP Report on *Phase 1 Contamination Assessment, Part Warwick Farm Racecourse*, prepared for Australian Jockey Club Ltd, Project 71999, 2 September 2010 (DP, 2010).

DP (2010) included a desktop study of site history sources (including historical photograph records, historical titles deeds, WorkCover records on the NSW Dangerous Goods Database, and a groundwater bore search) and a site walkover inspection.

The site was identified as the southern portion of the Warwick Farm Racecourse, which is located to the south of Governor Macquarie Drive, Warwick Farm. The site is approximately 29 hectares. DP understood that the Phase 1 contamination assessment was required in order to satisfy Liverpool Council's conditions in relation to rezoning and the future liability on the transfer of part of the property to Council.

At the time of the investigation the site was being used as a training ground for race horses. Much of the property was covered in lantana, blackberry and native bush. Areas that were maintained were generally paddocks used after training and tracks for vehicular and horse passage.

A search of the site history indicated that the site was used for residential, horse stud and training ground purposes. Prior to the 1920s it is unknown whether the land (known as "Stroud Farm") was used for livestock or market garden purposes. The Australian Jockey Club (AJC) purchased the land in 1923 and the area was used as supplementary land to the Warwick Farm Racecourse. The site has historically been used by AJC for horse training, with some stables.

Based on the then current and historical uses of the site, the potential for contamination associated with the site was generally considered low to moderate. The potential contamination risks were considered to be associated with:

- The potential historical use of fibrous cement products potentially containing asbestos;
- The potential historical use of lead based products in paint (stables);
- The potential historical use of the site for agricultural purposes;
- The dumping of anthropogenic goods into the bushland areas across the site; and
- The potential for fill across the site associated with the site formation and levelling.

Recommendations in regard to the conclusions of the desktop study were:

- Fill - there was no direct evidence suggesting significant fill across the site. However, there was considered to be some potential for fill to be present.
- The removal of any hazardous building materials from the site (if present) should be conducted in accordance with the WorkCover codes and standards;
- Any anthropogenic items, including tyres, household and electronic goods observed across the site should be disposed of at a suitable landfill, licensed to accept household waste;
- Soil sampling should be conducted in previously developed areas to ascertain whether potential contaminates of concern exist in surface soils (asbestos, pesticides, lead). Soil sampling should be generally based on NSW DECCW guidelines;
- Prior to redevelopment an unexpected finds protocol should be implemented.

3. Scope of Works

The scope of works for the contamination investigation was as follows:

- Review of DP (2010);
- A walkover of the subject site to identify current features, any areas of environmental concern (e.g. filling and fly tipping) and accessible areas for intrusive investigations;
- Positioning of 8 test bores (BH1 to BH8) across accessible areas of the site to provide a general coverage. The bores were positioned primarily to assess ground conditions at proposed warehouse building locations;
- Collection of soil samples from the test bores and submission of selected samples to a NATA accredited laboratory for a general suite of contaminants comprising the following:-
  - The priority heavy metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn);
  - Polycyclic aromatic hydrocarbon (PAH);
  - Total recoverable hydrocarbon (TRH)
  - Benzene, toluene, ethylbenzene and xylene (BTEX);
  - Organochlorine pesticides (OCP);
  - Organophosphorus pesticides (OPP);
  - Polychlorinated biphenyl (PCB);
  - Phenols;
  - Asbestos; and
  - QA/QC samples.
- Analysis of a selected number of samples for general physical properties including pH, chloride and sulphate content;
- Screening of soil samples for potential acid sulphate soils (PASS) and laboratory analysis of selected soil samples at a NATA accredited laboratory;
- Installation of three (3) groundwater monitoring wells in three of the bores (BH1, BH7 and BH8;
- Development of the wells by removal of a three borehole volumes or until dry. Micropurge wells, and once field parameters had stabilised (where possible), sample groundwater using low flow techniques;
- Analysis of groundwater samples for the following:
  - Heavy metals – arsenic, cadmium chromium, copper, lead, manganese, mercury, nickel, zinc
  - TRH;
  - BTEX;
  - VOC;
  - PAH (low level);
  - Phenols;
  - PCB;
  - OCP;

- QA/QC samples

- Assessment of soil and groundwater analytical data against appropriate health and ecologically based investigation and screening levels;
- Assessment of soil analytical data against appropriate health and ecologically based investigation and screening levels; and
- Preparation of this report.

4. Site Identification and Description

4.1 Site Identification

Coopers Paddock is currently registered as Lot 1 in Deposited Plan 581034 and occupies a total area in the order of 29 hectares (ha). For the purposes of this contamination investigation "the site" is defined by the footprint of the proposed development as shown on the Masterplan, and as outlined on Drawing 1 in Appendix A. The site is of irregular shape and has a total area of approximately 10 ha. The site occupies the northern portion of Coopers Paddock.

4.2 Site Description

At the time of preparing this report the site was being used as a training ground for race horses. The areas utilised by the race horses were generally cleared of vegetation other than grasses. The areas not used were covered in thick vegetation including weeds such as lantana and native flora.

A number of former stables were observed on the site at the time of conducting the fieldwork for this contamination investigation. The buildings did not appear to be in use as lantana had built up around the buildings.

The area to the north of the site is occupied by Governor Macquarie Drive and Warwick Farm Racecourse. To the west is Sydney Water Land. To the east is dense bushland then the Georges River, whilst to the south is the remainder of Coppers Paddock.

The site layout is shown in the aerial photograph base to Drawing 1, Appendix A.

5. Topography, Geology, Soils and Water

The site was observed to be generally flat. Sloping ground was only noted to occur on the eastern and southern borders towards the Georges River embankments.

Reference to the Penrith 1: 100 000 Geological Series Sheet indicates that the site is underlain by Tertiary fluvial deposits comprising clayey quartzose sand and clay. The site is closest to the boundary of Bringelly Shale which typically comprises shale, carbonaceous claystone, laminite, and fine to medium grained lithic sandstone. Subsurface conditions are likely to include lenses of alluvial deposits (sand, gravel, clay) overlying shale at depth.

Reference to the Penrith 1:100,000 Soils Landscape Map indicates that the majority of the site is situated within the alluvial soil group in the Berkshire Park landscape, and is typified by dissected, gently undulating low rise on the Tertiary terraces of the Hawkesbury/Nepean River system. Limitations encountered in this landscape are high soil erosion hazard if the area is cleared, along with gully, sheet and rill erosion on dissected areas. Waterlogging, impermeable subsoils and low fertility may also be encountered. The western portion of the site is situated within disturbed terrain, and is typified by level plains to hummocky terrain, which has been extensively disturbed by human activity. Limitations encountered depend on the nature of the material, but mass movement, unconsolidated low wet-strength materials, impermeable soil, poor drainage, low fertility and toxic materials maybe encountered.

Groundwater flow directions across the site are likely to be heavily influenced by the Georges River, which is located immediately adjacent to the east and south of the site. Flow directions will therefore vary depending on the position within the site. The depth of groundwater will also be influenced by the river level.

Reference to digital data of Acid Sulphate Soil Risk (supplied by NSW Department of Environment and Climate Change in 2008 based on published 1:25,000 Acid Sulfate Soils Risk Mapping, 1994-1998) indicates that the eastern portion of the site is located within an area known to have high probability of containing acid sulphate soils.

A groundwater bore search of the NSW Office of Water website database was conducted as part of DP (2010). Seven groundwater bores were located within a 2 km radius of the site. Work summaries were available for six of the seven bores. Bores GW058697 and GW058698 were recorded to be used for groundwater exploration. Bores GW017343 and GW017355 were recorded for irrigation purposes, while bores GW062422 and GW102026 were recorded for recreational purposes. Standing water levels (SWL) were found to be between 3.30 m below ground level (bgl) and 8.50 m bgl. Drillers' logs indicate that the lithology generally comprised clays, followed by sand, more clay and then shale.

6. Preliminary Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated (or potentially contaminated) and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source – pathway – receptor linkages.

A preliminary CSM for the site has been prepared based on the information and findings presented in DP (2010), as well as site observations as discussed in Section 4.2.

6.1 Potential Contamination Sources

Based on the current and previous site uses (as documented in DP, 2010) and DP's current and previous site observations the potential contamination sources (or areas of environmental concern) associated with the subject site are summarised in Table 1 below.

Table 1: Areas of Environmental Concern (AEC)

Potential Source	Description of Potential Contaminating Activity	Contaminants of Concern
Agricultural chemicals (low potential) (S1)	Potential application of pesticides during past agricultural activities up until about 1920s. No information is available to confirm that this is the case.	Persistent Organochlorine Pesticides (OCP) and Organophosphorus Pesticides (OPP)
Fly tipping (low potential) (S2)	No fly tipping was observed at the site, but there is a potential that fly tipping has occurred in the overgrown areas of the site.	Asbestos, and other potential contaminants including metals, TPH, BTEX, PAH, OCP, PCB and Phenols
Hazardous building materials (moderate potential) (S3)	Former stables located within the site appeared to be covered by fibrous cement sheeting coated in paint. The buildings appeared to be in reasonable condition, however access was limited.	Asbestos and lead.
Fill (moderate potential) (S4)	The use as a training track means there is a potential for fill to have been used across the site for formation and levelling of depressions and low lying areas of the subject site.	Typical and commonly screened contaminants for fill of an unknown source include Heavy Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc), total petroleum hydrocarbons (TPH), BTEX (benzene, toluene, ethyl benzene, xylene), polycyclic aromatic hydrocarbons (PAH), OCP, Polychlorinated Biphenyls (PCB), Phenols and Asbestos.

6.2 Potential Receptors

Human Health Receptors

R1 – Construction workers during the development of the site

R2 – Proposed end users once developed (industrial, visitors)

R3 – Intrusive maintenance workers once developed

R4 – Land users in adjacent areas (commercial).

Environmental (Ecological) Receptors

R5 – Groundwater.

R6 – Georges River and its riparian corridor (ecology)

6.3 Potential Pathways

Potential pathways for contamination to impact on receptors include the following:

P1 – Direct contact with soil (ingestion and dermal).

P2 – Inhalation of dust and/or vapours.

P3 – Leaching of contaminants and vertical mitigation into groundwater.

P4 – Surface water run-off.

P5 – Direct contact with groundwater.

6.4 Summary of Preliminary CSM

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human, water or environmental receptors from contamination sources on or in the vicinity of the site, via exposure pathways. The possible pathways between the above sources and receptors are provided in Table 2 below.

Table 2: Preliminary Conceptual Site Model

Source	Transport Pathway	Receptor	Comments
S1: Agricultural chemicals.	**P1**: Direct contact with soil (ingestion and dermal) **P2**: Inhalation of dust and/or vapours **P3**: Leaching of contaminants and vertical mitigation into groundwater **P4**: Surface water run-off	**R1**: Construction workers **R2**: Site users **R3**: Maintenance workers **R5**: Groundwater **R6**: Georges River (ecology)	Residual contamination from the past application of agricultural chemicals (if this occurred) may include persistent pesticides and metals. DP experience on sites with similar histories shows that this potential is low. Impacts are most likely seen in surface soils. The limited soil testing undertaken will assess this potential further.
S2: Fly tipping	**P1**: Direct contact with soil (ingestion and dermal) **P2**: Inhalation of dust and/or vapours **P4**: Surface water run-off	**R1**: Construction workers **R2**: Site users **R3**: Maintenance workers **R6**: Georges River (ecology)	There was no evidence of fly tipping noted in DP (2010) and during the recent site walkover. However, some areas are obscured by dense vegetation and therefore a potential exists for fly tipping in these areas. Being a secured area the potential for illegal fly tipping is low.
S3: Hazardous building materials	**P1**: Direct contact with soil (ingestion and dermal) **P2**: Inhalation of dust and/or vapours **P4**: Surface water run-off	**R1**: Construction workers **R3**: Maintenance workers	The existing buildings on the site should be assessed by a competent occupational hygienist prior to demolition, then if hazardous materials are present, managed by an appropriately licensed contractor.
S4: Filling	**P1**: Direct contact with soil (ingestion and dermal) **P2**: Inhalation of dust and/or vapours	**R1**: Construction workers **R2**: Site users	Broad scale filling at the site is not likely, however some localised filling in the past for waste disposal, levelling or

Source	Transport Pathway	Receptor	Comments
	P3: Leaching of contaminants and vertical mitigation into groundwater **P4**: Surface water run-off **P5:** Direct contact with groundwater	**R3**: Maintenance workers **R5**: Groundwater **R6**: Georges River (ecology)	infilling is possible. The limited soil investigations undertaken will assess this potential further

positions were governed by the proposed warehouse locations and were designed to provide preliminary geotechnical information as well as preliminary contamination information.

The test bores were labelled as BH1 to BH8. The test bores were designed to enable sampling of the media considered to be most likely impacted by contaminants, in this case, imported filling and near surface soils. The bores were also extended to permit sampling of groundwater (at three locations) and the assessment of geotechnical parameters.

Representative samples of the filling and natural soil were recovered from the test bores in order to assess the contamination status of the soils within the subject site.

7.4 Soil Sampling Methods

The test bores were drilled under the instruction and supervision of an environmental scientist from DP between 4 and 14 July 2014. All sample locations were cleared for services and underground pipes by a services locator and by review of dial-before-you-dig (DBYD) plans.

The test bores were drilled using either a truck–mounted drilling rig or track-mounted drilling rig. The bores were extended to depths of between 3 m and 8.95 m bgl. Given the absence of indicators of volatile contaminants (i.e. no observed staining or odours), soil samples were recovered directly from the spiral auger and SPT.

All sampling data was recorded on DP's test bore logs with essential information included in the chain-of-custody sheets. The general sample handling procedure adopted is summarised below:

- collect soil samples directly from spiral auger or SPT;
- transfer samples into laboratory-prepared glass jars, filled to the top to minimise the headspace within the sample jar, and capping immediately to minimise loss of volatiles;
- label sample containers with individual and unique identification, including project number, sample location and sample depth; and
- place the glass jars, with Teflon lined lid, into an ice cooled, insulated and sealed container for transport to the laboratory.

7.5 Well Installation Details and Groundwater Sampling Methodology

Groundwater monitoring wells were installed into bores BH1, BH7 and BH8. These bores were selected to provide coverage of the site and to enable triangulation to assess groundwater flow direction.

Groundwater monitoring wells are designed to intercept the water table of the same aquifer and permit sampling of water from middle of the screen section. The groundwater monitoring wells were constructed of 50 mm diameter acid washed class 18 PVC casing and machine slotted well screen intervals, with the upper end of the well screen positioned above the water table observed during drilling. Joints were screw threaded, thereby avoiding the use of glues and solvents which may contaminate the wells. BH1 was capped and finished with a Gatic cover, whilst BH7 and BH8 had

approximately 500 mm stick up of casing to aid in relocation. The ground surface levels were recorded on the bore logs.

As no groundwater was detected during the drilling of BH8, the well screen was positioned to intercept potential groundwater within the bedrock aquifer.

Following installation, the groundwater levels were measured at all wells using an interface meter and the wells were developed on 15 July 2014 by removing a minimum of three bore volumes of water or until the wells were dry using either a submersible pump or hand bailer. The wells were allowed to recharge and groundwater levels re-measured including the measurement of phase separated hydrocarbons (PSH). No PSH were noted.

The wells were micro-purged on 16 July 2014 using a low flow pump (Geopump) until field parameter readings stabilised (pH, temperature, dissolved oxygen (DO), conductivity, total dissolved solids (TDS) and redox) where possible, or using a hand bailer due to insufficient water within the well.

Once field parameters had stabilised, samples were collected on the same day using the low flow pump. Samples were placed with a minimum of aeration into appropriately preserved bottles. For analysis of metals the relevant sample fraction was filtered using an in-line, disposable, 0.45 µm filter that was changed between samples. It is noted that a longer period of stabilisation is preferred prior to sampling, however the due diligence time limitations did not permit this. As such, it is possible that the sampled water is not representative of the natural stable groundwater conditions at the site.

The sample pump and all non-disposable sampling equipment was decontaminated between samples via a "triple rinse" procedure i.e. a rinse of all particulates in tap water followed a decontamination using a 3% Decon 90 solution and a final rinse in deionised water.

The sample management comprised the following:

- collecting 10% replicate samples for QA/QC purposes, or at least one per field sampling date. In addition laboratory prepared trip spikes and blanks were taken into the field unopened for every day of sampling;
- samples were placed in insulated coolers to maintain a low temperature (through the use of ice; topped up as required) until transported to the analytical laboratory, and
- chain of custody documentation was maintained at all times and countersigned by the receiving laboratory on transfer of samples.

All samples were dispatched to the selected NATA accredited laboratories for analysis.

7.6 Field Quality Assurance and Quality Control

The field quality assurance (QA) and quality control (QC) procedures for sampling were as prescribed in Douglas Partners' *Field Procedures Manual*. Field replicate samples were recovered and analysed for a limited suite of contaminants by means of intra-laboratory and inter-laboratory analysis. Trip blank and trip spike samples were also included as part of the QA/QC process. This is in accordance with standard industry practice and guidelines.

No field rinsate samples were collected or analysed as part of the assessment. Given that soil samples were taken from spiral auger or SPT, and water samples were taken through disposable tubing and/or hand bailers, contaminant concentrations were considered likely to be low, rinsate sample test results were not considered to be critical to the outcomes of the investigation.

A complete discussion of the field QA/QC is presented in Appendix D. In summary, it is considered that on the basis of the field and laboratory QA/QC the analytical data reported by the laboratory is reliable and useable for this investigation.

7.7 Analytical Rationale

The analytical scheme was designed to obtain an indication of the potential presence and possible distribution of contaminants that may be attributable to the potential sources informed by the CSM and discussed in Section 6.

As discussed in Section 7.3, the media considered most likely to be impacted by contaminants are the filling and near surface soils. It is considered highly unlikely that deep soils are impacted by contaminants in the fill or near surface soils. As such, the analysis was undertaken primarily on fill, near surface soils and fly tipping. Samples were selected for analysis on the basis of the testing budget and in order to include analysis of all fill types encountered in the field.

All samples were screened for ASS. Samples were then selected for laboratory analysis on the basis of the screening results and testing budget.

7.8 Laboratory QA/QC

The analytical laboratory, accredited by NATA, is required to conduct in-house QA/QC procedures. These are normally incorporated into every analytical run and include reagent blanks, spike recovery, control samples, surrogate recovery and duplicate samples. These results are included in the laboratory reports in Appendix E.

The results of the DP assessment of laboratory QA/QC are presented in Appendix D. In summary, it is considered that on the basis of the field and laboratory QA/QC the analytical data reported by the laboratory is reliable and useable for this investigation.

8. Site Assessment Criteria

The proposed development at the site will include warehouses, ground level parking and landscaping.

The Site Assessment Criteria (SAC) applied in the current investigation is informed by the CSM which identified *human and ecological* receptors to potential contamination on the site (refer to Section 6). Analytical results were assessed (as a Tier 1 assessment) against the SAC comprising the investigation and screening levels of Schedule B1, NEPC (2013). The NEPC guidelines are endorsed by the NSW EPA under the CLM Act 1997. Petroleum based health screening levels for direct contact

have been 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).

The investigation and screening levels are applicable to generic land use settings and include consideration of, where relevant, the soil type and the depth of contamination. The investigation and screening levels are not intended to be used as clean up levels. Rather, they establish concentrations above which further appropriate investigation (e.g. Tier 2 assessment) should be undertaken. They are intentionally conservative and are based on a reasonable worst-case scenario.

The investigation and screening levels applied in the current investigation comprise levels adopted for a generic commercial/industrial land use scenario, and intrusive maintenance workers (also representing construction workers).

8.1 Soils

8.1.1 Health Investigation Levels

The Health Investigation Levels (HIL) and Health Screening Levels (HSL) are scientifically-based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential human health risk from chronic exposure to contaminants.

HILs are applicable to assessing health risk arising *via* all relevant pathways of exposure for a range of metals and organic substances. The HIL are generic to all soil types and apply generally to a depth of 3 m below the surface for commercial/industrial use. Site-specific conditions may determine the depth to which HILs apply for other land uses.

HSLs are applicable to selected petroleum compounds and fractions to assess the risk to human health via inhalation and direct contact pathways. HSL have been developed for different land uses, soil types and depths to contamination.

The generic HIL and HSL are considered to be appropriate for the assessment of contamination at the site. Given the proposed land use the adopted HIL and HSL are:

- **HIL-D** – commercial/industrial such as shops, offices, factories and industrial sites;
- **HSL-D** – commercial/industrial such as shops, offices, factories and industrial sites;
- **HSL-** Intrusive Maintenance Worker (shallow trench).

In addition, the HSL adopted are predicated on the inputs summarised in Table 3.

Table 3: Inputs to the Derivation of HSLs

Variable	Input	Rationale
Potential exposure pathway	Soil vapour intrusion (inhalation) / Direct contact *	There is a potential for vapour intrusion into building and service trenches, and direct contact with soil during construction and in public areas.
Soil Type	Sand	In the absence of laboratory particle analysis sand HSLs have been adopted as an initial conservative screen); sand being logged as a component of the sub-surface profile.
Depth to contamination	0 m to <1 m or 0 m to <2 m	Fill and near surface soils are identified as the most likely impacted media.

**Developed by CRC CARE (2011)*

The adopted soil HIL and HSL for the potential contaminants of concern are presented in Tables 4 and 5.

Table 4: Health Investigation and Screening Levels (HIL and HSL) in mg/kg unless otherwise indicated – Commercial/Industrial

Contaminants		HIL-D, HSL-D, Direct Contact	HSL-D Vapour Intrusion
Metals	Arsenic	3000	-
	Cadmium	900	-
	Chromium (VI)	3,600	-
	Copper	240,000	-
	Lead	1,500	-
	Mercury (inorganic)	120	-
	Nickel	730	-
	Zinc	400,000	-
PAH	Benzo(a)pyrene TEQ[1]	40	-
	Naphthalene	2,200	-
	Total PAH	4000	-
TRH	C6 – C10 (less BTEX) [F1]	26,000	260
	>C10-C16 (less Naphthalene) [F2]	20,000	NL
	>C16-C34 [F3]	27,000	-
	>C34-C40 [F4]	8,100	-
BTEX	Benzene	430	3
	Toluene	99,000	NL
	Ethylbenzene	27,000	NL
	Xylenes	81,000	230
Phenol	Phenol	240,000	-
OCP	Aldrin + Dieldrin	45	-
	Chlordane	530	-
	DDT+DDE+DDD	3,600	-
	Endosulfan	2,000	-
	Endrin	100	-
	Heptachlor	50	-
	HCB	80	-
	Methoxychlor	2,500	-
PCB [2]		7	-

Notes:
1 *sum of carcinogenic PAH*
2 *non dioxin-like PCBs only.*
3 *NL – Not limiting*

Table 5: Health Investigation and Screening Levels (HIL and HSL) in mg/kg unless otherwise indicated – Intrusive Maintenance Worker

Contaminants		HSL-Intrusive Maintenance Worker, Direct Contact	HSL-Intrusive Maintenance Worker, Vapour Intrusion
Metals	Arsenic	-	-
	Cadmium	-	-
	Chromium (VI)	-	-
	Copper	-	-
	Lead	-	-
	Mercury (inorganic)	-	-
	Nickel	-	-
	Zinc	-	-
PAH	Benzo(a)pyrene TEQ[1]	-	-
	Naphthalene	-	-
	Total PAH	-	-
TRH	C6 – C10 (less BTEX) [F1]	82,000	NL
	>C10-C16 (less Naphthalene) [F2]	62,000	NL
	>C16-C34 [F3]	85,000	-
	>C34-C40 [F4]	120,000	-
BTEX	Benzene	1,100	77
	Toluene	120,000	NL
	Ethylbenzene	85,000	NL
	Xylenes	130,000	NL
Phenol	Phenol	-	-
OCP	Aldrin + Dieldrin	-	-
	Chlordane	-	-
	DDT+DDE+DDD	-	-
	Endosulfan	-	-
	Endrin	-	-
	Heptachlor	-	-
	HCB	-	-
	Methoxychlor	-	-

Notes: *.NL – Not limiting*

8.1.2 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, but not available for the current project) 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.

EILs (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) are shown in the following Table 6. The following site specific data and assumptions have been used to determine the EILs:

- a protection level of 80% has been adopted;
- the EILs will apply to the top 2 m;
- given the likely source of soil contaminants (i.e. historical filling) the contamination is considered as "aged" (>2 years);
- ABCs have been taken as the approximate average EPA background concentrations for NSW as published in Olszowy (1995); and
- Site specific pH, CEC and clay content have been tested, and as such these values have been used in the determination of EILs, where appropriate.

The adopted EILs are listed in the following Table 6.

Table 6: Ecological Investigation Levels (EIL) in mg/kg

Analyte		ABC[1]	ACL	EIL[2]	Comments
Metals	Arsenic	NA	NA	160	Adopted parameters: pH of 7.7 (average tested); CEC of 5 $cmol_c/kg$ (assumed); organic carbon 1% (assumed); sand content (based on logs)
	Copper	-	140	140	
	Nickel	-	55	55	
	Chromium III	20	530	550	
	Lead	NA	NA	1,800	
	Zinc	140	360	500	
OCP	DDT	-	NA	640	
PAH	Naphthalene	-	NA	370	

Notes: 1. Taken from Olszowy (1995)
2. Commercial/industrial

8.1.3 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 7 have been used to determine the ESL. The adopted ESL, from Table 1B(6), Schedule B1 of NEPC (2013) are shown in Table 8.

Table 7: 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	Proposed warehouse development
Soil Texture	Coarse	Sandy filling was identified as the most conservative soil type in the test pits.

Table 8: Ecological Screening Levels (ESL) in mg/kg

Analyte		ESL	Comments
TPH	C6 – C10 (less BTEX) [F1]	215*	All ESLs are low reliability apart from those marked with * which are moderate reliability
	>C10-C16 (less Naphthalene) [F2]	170*	
	>C16-C34 [F3]	1,700	
	>C34-C40 [F4]	3,300	
BTEX	Benzene	75	
	Toluene	135	
	Ethylbenzene	165	
	Xylenes	180	
PAH	Benzo(a)pyrene	0.7	

8.1.4 Management Limits – Petroleum Hydrocarbons

In addition to appropriate consideration and application of the HSLs, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

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

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. Management Limits have been derived in NEPC (2013) for the same four petroleum fractions as the HSL (F1 to F4). The adopted Management Limits, from Table 1B(7), Schedule B1 of NEPC (2013) are shown in the following Table 9. The following site specific data and assumptions have been used to determine the Management Limits:

- the Management Limits will apply to any depth within the soil profile;
- the Management Limits for commercial land use apply;
- A "coarse" soil texture has been adopted, due to the high clay content observed during the investigation and to take a conservative approach.

Table 9: Management Limits in mg/kg

Analyte		Management Limit
TRH	$C_6 - C_{10}$ (F1) #	700
	$>C_{10}-C_{16}$ (F2) #	1,000
	$>C_{16}-C_{34}$ (F3)	3,500
	$>C_{34}-C_{40}$ (F4)	10,000

Separate management limits for BTEX and naphthalene are not available hence these have not been subtracted from the relevant fractions to obtain F1 and F2

8.1.5 Asbestos in Soil

Bonded asbestos-containing material (ACM) is the most common form of asbestos contamination across Australia, generally arising from:

- Inadequate removal and disposal practices during demolition of buildings containing asbestos products;
- Widespread dumping of asbestos products and asbestos containing fill on vacant land and development sites; and
- Commonly occurring in historical fill containing unsorted demolition materials.

Mining, manufacturing or distribution of asbestos products may result in sites being contaminated by friable asbestos including free fibres. Severe weathering or damage to bonded ACM may also result in the formation of friable asbestos comprising fibrous asbestos (FA) and/or asbestos fines (AF).

Asbestos only poses a risk to human health when asbestos fibres are made airborne and inhaled. If asbestos is bound in a matrix such as cement or resin, it is not readily made airborne except through substantial physical damage. Bonded ACM in sound condition represents a low human health risk, whilst both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres. Consequently, FA and AF must be carefully managed to prevent the release of asbestos fibres into the air.

A detailed asbestos assessment as outlined in NEPC (2013) was not undertaken as part of the DSI as the propensity for asbestos contamination had not yet been identified. Therefore the presence or absence of asbestos at a limit of reporting of 0.1 g/kg (and no respirable fibres) has been adopted for this DSI as an initial screen.

8.2 Groundwater

The potential receptors of impacted groundwater from the site include:

- Lateral migration of groundwater providing baseflow to Georges River, located at approximately 500 m down-gradient (east) from the site; and
- Extraction of groundwater for agricultural use.

8.2.1 Groundwater Investigation Levels

The Groundwater Investigation Levels (GIL) adopted in NEPC (2013) are based on:

- *Australian Drinking Water Guidelines* 2011 (ADWG);
- *Guidelines for Managing Risk in Recreational Waters* 2008 (GMRRW);
- *National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality* 2000 (ANZECC & ARMCANZ).

The adopted GIL for the analytes included in the assessment (where applicable), and the corresponding source documents, are shown in Table 10.

Table 10: Groundwater Investigation Levels (in µg/L unless otherwise stated)

Analyte		NEPC (2013) Fresh Waters [b]	NEPC (2013) Drinking Water	Comments
Metals	Arsenic (V)	13	10	
	Cadmium	0.2	2	
	Chromium (VI)	1	50	
	Copper	1.4	2,000	
	Lead	3.4	10	
	Mercury (total)	0.06	1	
	Nickel	11	20	
	Zinc	8	-	
PAH	Naphthalene	16	-	
	Benzo(a)pyrene	-	0.01	
BTEX	Benzene	950	1	
	Toluene	-	800	
	Ethylbenzene	-	300	
	Xylene (o)	350	-	
	Xylene (p)	200	-	
	Xylenes (Total)	-	600	
OCP	Chlordane	0.03	2	
	DDT	0.006	9	
	Endosulfan	0.03	20	
	Endrin	0.01	-	
	Heptachlor	0.01	-	
	Aldrin + Dieldrin	-	0.3	
	Lindane	0.2	10	
	Heptachlor Expoxide	-	0.3	
OPP	Bromophos-ethyl	-	-	
	Chlorpyrifos	0.01	0.01	
	Chlorpyrifos-methyl	-	-	
	Diazinon	0.01	0.004	
	Dimethoate	0.15	0.007	
	Ethion	-	0.004	
	Fenitrothion	0.2	0.007	
	Ronnel	-	-	

Analyte		NEPC (2013) Fresh Waters [b]	NEPC (2013) Drinking Water	Comments
PCB	Aroclor 1242	0.3	-	
	Aroclor 1254	0.01	-	
Phenols	Phenol	320	-	

Notes:

a *in cases where no high reliability trigger values are provided, the low reliability trigger values provided in ANZECC & ARMCANZ (2000) have been used as screening levels*

b *Investigation levels apply to typically slightly-moderately disturbed systems*

8.2.2 Health Screening Levels – Petroleum Hydrocarbons

The generic HSL are considered to be appropriate for the assessment of contamination at the site. Given the proposed land use the adopted HSL is:

- **HSL-D** – commercial/industrial

In addition, the HSL adopted is predicated on the following inputs prescribed in Table 11:

Table 11: Inputs to the Derivation of HSLs

Variable	Input	Rationale
Potential exposure pathway	Groundwater vapour intrusion (inhalation)	Conduits expected to be intercept groundwater.
Soil Type	Sand	Observed sands and sandy clays during field investigation.
Depth to contamination	*4 M < 8 M*	Conduits expected to intercept groundwater. Will require re-assessment if TRH is detected.

The adopted groundwater HSL for vapour intrusion, from Table 1A(4), Schedule B1 of NEPC (2013) are shown in the following Table 12.

Table 12: Groundwater Health Screening Levels (HSL) for Vapour Intrusion (µg/L)

Analyte		HSL-[D]
TRH	$C_6 - C_{10}$ (less BTEX) [F1]	6000
	$>C_{10}-C_{16}$ (less Naphthalene) [F2]	NL
BTEX	Benzene	5000
	Toluene	NL
	Ethylbenzene	NL
	Xylene	NL
PAH	Naphthalene	NL

Notes:
NL -The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour which is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil-vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for a given scenario. For these scenarios no HSL is presented for these chemicals. These are denoted as not limiting 'NL'.

8.3 ASS Classification Criteria

Acid Sulphate Soils (ASS) occur due to the presence of microscopic mineral grains which are stable in anaerobic conditions (e.g. soils below the water table, or in dense, clay-rich soils that are periodically re-wetted), but upon oxidation generate sulphuric acid or acid sulphate. ASS include actual acid sulphate soils (AASS) which have already oxidised and are highly acidic, or potential acid sulphate soils (PASS) which have the potential to become highly acidic when disturbed and may or may not be acidic in-situ.

The following guidelines related to ASS are endorsed by the NSW EPA:

- Acid Sulfate Soils Management Advisory Committee (ASSMAC) *Acid Sulfate Soils Management Guidelines* (1998) [ASSMAC (1998)]; and
- QASSIT/ Qld NRM&E/SCU/ NatCASS/QASSMAC/ASSMAC *Acid Sulfate Soils Laboratory Methods Guidelines Version 2.1—June 2004* Published by Department of Natural Resources, Mines, and Energy, Indooroopilly, Queensland, Australia, [Qld NRM&E (2004)] (this guideline supersedes the laboratory section of ASSMAC (1998)).

The thresholds for determining the need to manage ASS are provided in Table 13. With respect to the soils observed at the site, the results were compared against the action criteria for 'medium textured material (sandy loams to light clay)'. As there is no basement proposed, the results have been compared with criteria for less than 1,000 tonnes of disturbed soil.

Table 13: Thresholds for ASS Assessment (ASSMAC (1998)

Material Type	Existing + Potential Acidity	
	Equivalent acidity (mol H+/tonne) (oven-dry basis)	Equivalent sulphur (%S) (oven-dry basis)
ASSMAC Action Criteria for disturbance of 1 – 1000 tonnes		
coarse textured material i.e. sands to loamy sands	18	0.03
medium textured material i.e. sandy loams to light clay	36	0.06
fine textured material i.e. medium to heavy clays and silty clay	64	0.1
ASSMAC Action Criteria for disturbance of more than 1000 tonnes		
all textures	18	0.03

ASSMAC also provides indicative values for pH screening. The purpose of the screening test is to assist in determining appropriate samples for laboratory analysis and not to determine the presence or absence of ASS. It is noted that ASS screening results can provide a false positive or negative indication due to potential presence of inclusions in the soil (e.g. organic matter, shells, etc.) that may affect the pH values.

Indicators of ASS in pH screening results include:

- Colour change from grey to brown;
- Effervescence;
- A release of sulphur odours;
- Lowering of soil pH by at least one unit;
- A final (oxidised) pH of less than 3.5, and preferably less than 3.

ASSMAC also indicates that field pH of less than or equal to 4 indicates the presence of actual acid sulphate soils (i.e. ASS which have already released acid).

9. Fieldwork Results

The subsurface conditions encountered in the bores are presented in the test bore logs in Appendix F. Notes defining descriptive terms and classification methods are also included in Appendix F.

The principal strata sequentially encountered in the test bores comprised:

- Top soil – Grassed dark brown clayey sand, variable to depths up to 0.25 m
- Filling – Likely to be poorly compacted clayey sand filling with traces of gravel, variable to depths up to 1.0 m;
- Sandy/silty clay – Stiff to hard fluvial clay, variable depths from 0.3 m to about 6.0 m. Encountered primarily on the eastern part of the site (near the river).
- Clayey sand – Medium dense to very dense clayey sand, variable depths from 0.9 m to about 8.5 m. Encountered primarily on south – eastern part of the site.
- Sand – Loose to medium dense sand, variable depths from 0.2 m to about 8.0 m. Encountered primarily on the western part of the site.
- Sandstone – Extremely weathered to highly weathered sandstone, variable top of rock depths from about 2.0 m to 3.0 m.

Free groundwater was observed during drilling in BH1 and BH7 at depths of 6.5 m and 7.0 m bgl respectively.

No ACM was observed in the test bores.

All PID screening results were low, suggesting an absence of volatile contaminants in the soil samples.

10. Laboratory Testing

The results of the laboratory analysis undertaken are presented in Tables 14, 15 and 16, Appendix G.

The full laboratory reports together with the chain of custody and sample receipt information are presented in Appendix E.

11. Discussion of Results

11.1 Soil

The field results suggest that the subject site is underlain by a variable depth of filling, then sand, clayey sand and sandy clay and sandstone bedrock. There was nothing observed during the fieldwork to suggest that there is a high potential for contamination of the soils encountered.

The analytical results for the soil samples indicated that the concentrations of TRH, BTEX, PAH, PCB, OCP, OPP and phenols in all soil samples analysed were below the laboratory's limit of reporting and within the adopted SAC.

Low concentrations of heavy metals were recorded which were all within the adopted SAC.

Asbestos was not observed in any of the soil samples and was not detected at the reporting limit in any samples analysed for asbestos.

11.2 Assessment of Groundwater

Groundwater samples were collected from BH1, BH7 and BH8. The groundwater samples were analysed for heavy metals, TRH, BTEX, PAH, OCP, OPP, PCB and phenols.

No free product was observed in the monitoring wells. The concentrations of the analytes in groundwater were generally within the adopted GIL. There were minor exceedances of cadmium and nickel in BH7 and BH8. These exceedances of cadmium and nickel are considered to be relatively minor, and possibly a reflection of regional conditions, particularly given that cadmium and nickel concentrations in the soils were not deemed significant.

There was a minor exceedance of benzo(a)pyrene in BH8, though this is likely to be due to the soil disturbance during the drilling processes. Similarly, TRH concentrations were detected in all groundwater samples, although at concentrations were within the relevant GILs (where available). Again this is considered likely to be due to the drilling disturbance. Once more stabilised it is expected that the TRH and PAH concentrations will dissipate.

11.3 Acid Sulphate Soil

The majority of the field pH results were above pH 4, with the exception BH1/5.4-5.5, BH1/6.7-7.0 and BH8/3.9-4.0 indicating that there is minimal AASS (i.e. soils already producing acid) present in accordance with ASSMAC guidance.

The ASS screening and laboratory (SPOCAS) results indicate that there is PASS present at the site, with indicators through field screening and/or laboratory test results for soils from 3.5 m to 7.0 m depth. These indicators were reported for soil samples from one of the three samples analysed for ASS, suggesting minimal occurrence of PASS.

At this stage, the extent of earthworks for the proposed development is not known. However, given the relatively flat topography and no proposed basements, earthworks are likely to be limited to footing detail, minor levelling and services, all with penetrations of less than 3 m. As such, the potential for the works to encountered ASS is low. However, based on the limited assessment it is recommended that this potential is further investigated.

12. Conclusion and Recommendations

Based on the field and analytical results presented in this report, it is concluded that the site, as shown on Drawing 1, is compatible, from a contamination standpoint, for the proposed warehouse development as outlined in Section 1, subject to the following:

- Further rounds of groundwater sampling and testing due to the minor concentrations of TRH and PAH detected;
- Additional soil sampling and testing to provide more confidence in the results reported herein. The additional works should include testing for contaminants of concern and ASS conditions and could also be used to waste classify materials destined for off-site disposal;
- A hazardous building materials survey to identified hazardous building materials in the existing buildings (stables) on site;
- Demolition and removal of any hazardous materials by a contractor licensed for such activities, in accordance with WorkCover approved methods;
- Validation of the building footprints by an environmental consultant, once removed;
- Development and implementation of an "unexpected finds" protocol, incorporated into a site management plan for future civil works, which identifies investigation, remediation and/or management actions to be implemented in the event of a discovery of an unexpected contamination source.

13. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for part Cooper's Paddock, Governor Macquarie Drive, Warwick Farm, in general accordance with the proposal dated 25 June 2014. This report is provided for the exclusive use of Stockland Development 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.

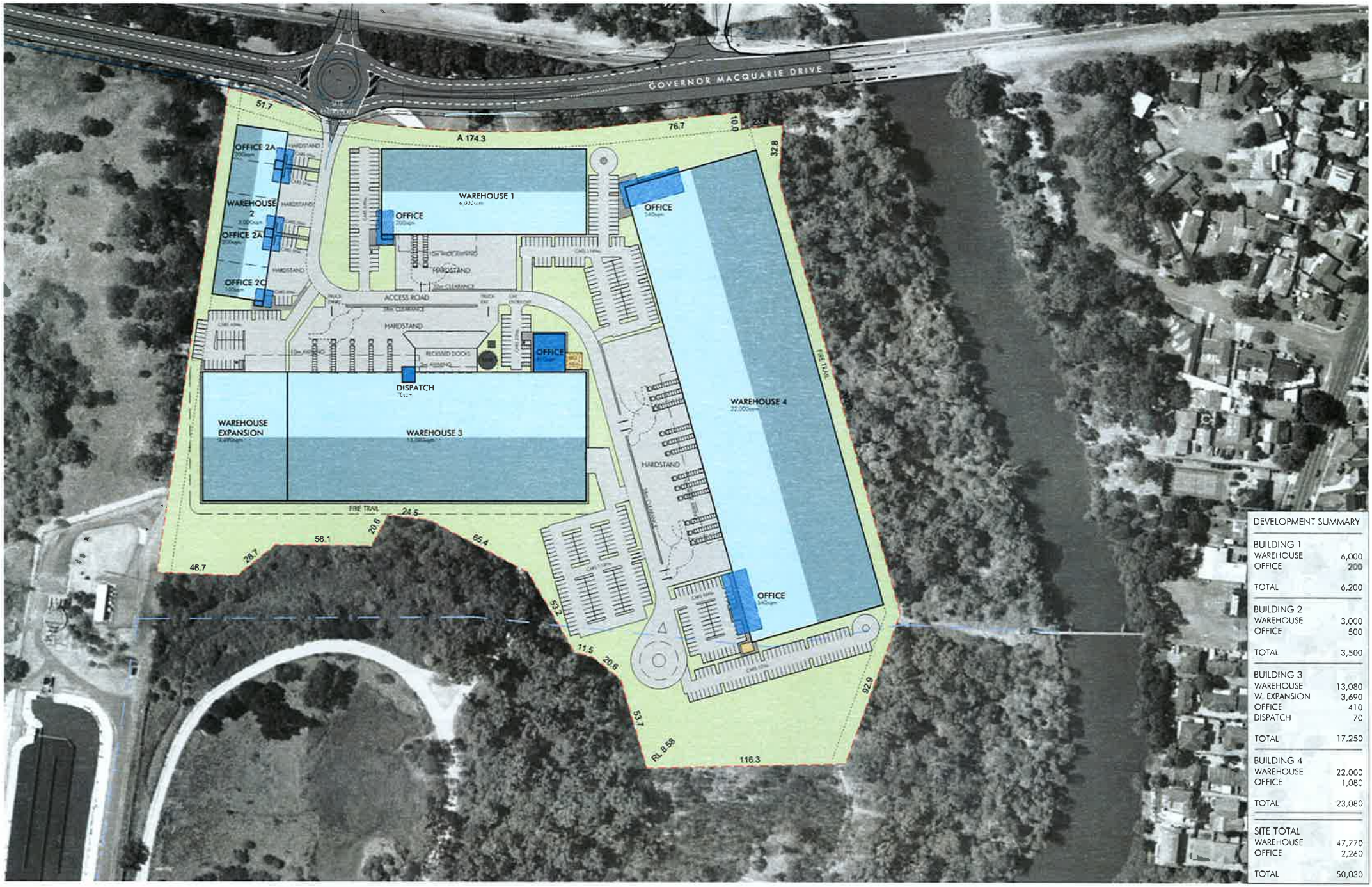
Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific testing locations, and then only to the depths investigated and 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 testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

Asbestos-based materials have not been detected by observation or by laboratory analysis either on the surface of the site or in fill at the locations sampled and analysed. A secondary indicator of the possible presence of asbestos-based materials is the presence of demolition materials including concrete, brick, tile and/or other miscellaneous waste materials. Such materials were not detected on the surface of the site at the locations sampled and analysed. The sampling plan adopted for this investigation is appropriate to achieve the stated project objectives, however, there are necessarily

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Stockland Development Pty Ltd	TITLE: **Site Boundary and Bore Locations** **Cooper's Paddock, Governor Macquaire Drive, Warwick Farm**	PROJECT No: 84377
	OFFICE: Sydney DRAWN BY: RJL		DRAWING No: 1
	SCALE: NTS DATE: 28 Jul 2014		REVISION: A



DEVELOPMENT SUMMARY	
BUILDING 1	
WAREHOUSE	6,000
OFFICE	200
TOTAL	6,200
BUILDING 2	
WAREHOUSE	3,000
OFFICE	500
TOTAL	3,500
BUILDING 3	
WAREHOUSE	13,080
W. EXPANSION	3,690
OFFICE	410
DISPATCH	70
TOTAL	17,250
BUILDING 4	
WAREHOUSE	22,000
OFFICE	1,080
TOTAL	23,080
SITE TOTAL	
WAREHOUSE	47,770
OFFICE	2,260
TOTAL	50,030

Stockland

Coopers Paddock

governor macquarie drive, warwick farm, nsw, australia

may 2014

Masterplan
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Appendix B

Data Quality Objectives

Data Quality Objectives

The contamination investigation has been devised broadly in accordance with the seven step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure* 1999 as amended 2013 (NEPC 2013). The DQO process is outlined as follows:

(1) State the Problem

Stockland Development proposes to purchase and develop the site for warehousing purposes. The Phase 1 contamination assessment of the site (DP, 2010) identified areas of potential contamination including potential past agricultural chemical usage, imported fill, and fly tipping associated with the subject site. The "problem" to be addressed is that the extent and nature of potential contamination on the subject site is unknown, and it is unclear whether the subject site is compatible with the proposed redevelopment.

(2) Identify the Decision/Objectives of the Study

The contamination investigation is a limited "due diligence" investigation aimed at assessing the potential for soil and groundwater contamination at the site.

The analytical data were compared to health investigation levels (HIL), health screening levels (HSL), ecological investigation levels (EIL), ecological screening levels (ESL), management limits and groundwater investigation levels (GIL) referenced from NEPC (2013). The assessment of the suitability of the subject site for the proposed development was based on the comparison of the analytical results for all contaminants of potential concern (COPC) to the adopted site assessment criteria (SAC).

The following specific decisions were made, as appropriate:

- What is the conceptual site model (i.e. sources, receptors, migration pathways, exposure)?
- Do the existing soils pose a potential risk to identified receptors?
- Does the existing groundwater beneath the site pose a potential risk to identified receptors?
- Is the data sufficient to make a decision regarding the abovementioned risks, and the compatibility of the subject site for the proposed development or are additional investigations required?
- Does contamination at the site, if encountered, trigger the Duty to Report requirements under the CLM Act 1997?
- Are there any off-site migration issues that need to be considered?
- Is the data sufficient to enable the preparation of a Remediation Action Plan (RAP) and/or Environmental Management Plan (EMP) should the data suggest these are required?

(3) Identify Information Inputs

Inputs into the decisions are as follows:

- Collection and review of site history information including information regarding previous and current activities undertaken on the site and the surrounding areas (DP, 2010);
- Regional geology, topography and hydrogeology;
- Soil samples collected from a total of 8 test bores, and groundwater samples collected from 3 monitoring wells, positioned across the accessible areas of the subject site (primarily for geotechnical investigation purposes), and analysed for the COPC;
- The lithology of the site as described in the test bore logs;
- Field and laboratory QA/QC data to assess the suitability of the environmental data for the assessment;
- All analysis undertaken at a NATA accredited laboratory; and
- The comparison of analytical test results with NEPC (2013) criteria discussed in Section 8 of the report.

(4) Define the Study Boundaries

Coopers Paddock is currently registered as Lot 1 in Deposited Plan 581034 with a total area in the order of 29 hectares. The subject site is of irregular shape and has a total area of approximately 10 hectares, located in the north portion of Coopers Paddock.

The vertical extent of the contamination investigation is defined by the depth of the test bores, however it is considered that the potential for contamination of deeper media is remote, given that no deep sources or readily migratory contaminants have been identified. The soils selected for analysis were generally surficial and from the fill medium, with the deepest analysed soil sample being 0.1 - 0.2 m below ground level. Again, it is considered highly unlikely that contamination has migrated to deeper media.

(5) Develop the Analytical Approach (or decision rule)

The information obtained during the assessment was used to characterise the subject site in terms of contamination issues and risk to human health and/or the environment. The decision rules used in characterising the subject site were as follows:

- Selected soil samples were analysed for the COPC;
- Laboratory test results for the systematic soil samples (i.e. non-targeted soil samples) were assessed individually;
- The adopted SAC were those published and/or endorsed by the NSW EPA;
- Where such criteria are not available, other recognised national or international standards were used;
- A significant exceedance of the SAC will trigger an assessment, most likely through the analysis of deeper soil samples, of the potential for migration or leaching of the contaminant to deeper soils and groundwater;
- Further investigation, remediation and/or management will be recommended if the subject site is found to be significantly contaminated.

Field and laboratory test results will be considered useable for the assessment after evaluation against the following data quality indicators (DQIs), which are evaluated in detail in Appendix C:

- Precision – a measure of variability or reproducibility of data;
- Accuracy – a measure of closeness of the data to the 'true' value;
- Representativeness – the confidence (qualitative) of data representativeness of media present on site;
- Completeness – a measure of the amount of usable data from a data collection activity; and
- Comparability – the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event.

(6) Specify the Performance or Acceptable Criteria

Decision errors for the analysis and evaluation of the respective COPC in soil are:

1. Deciding that the site's fill/soil exceed the SAC when they truly do not; and
2. Deciding that the site's fill/soils are within the SAC when they are truly not.

Decision errors for the proposed assessment will be minimised and measured by the following:

- The sampling regime targeted the media most likely to contain contaminants;
- Sample collection and handling techniques were in accordance with industry practice as outlined in DP's Field Procedures Manual;
- Samples were prepared and analysed by NATA-accredited laboratories with the acceptance limits for laboratory QA/QC parameters based on the laboratory reported acceptance limits and those stated in NEPC (2013);

- The analyte selection is based on the available site history, past site activities, site features and the findings reported in DP (2010). The potential for contaminants other than those analysed is considered to be low;
- The SAC were adopted from established and NSW EPA endorsed guidelines. Where not available, recognised national and international guidelines were used. The SAC have risk probabilities already incorporated;
- Only NATA accredited laboratories using NATA endorsed methods are used to perform laboratory analysis. Where NATA endorsed methods are not used, the reasons are stated. The effect of using non-NATA methods on the decision making process are explained.

(7) Optimise the design for obtaining data

Sampling design and procedures that were implemented to optimise data collection for achieving the DQOs included the following:

- Only NATA accredited laboratories using NATA endorsed methods were used to perform laboratory analysis; and
- An adequately experienced environmental scientist conducted the field work and sample analysis interpretation.

Appendix C

Data Quality Indicators

Data Quality Indicators

Field and laboratory procedures were assessed against the following data quality indicators (DQIs):

- Completeness – a measure of the amount of usable data from a data collection activity;
- Comparability – the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness – the confidence (qualitative) of data representativeness of media present on-site;
- Precision – a measure of variability or reproducibility of data; and
- Accuracy – a measure of closeness of the data to the 'true' value.

The DQIs were assessed as outlined in the following table.

DQI	Considerations as specified in NEPM Schedule B2	Comment
Completeness		
Field Considerations	All critical locations sampled	The soil sampling was conducted from bores located for geotechnical investigation purposes, but provided some information in relation to identified potential sources including filling and agricultural chemicals.
	All samples collected (from grid and at depth)	as above
	Standard operating practices (SOPs) appropriate and complied with	Field staff followed SOPs as defined in the DP *Field Procedures Manual.* Samples were recovered from spiral augers and SPT tubes. The procedure was considered adequate given the low potential for volatile contaminants.
	Experienced sampler	A DP environmental scientist with 3 years' experience led the field team.
	Documentation correct	The documentation included the fieldwork instruction sheet, bore logs, and chains of custody, all of which were reviewed by the Project Manager (Senior Associate).

DQI	Considerations as specified in NEPM Schedule B2	Comment
Laboratory Considerations	All critical samples analysed according to the proposal and Phase 1 contamination assessment report (DP, 2010)	The DP proposal was followed. Any variation to the proposal has been recorded in the report.
	All analytes analysed according to the proposal	All analytes analysed according to the DP Proposal. Any variation has been recorded in the report.
	Appropriate methods and PQLs/LOR	NATA approved methods have been adopted. Limits of reporting (LORs) and practical quantitation limits (PQLs) in accordance with the method have been used by the contract laboratory.
	Sample Documentation complete	Chain-of-custody (CoC) maintained and appended to the Certificates of Analysis(s). All Certificates of Analysis are complete and appended to the report.
	Sample holding times complied with	Sample holding times complied with by the NATA accredited laboratory.
Comparability		
Field Considerations	Same SOPs used on each occasion	Field staff followed SOPs for each day of sampling as defined in the DP Field Procedures Manual
	Experienced sampler	As above
	Climatic conditions	Fine conditions were experienced on each day of sampling.
	Same types of samples collected	Field staff followed SOPs as defined in the DP Field Procedures Manual. All samples were essentially undisturbed and collected from SPTs (where possible) or from spiral augers. Although not the preferred sampling method, the implications are not considered to be significant given the low potential for volatile contaminants.
Laboratory Considerations	Sample analytical methods used	The laboratory used is accredited by NATA for the analyses undertaken. Laboratory methods are as stated on the Certificates of Analysis

DQI	Considerations as specified in NEPM Schedule B2	Comment
	Sample PQLs / LORs	PQL or LOR set by the laboratories are below the adopted site criteria or indicate across-the-board lack of detection (e.g. groundwater).
	Same laboratories	Envirolab Services was used for primary sample analysis.
	Same units	All laboratory results are expressed in consistent units for each media type.
Representativeness		
Field Considerations	Appropriate media sampled according to the proposal	Appropriate media were sampled in accordance with the proposal.
	All media identified in proposal sampled	All media identified in the proposal were sampled.
Laboratory Considerations	All samples analysed according to SAQP	All samples analysed according to the proposal, which incorporated a brief SAQP.
Precision		
Field Considerations	SOPs appropriate and complied with	Field staff followed SOPs as defined in the DP Field procedures Manual.
Laboratory Considerations	Analysis of: 1) laboratory and inter-laboratory duplicates 2) field duplicates 3) laboratory-prepared volatile trip spikes	The DSI included the analysis of duplicates, trip spike and trip blank samples. The laboratory acceptance limits are: [1) Average relative percentage difference (RPD) result <10 times PQL/LOR, no limit; results >10 times PQL/LOR, 0% -50% 2) Average relative percentage difference (RPD) result <10 times PQL/LOR, no limit; results >10 times PQL/LOR, 0% -50% 3) Recovery of 70-130%]
Accuracy (bias)		
Field Considerations	SOPs appropriate and complied with	Field staff followed the SOPs as defined in the DP Field procedures Manual.
Laboratory Considerations	Analysis of:	Envirolab Services and Labmark included as part of their QC blanks, duplicates, spikes and control samples. The laboratory

DQI	Considerations as specified in NEPM Schedule B2	Comment
		acceptance limits are:
	1) field blanks	1) Concentrations of analytes are <PQL/LOR
	2) rinsate blank	2) Concentrations of analytes are <PQL/LOR
	3) reagent blank/method blank	3) Recoveries are within 60-140%.
	4) matrix spike	4) Recoveries within 70-130% for inorganics and 60-140% for organics.
	5) surrogate spike	5) Recoveries are within 70-130% for inorganics and 60-140% for organics.
	6) reference material	6) Analysis within the acceptable limits of the Certificate of Analysis for the reference material. These results are generally not contained in the Certificate of Analysis.
	7) laboratory control sample	7) Recoveries are within 70-130% for inorganics and 60-140% for organics.
	8) laboratory-prepared spikes	8) Recoveries are within 60-140%.

Appendix D

Field and Laboratory QA/QC

QA/QC PROCEDURES AND RESULTS

Q1 - FIELD QUALITY ASSURANCE AND QUALITY CONTROL

The field quality control (QC) procedures for sampling as prescribed in Douglas Partners *Field Procedures Manual* were followed at all times during the assessment.

Q1.1 Sampling Team

Field sampling was undertaken by DP Environmental Scientist Richard Lamont on 4, 14 and 16 July 2014. Sampling was undertaken during fine weather conditions.

Q1.2 Sample Collection and Dispatch

Sample collection procedures and dispatch for soil are reported in Sections 7.4 and 7.5 of the report.

Q1.3 Logs

Logs for each sampling location were recorded in the field. The location of individual samples were recorded on the field logs along with location, depth, initials of sampler, replicate locations and replicate type. Logs are presented in Appendix F.

Q1.4 Chain-of-Custody (COC)

Analysis to be performed on each sample was recorded on the COC which accompanied samples to the analytical laboratory. Signed copies of COCs are presented in Appendix E, following the laboratory reports.

Q1.5 Sample Splitting Techniques

Replicate samples were collected in the field as a measure of accuracy, precision and repeatability of the results. Field replicate samples for soil were collected from the same location and at an identical depth to the primary sample. Equal portions of the recovered sample were placed into the sampling jars and sealed. *The sample was not homogenised in a bowl and then split, as this process can lead to loss of volatiles from the soil should they be present.* Replicate samples were labelled with a DP identification number, recorded on DP bore logs, so as to conceal their relationship to their primary sample from the analysing laboratory.

Q1.6 Decontamination Procedures

Soil samples were recovered directly from the SPT tube, push tube sleeve or spiral auger by the Environmental Scientist using disposable latex gloves. No additional sampling equipment was utilised therefore negating the need for decontamination.

Q1.7 Trip Spikes

According to the NSW EPA *Guidelines for Consultants Reporting on Contaminated Sites* (2011), laboratory prepared trip spikes are to be taken into the field, subjected to the same

preservation methods as the field samples, then analysed, for the purposes of determining the losses in volatile organics incurred prior to reaching the laboratory.

The laboratory prepared a soil trip spike which were preserved in the standard manner and taken into the field unopened. The volatile organic recovery rates are shown below. At this stage, the laboratory has no standard acceptance limits in recovery rates as results from in-house laboratory controls often vary. Results (Table Q1) indicate that the percentage loss for BTEX during the sample transport was minimal and therefore it is considered that appropriate preservation techniques were employed. The results also indicate that any potential loss of volatiles from the recovered samples that might have occurred would only be minimal and would therefore not affect the outcome/conclusions of the assessment.

Table Q1 – Trip Spike Results

Sample ID	Matrix	Recovery (%)				
		Benzene	Toluene	Ethyl Benzene	m+p xylene	o xylene
Trip Spike 040714	soil	98	99	97	98	97
Trip Spike 140714	Soil	100	99	99	99	99
Trip Spike 160714	water	76	77	78	77	77

Q1.8 Trip Blanks

Laboratory prepared soil and water trip blanks were taken out to the field unopened, subjected to the same preservation methods as the field samples, then analysed for the purposes of determining the transfer of contaminants into the blank sample incurred prior to reaching the laboratory. The result of the laboratory analysis for the trip blanks is shown in Table Q2.

Table Q2 Trip Blank Results

Sample ID	Matrix	BTEX				
		Benzene	Toluene	Ethyl Benzene	m+p xylene	o xylene
Trip Spike 040714	soil	<0.2	<0.5	<1	<2	<1
Trip Blank 140714	Soil	<0.2	<0.5	<1	<2	<1
Trip Blank 160714	Water	<1	<	<1	<2	<1

The concentrations of analytes were all below practical quantitation limits indicating that cross contamination had not occurred during the course of the round trip from the site to the laboratory.

Q1.9 Relative Percentage Difference

A measure of the consistency of results for field samples is derived by the calculation of relative percentage differences (RPDs) for duplicate samples. A RPD of ± 30% is generally considered acceptable for inorganic analytes by the EPA, although in general a wider RPD range may be acceptable for organic analytes (up to 50%).

Q1.9.1 Intra-Laboratory Analysis

Intra-laboratory replicates were conducted as an internal check of the reproductively within the primary laboratory (Envirolab Services Pty Ltd) and as a measure of consistency of sampling techniques. Replicate samples were collected at a rate of approximately one replicate sample for every ten original samples collected and also analysed at a rate of 10% of primary samples analysed. Chemicals of concern were analysed at a higher frequency to other chemicals of secondary concern. One sample and its replicate pair was analysed for heavy metals, TPH, BTEX and PAH.

The comparative results of analysis between original and replicate samples are summarised in the tables below.

Table Q3 – Intra-laboratory Results TPH, BTEX, PAH

Sample ID	Material type	TPH		BTEX				PAH	
		C6-C9	C10-C36	Benzene	Toluene	Ethyl-benzene	m + p-Xylene	BaP	Total PAH
BH3/0.1-0.2	Soil	<25	<250	<0.5	<0.5	<1	<2	<0.5	<2
BD1 040714	Soil	<25	<250	<0.5	<0.5	<1	<2	<0.5	<2
Difference		0	0	0	0	0	0	0	0
RPD%		0	0	0	0	0	0	0	0
BH8/0.1-0.2	Soil	<25	<250	<0.5	<0.5	<1	<2	<0.5	<2
BD1/140714	Soil	<25	<250	<0.5	<0.5	<1	<2	<0.5	<2
Difference		0	0	0	0	0	0	0	0
RPD%		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table Q4 – Intra-laboratory Results – Heavy Metals

Sample ID	Material type	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BH3/0.1-0.2	soil	<4	<0.4	6	6	8	<0.1	2	9
BD1 040714	soil	<4	<0.4	3	2	5	<0.1	1	7
Difference		0	0	3	4	3	0	1	2
RPD%		**0**	**0**	**67**	**100**	**46**	**0**	**33**	**25**
BH8/0.1-0.2	soil	<4	<0.4	13	3	13	<0.1	4	8
BD1/140714	soil	<4	<0.4	8	1	6	<0.1	1	3
Difference		0	0	5	2	7	0	3	5
RPD%		**0**	**0**	**48**	**100**	**74**	**0**	**120**	**91**

Table Q5 – Intra-laboratory Results - BTEX

Sample ID	Material type	BTEX			
		Benzene	Toluene	Ethyl-benzene	m + p-Xylene
BH1	Water	<1	<1	<1	<2
BD1 160714	water	<1	<1	<1	<2
Difference		0	0	0	0
RPD(%)		**0**	**0**	**0**	**0**

Table Q6 Intra-laboratory Results – Heavy Metals

Sample ID	Material type	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BH102/0.3-0.5	Water	<1	<0.1	<1	<1	<1	<0.05	9	45
BD2120414	Water	<1	<0.1	<1	<1	<1	<0.05	10	53
Difference		0	0	1	2	0	0	1	8
RPD(%)		**0**	**0**	**0**	**0**	**0**	**0**	**11**	**9**

The calculated RPD values were all within the acceptable range of ± 50% for the sample and its replicates with the exception of those shaded. However, these results are not considered to be of concern due to:

- The low actual difference between the concentrations;
- The duplicate samples being collected in filling material which is heterogeneous in nature, therefore differences are representative of the material and not the result inconsistencies in the sampling technique or laboratory precision; and/or
- The concentrations being at or close to the practical quantitation limit.

It is considered that the results, overall, indicate an acceptable consistency between the samples and their replicates and indicate that suitable field sampling methodology was adopted and laboratory precision was achieved.

Q2 - LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL

Q2.1 Laboratory Accreditation

Only laboratories accredited by the National Association of Testing Authorities (NATA) for the chemical analyses undertaken were used for analysis of samples recovered as part of this assessment. Samples were submitted to the following laboratory for analysis:

- Primary Laboratory: Envirolab Services Pty Ltd (Chatswood);

Envirolab Services are NATA accredited for the analyses undertaken. Envirolab's accreditation number is 2901 and they are accredited for compliance with ISO/IEC 17025. In-house procedures are employed by Envirolab in the absence of documented standards. This is performed yearly and is reviewed by NATA.

Envirolab participate in all common Proficiency Rounds including NARL (NMI) for organics and metals, PTA (NATA for organics, inorganics, asbestos and metals, QLD Govt for SPOCAS and National Residue Survey for metals). Envirolab also participate in non-accredited rounds conducted by the University of Wollongong.

Q2.2 Chain-of-Custody

Chain-of-custody information was recorded on the DP standard chain-of-custody (COC) sheets, which accompanied samples to the analytical laboratories. COCs contained sampling date, receipt date and time and the identity of samples. Copies of COCs, signed by the analytical laboratories, are presented in Appendix E, following the laboratory reports.

Q2.3 Batch Numbers and Holding Times

The following table lists the laboratory batch numbers applicable to this assessment, together with the corresponding sampling, sample receipt and COC receipt dates.

Table Q7 – Batch Details

Laboratory	Batch No.	Sampling Date	COC Receipt
Envirolab	112671 113088 113268	04/07/2014 14/07/2014 16/07/2014	17/07/2014 15/07/2014 17/07/2014

Schedule B(3) of the *National Environment Protection (Assessment of Site Contamination) Measure* 2013 (NEPM) prepared by the National Environment Protection Council (NEPC), details recommended maximum holding times for samples for various analytes.

A review of the laboratory report sheets and chain-of-custody documentation indicated that holding times were met by both laboratories, as summarised in the table below.

Table Q8 - Holding Times

Matrix	Analyte	Recommended maximum holding time	Holding time met
Soil	Heavy Metals: As, Cd, Cr, Cu, Pb, Hg, Ni, Zn	6 months	yes
	TPH C_6-C_9	14 days	yes
	TPH C_{10}-C_{36}	14 days	yes
	BTEX	14 days	yes
	PAH	14 days	yes
	OCP	14 days	yes
	PCB	14 days	yes
	Phenols	14 days	yes
	VOCs	14 days	yes
	pH	7 days	yes
	Asbestos	Nil	yes
Water	Metals	6 months	yes
	TPH C_6-C_9	14 days	yes
	TPH C_{10}-C_{36}	7 days	yes
	BTEX	14 days	yes
	PAH	7 days	yes
	OCP	7 days	yes
	OPP	7 days	yes
	PCB	7 days	yes
	Speciated phenols	7 days	yes
	VOCs	14 days	yes
	pH	6 hours	yes
	hardness	28 days	yes

Q2.4 Analytical Methods

The laboratory analytical methods are provided on the laboratory certificates in Appendix E and summarised below in Tables Q9.

The test methods used by the laboratories generally comply with those listed in the NEPM and the Australian and New Zealand Environment and Conservation Council (ANZECC)-1996 "*Guidelines for the Laboratory Analysis of Contaminated Soils*". Alternate methods used by Envirolab (i.e. not identified in the NEPM and ANZECC guidelines) have been validated by Envirolab, as recommended in the NEPM and ANZECC guidelines, and endorsed by NATA.

Table Q9 - Soil Analysis

Analyte	PQL / LOR [1] (mg/kg) Envirolab / Labmark	Envirolab Reference Method
Heavy Metals Cd, Cr, Cu, Pb, Ni, Zn	1.0 / 0.1-5.0	ICP-AES (Metals.20)
Arsenic (As)	4.0 / 1.0	ICP-AES (Metals.20)
Mercury (Hg)	0.10 / 0.05	CV-AAS (Metals.21)
VOC	0.5-10 / 0.5-5.0	P&T/GC/MS (GC.14)
TPH C_6-C_9	25 / 10	P&T/GC/MS (GC.16)
TPH C_{10}-C_{36}	250 / 250	GC/FID (GC.3)
BTEX	0.5-2 / 0.2-1.0	P&T/GC/MS (GC.14)
OCP	0.1 / 0.05	GC/ECD (GC.5)
PCB	0.1 / 0.5	GC/ECD (GC.6)
PAH	0.05-0.1 / 0.5-1.0	GC/MS (GC.12 subset)
Phenols	1-10 / 0.5-1.0	GC/MS (GC.12)
Asbestos	qualitative identification	AS4964-2004, qualitative identification using Polarised Light Microscopy and Dispersion Staining Techniques.

1: Practical Quantitation Limit / Limit of Reporting

Organophosphorus Pesticides Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	112671-1 BH1 0.1-0.2 04/07/2014 Soil	112671-2 BH3 0.1-0.2 04/07/2014 Soil	112671-4 BH5 0.1-0.2 04/07/2014 Soil
Date extracted	-	08/07/2014	08/07/2014	08/07/2014
Date analysed	-	09/07/2014	09/07/2014	09/07/2014
Diazinon	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	83	80	81

PCBs in Soil				
Our Reference:	UNITS	112671-1	112671-2	112671-4
Your Reference	----------	BH1	BH3	BH5
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		04/07/2014	04/07/2014	04/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	08/07/2014	08/07/2014	08/07/2014
Date analysed	-	09/07/2014	09/07/2014	09/07/2014
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1
Surrogate TCLMX	%	83	80	81

Total Phenolics in Soil				
Our Reference:	UNITS	112671-1	112671-2	112671-4
Your Reference	----------	BH1	BH3	BH5
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		04/07/2014	04/07/2014	04/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	08/07/2014	08/07/2014	08/07/2014
Date analysed	-	08/07/2014	08/07/2014	08/07/2014
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5

Acid Extractable metals in soil					
Our Reference:	UNITS	112671-1	112671-2	112671-3	112671-4
Your Reference	----------	BH1	BH3	BD1/04/07/14	BH5
Depth	----------	0.1-0.2	0.1-0.2	-	0.1-0.2
Date Sampled		04/07/2014	04/07/2014	04/07/2014	04/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date digested	-	08/07/2014	08/07/2014	08/07/2014	08/07/2014
Date analysed	-	08/07/2014	08/07/2014	08/07/2014	08/07/2014
Arsenic	mg/kg	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	2	6	3	7
Copper	mg/kg	<1	6	2	2
Lead	mg/kg	2	8	5	6
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	2	2	1	2
Zinc	mg/kg	<1	9	7	4

Moisture Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	112671-1 BH1 0.1-0.2 04/07/2014 Soil	112671-2 BH3 0.1-0.2 04/07/2014 Soil	112671-3 BD1/04/07/14 - 04/07/2014 Soil	112671-4 BH5 0.1-0.2 04/07/2014 Soil
Date prepared	-	08/07/2014	08/07/2014	08/07/2014	08/07/2014
Date analysed	-	09/07/2014	09/07/2014	09/07/2014	09/07/2014
Moisture	%	3.9	8.7	6.6	9.2

Asbestos ID - soils				
Our Reference:	UNITS	112671-1	112671-2	112671-4
Your Reference	----------	BH1	BH3	BH5
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		04/07/2014	04/07/2014	04/07/2014
Type of sample		Soil	Soil	Soil
Date analysed	-	9/07/2014	9/07/2014	9/07/2014
Sample mass tested	g	Approx 20g	Approx 20g	Approx 25g
Sample Description	-	Brown sandy soil	Brown sandy soil	Brown sandy soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

Miscellaneous Inorg - soil				
Our Reference:	UNITS	112671-1	112671-2	112671-4
Your Reference	----------	BH1	BH3	BH5
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2
Date Sampled		04/07/2014	04/07/2014	04/07/2014
Type of sample		Soil	Soil	Soil
Date prepared	-	11/07/2014	11/07/2014	11/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014
pH 1:5 soil:water	pH Units	7.6	8.0	7.6
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	24	<10

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			08/07/2014	[NT]	[NT]	LCS-4	08/07/2014
Date analysed	-			09/07/2014	[NT]	[NT]	LCS-4	09/07/2014
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-4	119%
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-4	119%
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	LCS-4	116%
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	LCS-4	122%
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-4	120%
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	LCS-4	118%
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-4	122%
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	111	[NT]	[NT]	LCS-4	114%
QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			08/07/2014	[NT]	[NT]	LCS-4	08/07/2014
Date analysed	-			09/07/2014	[NT]	[NT]	LCS-4	09/07/2014
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-4	88%
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	90%
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	87%
TRH >C_{10}-C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-4	88%
TRH >C_{16}-C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	90%
TRH >C_{34}-C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	87%
Surrogate o-Terphenyl	%		Org-003	83	[NT]	[NT]	LCS-4	95%
QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			08/07/2014	[NT]	[NT]	LCS-4	08/07/2014
Date analysed	-			09/07/2014	[NT]	[NT]	LCS-4	09/07/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	101%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	106%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	100%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	98%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	98%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-4	92%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-4	103%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	94	[NT]	[NT]	LCS-4	98%
QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			08/07/2014	[NT]	[NT]	LCS-4	08/07/2014
Date analysed	-			09/07/2014	[NT]	[NT]	LCS-4	09/07/2014
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	90%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	86%
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	78%
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	87%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	89%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	89%
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	90%
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	81%
pp-DDD	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	96%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-4	81%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%		Org-005	77	[NT]	[NT]	LCS-4	82%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			08/07/2014	[NT]	[NT]	LCS-4	08/07/2014
Date analysed	-			09/07/2014	[NT]	[NT]	LCS-4	09/07/2014
Diazinon	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Dimethoate	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Ronnel	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	LCS-4	94%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	LCS-4	78%
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	[NT]	[NT]	LCS-4	90%
Surrogate TCMX	%		Org-008	77	[NT]	[NT]	LCS-4	79%
QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			08/07/2014	[NT]	[NT]	LCS-4	08/07/2014
Date analysed	-			09/07/2014	[NT]	[NT]	LCS-4	09/07/2014
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	LCS-4	96%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		Org-006	77	[NT]	[NT]	LCS-4	83%
QUALITY CONTROL Total Phenolics in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			08/07/2014	[NT]	[NT]	LCS-1	08/07/2014
Date analysed	-			08/07/2014	[NT]	[NT]	LCS-1	08/07/2014
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	LCS-1	99%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			08/07/2014	[NT]	[NT]	LCS-7	08/07/2014
Date analysed	-			08/07/2014	[NT]	[NT]	LCS-7	08/07/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-7	96%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-7	102%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-7	100%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-7	98%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-7	95%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-7	105%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-7	99%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-7	98%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

QUALITY CONTROL Asbestos ID - soils	UNITS	PQL	METHOD	Blank
Date analysed	-			[NT]

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			11/07/2014	112671-1	11/07/2014 || 11/07/2014	LCS-1	11/07/2014
Date analysed	-			11/07/2014	112671-1	11/07/2014 || 11/07/2014	LCS-1	11/07/2014
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	112671-1	7.6 || 7.8 || RPD: 3	LCS-1	102%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	112671-1	<10 || <10	LCS-1	100%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	112671-1	<10 || <10	LCS-1	102%

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

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CERTIFICATE OF ANALYSIS 112864

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Richard L, Paul G, Jason S

Sample log in details:

Your Reference:	**84377, Warwick Farm**
No. of samples:	1 Soil
Date samples received / completed instructions received	10/07/2014 / 10/07/2014

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	18/07/14 / 18/07/14
Date of Preliminary Report:	Not Issued

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

sPOCAS Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ---------- 	112864-1 BH1 6.9-7.0 04/07/2014 Soil
Date prepared	-	14/7/2014
Date analysed	-	14/7/2014
pH kcl	pH units	4.6
TAA pH 6.5	moles H^+/t	14
s-TAA pH 6.5	%w/w S	0.02
pH ox	pH units	4.4
TPA pH 6.5	moles H^+/t	25
s-TPA pH 6.5	%w/w S	0.04
TSA pH 6.5	moles H^+/t	11
s-TSA pH 6.5	%w/w S	0.02
ANCE	% $CaCO_3$	<0.05
a-ANCE	moles H^+/t	<5
s-ANCE	%w/w S	<0.05
SKCl	%w/w S	<0.005
SP	%w/w	0.007
SPOS	%w/w	<0.005
a-SPOS	moles H^+/t	<5
CaKCl	%w/w	0.01
CaP	%w/w	0.01
CaA	%w/w	<0.005
MgKCl	%w/w	0.007
MgP	%w/w	0.007
MgA	%w/w	<0.005
Fineness Factor	-	1.5
a-Net Acidity	moles H^+/t	16
Liming rate	kg $CaCO_3$/t	1.2
a-Net Acidity without ANCE	moles H^+/t	NA
Liming rate without ANCE	kg $CaCO_3$/t	NA

Chromium Suite		
Our Reference:	UNITS	112864-1
Your Reference	----------	BH1
Depth	----------	6.9-7.0
Date Sampled		04/07/2014
Type of sample		Soil
Chromium Reducible Sulfur	%w/w	<0.005
a-Chromium Reducible Sulfur	moles H^+/t	<3

PAHs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	113088-1 BH2 0.1-0.2 14/07/2014 Soil	113088-2 BH4 0.1-0.2 14/07/2014 Soil	113088-3 BH6 0.1-0.2 14/07/2014 Soil	113088-4 BH7 0.1-0.1 14/07/2014 Soil	113088-5 BH8 0.1-0.2 14/07/2014 Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	97	92	90	100	92

PAHs in Soil		
Our Reference:	UNITS	113088-6
Your Reference	----------	BD1/140714
Depth	----------	-
Date Sampled		14/07/2014
Type of sample		Soil
Date extracted	-	16/07/2014
Date analysed	-	16/07/2014
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5
Total +ve PAH's	mg/kg	NIL (+)VE
Surrogate p-Terphenyl-d14	%	90

Organochlorine Pesticides in soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	113088-1 BH2 0.1-0.2 14/07/2014 Soil	113088-2 BH4 0.1-0.2 14/07/2014 Soil	113088-3 BH6 0.1-0.2 14/07/2014 Soil	113088-4 BH7 0.1-0.1 14/07/2014 Soil	113088-5 BH8 0.1-0.2 14/07/2014 Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	97	92	86	95	89

Organochlorine Pesticides in soil		
Our Reference:	UNITS	113088-6
Your Reference	----------	BD1/140714
Depth	----------	-
Date Sampled		14/07/2014
Type of sample		Soil
Date extracted	-	16/07/2014
Date analysed	-	16/07/2014
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Surrogate TCMX	%	90

Organophosphorus Pesticides Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	113088-1 BH2 0.1-0.2 14/07/2014 Soil	113088-2 BH4 0.1-0.2 14/07/2014 Soil	113088-3 BH6 0.1-0.2 14/07/2014 Soil	113088-4 BH7 0.1-0.1 14/07/2014 Soil	113088-5 BH8 0.1-0.2 14/07/2014 Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	97	92	86	95	89

Organophosphorus Pesticides Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	113088-6 BD1/140714 - 14/07/2014 Soil
Date extracted	-	16/07/2014
Date analysed	-	16/07/2014
Diazinon	mg/kg	<0.1
Dimethoate	mg/kg	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1
Ronnel	mg/kg	<0.1
Chlorpyriphos	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Bromophos-ethyl	mg/kg	<0.1
Ethion	mg/kg	<0.1
Surrogate TCMX	%	90

PCBs in Soil						
Our Reference:	UNITS	113088-1	113088-2	113088-3	113088-4	113088-5
Your Reference	----------	BH2	BH4	BH6	BH7	BH8
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.1	0.1-0.2
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	97	92	86	95	89

PCBs in Soil		
Our Reference:	UNITS	113088-6
Your Reference	----------	BD1/140714
Depth	----------	-
Date Sampled		14/07/2014
Type of sample		Soil
Date extracted	-	16/07/2014
Date analysed	-	16/07/2014
Arochlor 1016	mg/kg	<0.1
Arochlor 1221	mg/kg	<0.1
Arochlor 1232	mg/kg	<0.1
Arochlor 1242	mg/kg	<0.1
Arochlor 1248	mg/kg	<0.1
Arochlor 1254	mg/kg	<0.1
Arochlor 1260	mg/kg	<0.1
Surrogate TCLMX	%	90

Total Phenolics in Soil						
Our Reference:	UNITS	113088-1	113088-2	113088-3	113088-4	113088-5
Your Reference	----------	BH2	BH4	BH6	BH7	BH8
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.1	0.1-0.2
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Total Phenolics in Soil		
Our Reference:	UNITS	113088-6
Your Reference	----------	BD1/140714
Depth	----------	-
Date Sampled		14/07/2014
Type of sample		Soil
Date extracted	-	17/07/2014
Date analysed	-	17/07/2014
Total Phenolics (as Phenol)	mg/kg	<5

Acid Extractable metals in soil						
Our Reference:	UNITS	113088-1	113088-2	113088-3	113088-4	113088-5
Your Reference	----------	BH2	BH4	BH6	BH7	BH8
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.1	0.1-0.2
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	1	2	6	85	13
Copper	mg/kg	<1	2	4	23	3
Lead	mg/kg	2	6	12	4	13
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	<1	2	3	74	4
Zinc	mg/kg	2	6	18	38	8

Acid Extractable metals in soil		
Our Reference:	UNITS	113088-6
Your Reference	----------	BD1/140714
Depth	----------	-
Date Sampled		14/07/2014
Type of sample		Soil
Date digested	-	16/07/2014
Date analysed	-	17/07/2014
Arsenic	mg/kg	<4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	8
Copper	mg/kg	1
Lead	mg/kg	6
Mercury	mg/kg	<0.1
Nickel	mg/kg	1
Zinc	mg/kg	3

Moisture						
Our Reference:	UNITS	113088-1	113088-2	113088-3	113088-4	113088-5
Your Reference	----------	BH2	BH4	BH6	BH7	BH8
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.1	0.1-0.2
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Moisture	%	4.7	2.3	5.4	3.7	6.9

Moisture		
Our Reference:	UNITS	113088-6
Your Reference	----------	BD1/140714
Depth	----------	-
Date Sampled		14/07/2014
Type of sample		Soil
Date prepared	-	16/07/2014
Date analysed	-	17/07/2014
Moisture	%	8.9

Asbestos ID - soils						
Our Reference:	UNITS	113088-1	113088-2	113088-3	113088-4	113088-5
Your Reference	----------	BH2	BH4	BH6	BH7	BH8
Depth	----------	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.1	0.1-0.2
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Sample mass tested	g	Approx 30g	Approx 35g	Approx 35g	Approx 50g	Approx 35g
Sample Description	-	Brown sandy soil	Brown fine-grained soil	Brown fine-grained soil	Brown coarse-grained soil & rocks	Brown sandy soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Date analysed	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
$TRHC_6$ - C_9	mg/kg	25	Org-016	<25	113088-1	<25 || <25	LCS-2	97%
$TRHC_6$ - C_{10}	mg/kg	25	Org-016	<25	113088-1	<25 || <25	LCS-2	97%
Benzene	mg/kg	0.2	Org-016	<0.2	113088-1	<0.2 || <0.2	LCS-2	88%
Toluene	mg/kg	0.5	Org-016	<0.5	113088-1	<0.5 || <0.5	LCS-2	98%
Ethylbenzene	mg/kg	1	Org-016	<1	113088-1	<1 || <1	LCS-2	101%
m+p-xylene	mg/kg	2	Org-016	<2	113088-1	<2 || <2	LCS-2	100%
o-Xylene	mg/kg	1	Org-016	<1	113088-1	<1 || <1	LCS-2	105%
naphthalene	mg/kg	1	Org-014	<1	113088-1	<1 || <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	95	113088-1	96 || 97 || RPD: 1	LCS-2	99%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Date analysed	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
$TRHC_{10}$ - C_{14}	mg/kg	50	Org-003	<50	113088-1	<50 || <50	LCS-2	105%
$TRHC_{15}$ - C_{28}	mg/kg	100	Org-003	<100	113088-1	<100 || <100	LCS-2	120%
$TRHC_{29}$ - C_{36}	mg/kg	100	Org-003	<100	113088-1	<100 || <100	LCS-2	94%
TRH>C_{10}-C_{16}	mg/kg	50	Org-003	<50	113088-1	<50 || <50	LCS-2	105%
TRH>C_{16}-C_{34}	mg/kg	100	Org-003	<100	113088-1	<100 || <100	LCS-2	120%
TRH>C_{34}-C_{40}	mg/kg	100	Org-003	<100	113088-1	<100 || <100	LCS-2	94%
Surrogate o-Terphenyl	%		Org-003	108	113088-1	100 || 87 || RPD: 14	LCS-2	103%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Date analysed	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	LCS-2	94%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	LCS-2	89%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	LCS-2	91%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	LCS-2	92%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	LCS-2	93%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	LCS-2	87%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	113088-1	<0.2 || <0.2	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	113088-1	<0.05 || <0.05	LCS-2	98%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	111	113088-1	97 || 86 || RPD: 12	LCS-2	92%
QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Date analysed	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
HCB	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	90%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	112%
Heptachlor	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	102%
delta-BHC	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	101%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	97%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	97%
Dieldrin	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	110%
Endrin	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	104%
pp-DDD	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	109%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	LCS-2	116%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	106	113088-1	97 || 85 || RPD: 13	LCS-2	88%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Date analysed	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Diazinon	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Dimethoate	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Ronnel	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	LCS-2	109%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	LCS-2	94%
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	113088-1	<0.1 || <0.1	LCS-2	97%
Surrogate TCMX	%		Org-008	106	113088-1	97 || 85 || RPD: 13	LCS-2	93%
QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Date analysed	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	113088-1	<0.1 || <0.1	LCS-2	90%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	113088-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	106	113088-1	97 || 85 || RPD: 13	LCS-2	91%
QUALITY CONTROL Total Phenolics in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			17/07/2014	[NT]	[NT]	LCS-1	17/07/2014
Date analysed	-			17/07/2014	[NT]	[NT]	LCS-1	17/07/2014
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	LCS-1	100%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			16/07/2014	113088-1	16/07/2014 || 16/07/2014	LCS-2	16/07/2014
Date analysed	-			17/07/2014	113088-1	17/07/2014 || 17/07/2014	LCS-2	17/07/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	113088-1	<4 || <4	LCS-2	102%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	113088-1	<0.4 || <0.4	LCS-2	108%

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CERTIFICATE OF ANALYSIS 113161

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Richard L, Paul G, Jason S

Sample log in details:

Your Reference:	**84377, Warwick Farm**
No. of samples:	2 Soils
Date samples received / completed instructions received	16/07/2014 / 16/07/2014

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	24/07/14 / 24/07/14
Date of Preliminary Report:	Not Issued

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

sPOCAS Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ---------- 	113161-1 BH4 0.1-0.2 14/07/2014 Soil	113161-2 BH8 3.9-4.0 14/07/2014 Soil
Date prepared	-	17/7/2014	17/7/2014
Date analysed	-	17/7/2014	17/7/2014
pH $_{kcl}$	pH units	5.4	4.3
TAA pH 6.5	moles H^+/t	5	42
s-TAA pH 6.5	%w/w S	<0.01	0.07
pH $_{Ox}$	pH units	3.1	4.1
TPA pH 6.5	moles H^+/t	<5	42
s-TPA pH 6.5	%w/w S	<0.01	0.07
TSA pH 6.5	moles H^+/t	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01
ANCE	% $CaCO_3$	<0.05	<0.05
a-ANCE	moles H^+/t	<5	<5
s-ANCE	%w/w S	<0.05	<0.05
SKCl	%w/w S	<0.005	0.01
SP	%w/w	0.007	0.01
SPOS	%w/w	0.006	<0.005
a-SPOS	moles H^+/t	<5	<5
CaKCl	%w/w	0.04	0.01
CaP	%w/w	0.04	0.01
CaA	%w/w	<0.005	<0.005
MgKCl	%w/w	0.008	0.035
MgP	%w/w	0.008	0.034
MgA	%w/w	<0.005	<0.005
SHCl	%w/w S	[NT]	0.011
SNAS	%w/w S	[NT]	<0.005
a-SNAS	moles H^+/t	[NT]	<5
s-SNAS	%w/w S	[NT]	<0.01
Fineness Factor	-	1.5	1.5
a-Net Acidity	moles H^+/t	<10	43
Liming rate	kg $CaCO_3$/t	<0.75	3.2
a-Net Acidity without ANCE	moles H^+/t	NA	NA
Liming rate without ANCE	kg $CaCO_3$/t	NA	NA

Chromium Suite			
Our Reference:	UNITS	113161-1	113161-2
Your Reference	----------	BH4	BH8
Depth	----------	0.1-0.2	3.9-4.0
Date Sampled		14/07/2014	14/07/2014
Type of sample		Soil	Soil
Chromium Reducible Sulfur	%w/w	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+/t	<3	<3

Method ID	Methodology Summary
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			17/7/2014	[NT]	[NT]	LCS-1	17/7/2014
Date analysed	-			17/7/2014	[NT]	[NT]	LCS-1	17/7/2014
pH kcl	pH units		Inorg-064	[NT]	[NT]	[NT]	LCS-1	93%
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	105%
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
pH ox	pH units		Inorg-064	[NT]	[NT]	[NT]	LCS-1	100%
TPA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	88%
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
TSA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	87%
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
ANCE	% $CaCO_3$	0.05	Inorg-064	<0.05	[NT]	[NT]	[NR]	[NR]
a-ANCE	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-ANCE	%w/w S	0.05	Inorg-064	<0.05	[NT]	[NT]	[NR]	[NR]
SKCl	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	101%
SP	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	83%
SPOS	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	77%
a-SPOS	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	78%
CaKCl	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	101%
CaP	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
CaA	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
MgKCl	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	99%
MgP	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
MgA	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
SHCl	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
SNAS	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
a-SNAS	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-SNAS	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
Fineness Factor	-	1.5	Inorg-064	<1.5	[NT]	[NT]	[NR]	[NR]
a-Net Acidity	moles H^+/t	10	Inorg-064	<10	[NT]	[NT]	LCS-1	79%
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[NT]	[NT]	LCS-1	78%

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
a-Net Acidity without ANCE	moles H^+/t	10	Inorg-064	<10	[NT]	[NT]	[NR]	[NR]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NR]	[NR]
QUALITY CONTROL Chromium Suite	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	[NT]	[NT]	LCS-1	112%
a-Chromium Reducible Sulfur	moles H^+/t	3	Inorg-068	<3	[NT]	[NT]	[NR]	[NR]

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Douglas Partners
Geotechnics · Environment · Groundwater

CHAIN OF CUSTODY

Project Name: Warwick Farm Contamination Assessment.....
Project No:84377 ..... Sampler: RJL..... .....
Project Mgr: PG .....Mob. Phone: 0434561888 .....
Email: Richard.lamont@douglaspartners.com.au; paul.gorman@douglaspartners.com.au
Jason.surjadinata@douglaspartners.com.au
Date Required: standard turn around..... Lab Quote No. .....

To: Envirolab Services
12 Ashley Street, Chatswood NSW 2068
Attn: Aileen Hie

Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	S - soil W – water	Container type	SPOCAS	Chromium Reducible										Notes
BH4	0.1-0.2	1	14/7	S	P	x	X										
BH8	3.9-4.0	2	14/7	S	P	x	x										

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 113161
Date Received: 16/7/14
Time Received: 13.00
Received by: LSB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No. .....
Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114
Phone: (02) 9809 0666
Fax: (02) 9809 4095

Relinquished by: R.Lamont	Signed: RLamont	Date & Time: 16/7/14	Received By: LSB ELB	Date & Time: 16/7/14 1300
Relinquished by:	Signed:	Date & Time:	Received By:	Date & Time:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 113268

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Richard Lamont, Paul Gorman, Jason Surjadinata

Sample log in details:

Your Reference:	**84377, Warwick Farm Contamination Assessment**
No. of samples:	6 Waters
Date samples received / completed instructions received	17/07/2014 / 17/07/2014

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	24/07/14 / 22/07/14
Date of Preliminary Report:	Not Issued

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Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	113268-1 BH1 16/07/2014 Water	113268-2 BD1/160714 16/07/2014 Water	113268-3 BH7 16/07/2014 Water	113268-4 BH8 16/07/2014 Water	113268-5 Trip Spike 16/07/2014 Water
Date extracted	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	19/07/2014	19/07/2014	19/07/2014	19/07/2014	19/07/2014
$TRHC_6 - C_9$	µg/L	23	24	<10	16	[NA]
$TRHC_6 - C_{10}$	µg/L	23	24	<10	21	[NA]
$TRHC_6 - C_{10}$ less BTEX (F1)	µg/L	23	24	<10	19	[NA]
Benzene	µg/L	<1	<1	<1	<1	76%
Toluene	µg/L	<1	<1	<1	<1	77%
Ethylbenzene	µg/L	<1	<1	<1	<1	78%
m+p-xylene	µg/L	<2	<2	<2	<2	77%
o-xylene	µg/L	<1	<1	<1	2	77%
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	101	102	101	100	100
Surrogate toluene-d8	%	98	100	100	99	99
Surrogate 4-BFB	%	97	97	96	97	99

vTRH(C6-C10)/BTEXN in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	113268-6 Trip Blank 16/07/2014 Water
Date extracted	-	18/07/2014
Date analysed	-	19/07/2014
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Surrogate Dibromofluoromethane	%	101
Surrogate toluene-d8	%	100
Surrogate 4-BFB	%	98

svTRH (C10-C40) in Water					
Our Reference:	UNITS	113268-1	113268-2	113268-3	113268-4
Your Reference	----------	BH1	BD1/160714	BH7	BH8
Date Sampled	----------	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Type of sample		Water	Water	Water	Water
Date extracted	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
TRHC$_{10}$ - C$_{14}$	µg/L	<50	<50	<50	140
TRHC$_{15}$ - C$_{28}$	µg/L	410	450	<100	480
TRHC$_{29}$ - C$_{36}$	µg/L	<100	<100	<100	150
TRH>C$_{10}$ - C$_{16}$	µg/L	<50	<50	<50	170
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	<50	<50	<50	170
TRH>C$_{16}$ - C$_{34}$	µg/L	450	460	<100	540
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	<100	<100	<100
Surrogate o-Terphenyl	%	114	115	128	83

PAHs in Water - Low Level Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	113268-1 BH1 16/07/2014 Water	113268-2 BD1/160714 16/07/2014 Water	113268-3 BH7 16/07/2014 Water	113268-4 BH8 16/07/2014 Water
Date extracted	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Naphthalene	µg/L	0.1	<0.1	<0.1	0.3
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	0.3
Phenanthrene	µg/L	<0.1	<0.1	<0.1	0.7
Anthracene	µg/L	<0.1	<0.1	<0.1	0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	1
Pyrene	µg/L	<0.1	<0.1	<0.1	1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	0.4
Chrysene	µg/L	<0.1	<0.1	<0.1	0.5
Benzo(b+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	0.7
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	0.5
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	0.3
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	0.4
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	1
Total +ve PAH's	µg/L	0.1	NIL (+)VE	NIL (+)VE	6.1
Surrogate p-Terphenyl-d14	%	129	117	134	95

OCP in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	113268-1 BH1 16/07/2014 Water	113268-2 BD1/160714 16/07/2014 Water	113268-3 BH7 16/07/2014 Water	113268-4 BH8 16/07/2014 Water
Date extracted	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
HCB	µg/L	<0.2	<0.2	<0.2	<0.2
alpha-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
gamma-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
beta-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
Heptachlor	µg/L	<0.2	<0.2	<0.2	<0.2
delta-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
Aldrin	µg/L	<0.2	<0.2	<0.2	<0.2
Heptachlor Epoxide	µg/L	<0.2	<0.2	<0.2	<0.2
gamma-Chlordane	µg/L	<0.2	<0.2	<0.2	<0.2
alpha-Chlordane	µg/L	<0.2	<0.2	<0.2	<0.2
Endosulfan I	µg/L	<0.2	<0.2	<0.2	<0.2
pp-DDE	µg/L	<0.2	<0.2	<0.2	<0.2
Dieldrin	µg/L	<0.2	<0.2	<0.2	<0.2
Endrin	µg/L	<0.2	<0.2	<0.2	<0.2
pp-DDD	µg/L	<0.2	<0.2	<0.2	<0.2
Endosulfan II	µg/L	<0.2	<0.2	<0.2	<0.2
pp-DDT	µg/L	<0.2	<0.2	<0.2	<0.2
Endrin Aldehyde	µg/L	<0.2	<0.2	<0.2	<0.2
Endosulfan Sulphate	µg/L	<0.2	<0.2	<0.2	<0.2
Methoxychlor	µg/L	<0.2	<0.2	<0.2	<0.2
Surrogate TCMX	%	113	103	120	78

OP Pesticides in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	113268-1 BH1 16/07/2014 Water	113268-2 BD1/160714 16/07/2014 Water	113268-3 BH7 16/07/2014 Water	113268-4 BH8 16/07/2014 Water
Date extracted	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Diazinon	µg/L	<0.2	<0.2	<0.2	<0.2
Dimethoate	µg/L	<0.2	<0.2	<0.2	<0.2
Chlorpyriphos-methyl	µg/L	<0.2	<0.2	<0.2	<0.2
Ronnel	µg/L	<0.2	<0.2	<0.2	<0.2
Chlorpyriphos	µg/L	<0.2	<0.2	<0.2	<0.2
Fenitrothion	µg/L	<0.2	<0.2	<0.2	<0.2
Bromophos ethyl	µg/L	<0.2	<0.2	<0.2	<0.2
Ethion	µg/L	<0.2	<0.2	<0.2	<0.2
Surrogate TCMX	%	113	103	120	78

PCBs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	113268-1 BH1 16/07/2014 Water	113268-2 BD1/160714 16/07/2014 Water	113268-3 BH7 16/07/2014 Water	113268-4 BH8 16/07/2014 Water
Date extracted	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Arochlor 1016	µg/L	<2	<2	<2	<2
Arochlor 1221	µg/L	<2	<2	<2	<2
Arochlor 1232	µg/L	<2	<2	<2	<2
Arochlor 1242	µg/L	<2	<2	<2	<2
Arochlor 1248	µg/L	<2	<2	<2	<2
Arochlor 1254	µg/L	<2	<2	<2	<2
Arochlor 1260	µg/L	<2	<2	<2	<2
Surrogate TCLMX	%	113	103	120	78

Total Phenolics in Water					
Our Reference:	UNITS	113268-1	113268-2	113268-3	113268-4
Your Reference	----------	BH1	BD1/160714	BH7	BH8
Date Sampled	----------	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Type of sample		Water	Water	Water	Water
Date extracted	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05

HM in water - dissolved					
Our Reference:	UNITS	113268-1	113268-2	113268-3	113268-4
Your Reference	----------	BH1	BD1/160714	BH7	BH8
Date Sampled	----------	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Type of sample		Water	Water	Water	Water
Date prepared	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014	18/07/2014
Arsenic-Dissolved	µg/L	<1	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	0.6	0.4
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	2	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	9	10	48	12
Zinc-Dissolved	µg/L	45	53	98	30

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			18/07/2014	[NT]	[NT]	LCS-W1	18/07/2014
Date analysed	-			19/07/2014	[NT]	[NT]	LCS-W1	19/07/2014
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	95%
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	95%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	95%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	94%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	95%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	95%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	96%
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	99	[NT]	[NT]	LCS-W1	98%
Surrogate toluene-d8	%		Org-016	99	[NT]	[NT]	LCS-W1	100%
Surrogate 4-BFB	%		Org-016	96	[NT]	[NT]	LCS-W1	97%
QUALITY CONTROL svTRH (C10-C40) in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			18/07/2014	[NT]	[NT]	LCS-W1	18/07/2014
Date analysed	-			18/07/2014	[NT]	[NT]	LCS-W1	18/07/2014
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	99%
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	99%
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	100%
TRH>C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	99%
TRH>C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	99%
TRH>C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	100%
Surrogate o-Terphenyl	%		Org-003	97	[NT]	[NT]	LCS-W1	86%
QUALITY CONTROL PAHs in Water - Low Level	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			18/07/2014	[NT]	[NT]	LCS-W1	18/07/2014
Date analysed	-			18/07/2014	[NT]	[NT]	LCS-W1	18/07/2014
Naphthalene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	113%
Acenaphthylene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	117%
Phenanthrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	110%

QUALITY CONTROL PAHs in Water - Low Level	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	109%
Pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	108%
Benzo(a)anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	103%
Benzo(b+k)fluoranthene	µg/L	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W1	112%
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	133	[NT]	[NT]	LCS-W1	77%

QUALITY CONTROL OCP in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			18/07/2014	[NT]	[NT]	LCS-W1	18/07/2014
Date analysed	-			18/07/2014	[NT]	[NT]	LCS-W1	18/07/2014
HCB	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
alpha-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	106%
gamma-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
beta-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	86%
Heptachlor	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	93%
delta-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Aldrin	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	89%
Heptachlor Epoxide	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	88%
gamma-Chlordane	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
alpha-Chlordane	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Endosulfan I	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
pp-DDE	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	85%
Dieldrin	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	92%
Endrin	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	85%
pp-DDD	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	87%
Endosulfan II	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
pp-DDT	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	96%

Appendix F

Test Bore Results

and Notes About this Report

About this Report

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.

Sampling Methods

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

Sampling Methods

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Descriptions

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

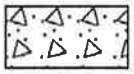
Symbols & Abbreviations

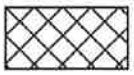
Graphic Symbols for Soil and Rock

General

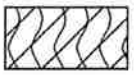

Asphalt


Road base

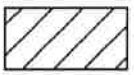

Concrete

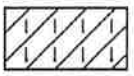

Filling

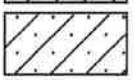
Soils


Topsoil


Peat

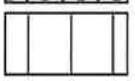

Clay


Silty clay

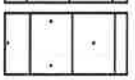

Sandy clay

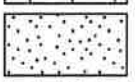

Gravelly clay

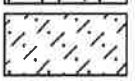

Shaly clay

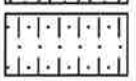

Silt


Clayey silt


Sandy silt


Sand

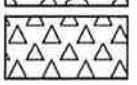

Clayey sand


Silty sand

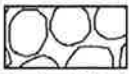

Gravel

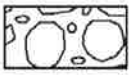

Sandy gravel


Cobbles, boulders

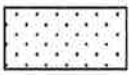

Talus

Sedimentary Rocks

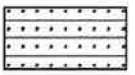

Boulder conglomerate

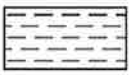

Conglomerate


Conglomeratic sandstone

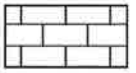

Sandstone


Siltstone


Laminite

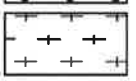

Mudstone, claystone, shale

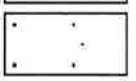

Coal


Limestone

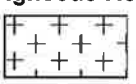
Metamorphic Rocks

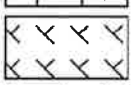

Slate, phyllite, schist

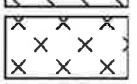

Gneiss

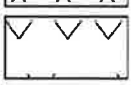

Quartzite

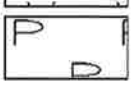
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 7.0 AHD
EASTING: 310144
NORTHING: 6245266
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 84377
DATE: 4/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	TOPSOIL - grass and dark brown silty sand filling		A/E	0.1 0.2		PID=2		Gatic cover
	0.6	FILLING - light brown, fine to medium sand filling with trace gravel							
	0.8	FILLING - light yellow, fine to medium sand filling							
	1	SAND - loose, white, fine to medium sand		A/S	1.0 1.45		3,4,4 N = 8 PID=3.5		Backfill
	2.0	SAND - loose to medium dense, dark brown, fine to medium sand		A/S	2.5 2.95		4,4,6 N = 10 PID=2		
	3.5	SAND - medium dense, dark brown and orange, fine to medium sand		A/S	4.0 4.45		10,12,14 N = 26 PID=2		Bentonite
	4.8	SILTY CLAY - grey, silty clay							
	4.9	SAND - dense, orange, fine to medium sand		A/S	5.5 5.95		19,20,24 N = 44 PID=4.0		Backfilled with gravel
	6.2	Becoming moist at 6.1m SAND - dense, brown, fine to medium sand		A/S	7.0 7.45		14,16,19 N = 35 PID=2.5	▼	Machine slotted PVC screen
	8.0	Bore discontinued at 8.0m - target depth reached							Spear Point Cap

RIG: Ausrock 4000 **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 8.0m

WATER OBSERVATIONS: Free groundwater observed at 6.5m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U$_x$	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 6.4 AHD
EASTING: 310168
NORTHING: 6245074
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 84377
DATE: 14/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.3	FILLING - light yellow, sand filling with some organic matter (leaves and rootlets) and trace subangular gravel		A/E	0.1 0.2		PID=1.5		
		SAND - loose, light yellow, fine to medium sand							
				A/S	1.0		5,1,2 N = 3 PID<1		
	1.3	SAND - light brown, fine to medium sand			1.45				
				A/E	2.9				
	3.0	Bore discontinued at 3.0m - target depth reached			3.0		PID=1		

RIG: Geoprobe 7822DT **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 3.0m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 6.0 AHD
EASTING: 310319
NORTHING: 6245234
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 84377
DATE: 4/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
6	0.85	TOPSOIL - grass and dark brown clayey sand filling		A/E*	0.1 0.2 0.3		PID<1		
5	1.0	FILLING - light brown, fine to medium sand filling with some grey and orange sand, clay inclusions, rootlets		A/S	1.0		6,10,14 N = 24 PID=1		
	1.3	SILTY CLAY - very stiff, grey and orange silty clay			1.45		8,10,16 N = 26 PID<1		
4		SILTY CLAY - very stiff, brown silty clay		A/S	2.5				
3	3.3	SAND - loose, brown, fine to medium sand		A/S	4.0 4.45		5,3,5 N = 8 PID<1		
2	5.3	SAND - medium dense, brown mottled light grey, fine to medium sand		A/S	5.5		8,4,12 N = 16 PID<1		
1	5.95	Bore discontinued at 5.95m - target depth reached			5.95				
0									
-1									
-2									
-3									

RIG: Ausrock 4000 **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 5.95m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD1/040714 collected at 0.1-0.2m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 6.6 AHD
EASTING: 310301
NORTHING: 6245129
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 84377
DATE: 14/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING - light yellow, fine to medium sand filling with some subangular gravel and rootlets		A/E	0.1 0.2		PID=1		
	0.4	SAND - medium dense, light yellow, fine to medium sand		A/S	1.0 1.45		8,8,10 N = 18 PID=1		
	2.0	SAND - orange, fine to medium sand							
	2.2	CLAYEY SAND - orange clayey sand							
	2.4	SANDY CLAY - very stiff, orange and grey, sandy clay		A/S	2.5 2.95		8,8,19 N = 27 PID<1		
	3.0	SAND - medium dense, light brown, fine to medium sand		S	4.0 4.45		8,7,7 N = 14 PID<1		
	4.3	SAND - medium dense, brown, fine to medium sand							
	5.0	Bore discontinued at 5.0m - target depth reached							

RIG: Geoprobe 7822DT **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 5.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Bulk sample taken at 0.2-1.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 8.5 AHD
EASTING: 310582
NORTHING: 6245054
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 84377
DATE: 4/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	TOPSOIL - grass and dark brown clayey sand filling		A/E	0.1		PID<1		
		FILLING - light brown and orange, silt and sand filling			0.2				
	0.6	SAND - light brown, fine to medium sand							
	0.9	CLAYEY SAND - medium dense to very dense, brown and red, clayey sand		A/S	1.0		4,7,12 N = 19 PID<1		
					1.45				
				A/S	2.5		20,24,28 N = 52 PID<1		
					2.95				
				A/S	4.0		15,20,25 N = 45 PID<1		
	4.5	CLAYEY SAND - medium dense, red and grey, clayey sand			4.45				
				A/S	5.5		7,12,14 N = 26 PID<1		
	5.95	Bore discontinued at 5.95m - target depth reached			5.95				

RIG: Ausrock 4000 **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 5.95m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 8.2 AHD
EASTING: 310434
NORTHING: 6241118
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 84377
DATE: 14/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.3	FILLING - white sand filling with some subangular gravel		A/E	0.1 0.2		PID=1		
	0.8	SANDY CLAY - orange sandy clay							
	1	SANDY CLAY - stiff, red and grey, sandy clay - very stiff at 1.5m		A/S	1.0 1.45		9,14,19 N = 33 PID=1.5		
	2.7	SANDSTONE (Cemented fluvial sand?) - red and grey, extremely weathered sandstone		A/S	2.5 2.95		10,12,22 N = 34 PID=1.5		
	5.0	Bore discontinued at 5.0m - target depth reached							

RIG: Geoprobe 7822DT **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased
TYPE OF BORING: Solid flight auger to 5.0m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 5.8 AHD
EASTING: 310574
NORTHING: 6244965
DIP/AZIMUTH: 90°/--

BORE No: BH7
PROJECT No: 84377
DATE: 14/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	FILLING - light brown, clayey sand filling with gravel		A/E	0.1		PID=3.5		Gatic cover
		CLAY - very stiff, brown, red and grey, sandy clay			0.2				
				A/S	0.9		8,12,15 N = 27 PID=3		
					1.0				
					2.5				Backfill
				A/S			14,23,26 N = 49 PID=3		
	2.8								
	2.9	SANDY CLAY - hard, light grey mottled brown, sandy clay			2.95				
		SAND - stiff, orange mottled grey, sandy clay							
	3.7	SANDY CLAY - hard, red and orange mottled grey, sandy clay			4.0				
	4.2	SANDY CLAY - hard, light grey mottled orange, sandy clay		A/S			15,17,23 N = 40 PID=1		
					4.45				
	4.7	SANDY CLAY - hard, orange sandy clay							Bentonite
					5.5				
	5.7	CLAYEY SAND - white, clayey sand		A/S			13,18,22 N = 40 PID=2		
					5.95				
	6.2	CLAYEY SAND - medium dense, red, orange and light grey, clayey sand							Backfilled with gravel
		- moist at 7.0m			7.0			▼	Machine slotted PVC screen
				A/S			8,11,14 N = 25 PID=1		
					7.45				
	8.5	Bore discontinued at 8.5m - target depth reached			8.5				Spear Point Cap
				A/S			9,14,18 N = 32 PID=1		
					8.95				

RIG: Geoprobe 7822DT **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased

TYPE OF BORING: Push tube to 1.5m; Solid flight auger to 8.5m

WATER OBSERVATIONS: Free groundwater observed at 7.0m

REMARKS: Bulk sample taken at 0.2-1.0m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Stockland Development Pty Ltd
PROJECT: Geotechnical & Contamination Investigations
LOCATION: Cooper's Paddock, Governor Macquarie Drive,Warwick Farm

SURFACE LEVEL: 7.1 AHD
EASTING: 310480
NORTHING: 6245244
DIP/AZIMUTH: 90°/--

BORE No: BH8
PROJECT No: 84377
DATE: 14/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.2	FILLING - light brown, silty sand filling with some subangular gravel		A/E*	0.1 0.2		PID=2		Gatic cover
	0.5	SILTY SAND - yellow silty sand							
		SANDY CLAY - very stiff to hard, brown and red, sandy clay		A/S	1.0 1.45		12,20,29 N = 49 PID=2		Backfill
	2.0	SANDSTONE - extremely weathered, red, white and orange sandstone		A/S	2.5 2.95		28,43,52 N = 95 PID<1		Bentonite
		- highly weathered at 3.0m							
	4.0	SANDSTONE (Cemented fluvial sand?) - highly weathered, grey red sandstone		A/S	4.0 4.45		21,50,46 N = 96 PID=2		Backfilled with gravel Machine slotted PVC screen
	7.0	Bore discontinued at 7.0m - target depth reached							Spear Point Cap

RIG: Geoprobe 7822DT **DRILLER:** Terratest **LOGGED:** RJL **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *BD1/140714 taken at 0.1-0.2m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Appendix G

Laboratory Summary Tables

		BTEX							Halogenated Benzenes	Inorganics				Lead	Metals							Organoch								
	B(a)P Total Potency Equivalent	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 less BTEX (F1)	Hexachlorobenzene	Chloride	Moisture	pH (aqueous extract)	Sulphate	Lead	Arsenic	Cadmium	Chromium (III+VI)	Copper	Mercury	Nickel	Zinc	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	pH_Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.5	0.2	1	0.5	2	1		25	0.1	10	0.1		10	1	4	0.4	1	1	0.1	1	1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1
HSL-D Commercial / Industrial		**430**	**27000**	**99000**			**81000**																							
NEPM 2013 Commercial and industrial, Coarse Soil		**75**	**165**	**135**			**180**																							
NEPM 2013 Commercial/ industrial D Soil									**80**					**1500**	**3000**	**900**		**240000**	**730**	**6000**	**400000**				**45**						
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 0 to <1m,		**3**					**230**	**260**																						
EIL														**1800**	**160**		**550**	**140**		**55**	**500**									**640**
ESL	**0.7**	**75**	**165**	**135**			**180**																							

Field_ID	Sample_Depth_Range	Sampled_Date-Time																												
BH1	0.1-0.2	4/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	<10	3.9	7.6	<10	2	<4	<0.4	2	<1	<0.1	2	<1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH2	0.1-0.2	14/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	-	4.7	-	-	2	<4	<0.4	1	<1	<0.1	<1	2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH3	0.1-0.2	4/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	<10	8.7	8	24	8	<4	<0.4	6	6	<0.1	2	9	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH4	0.1-0.2	14/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	-	2.3	-	-	6	<4	<0.4	2	2	<0.1	2	6	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH5	0.1-0.2	4/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	<10	9.2	7.6	<10	6	<4	<0.4	7	2	<0.1	2	4	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH6	0.1-0.2	14/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	-	5.4	-	-	12	<4	<0.4	6	4	<0.1	3	18	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH7	0.1-0.2	14/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	-	3.7	-	-	4	<4	<0.4	85	23	<0.1	74	38	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH8	0.1-0.2	14/07/2014	<0.5	<0.2	<1	<0.5	<2	<1	<3	<25	<0.1	-	6.9	-	-	13	<4	<0.4	13	3	<0.1	4	8	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

	Chlorine Pesticides											Organophosphorous Pesticides								PAH/Phenols													
	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Bromophos-ethyl	Chlorpyrifos	Chlorpyrifos-methyl	Diazinon	Dimethoate	Ethion	Fenitrothion	Ronnel	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(g,h,i)perylene	Carcinogenic PAHs as B(a)P TPE	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.2	0.1		0.1	0.1	0.1	0.1	0.1	0.1		0.1
HSL-D Commercial / Industrial																																	11000		
NEPM 2013 Commercial and industrial, Coarse Soil																								0.7											
NEPM 2013 Commercial/ industrial D Soil	3600					100			50		2500		2000														40							4000	
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 0																																			
EIL																																	370		
ESL																																			
Field_ID	Sample_Depth_Range	Sampled_Date-Time																																	
BH1	0.1-0.2	4/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.622	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
BH2	0.1-0.2	14/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.672	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
BH3	0.1-0.2	4/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.622	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
BH4	0.1-0.2	14/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.672	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
BH5	0.1-0.2	4/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.622	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
BH6	0.1-0.2	14/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.672	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
BH7	0.1-0.2	14/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.672	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
BH8	0.1-0.2	14/07/2014	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.1	<0.672	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1

			Polychlorinated Biphenyls							TPH										
			Phenolics Total	Pyrene	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C6-C10	Asbestos
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
EQL			5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	50	100	100	50	25	50	100	100		25	
HSL-D Commercial / Industrial												20000	27000	38000							26000	
NEPM 2013 Commercial and industrial, Coarse Soil												170	1700	3300							215	
NEPM 2013 Commercial/ industrial D Soil																						
NEPM 2013 Commercial/Industrial D Soil HSL for Vapour Intrusion, 0																						
EIL																						
ESL													1700	3300	170						215	
Field_ID	Sample_Depth_Range	Sampled_Date-Time																				
BH1	0.1-0.2	4/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD
BH2	0.1-0.2	14/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD
BH3	0.1-0.2	4/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD
BH4	0.1-0.2	14/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD
BH5	0.1-0.2	4/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD
BH6	0.1-0.2	14/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD
BH7	0.1-0.2	14/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD
BH8	0.1-0.2	14/07/2014	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<250	<25	NAD

	Organophorous Pesticides					PAH/Phenols																	Polychlorinated Biphenyls							TPH									
	Diazinon	Dimethoate	Ethion	Fenitrothion	Ronnel	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(g,h,i)perylene	Carcinogenic PAHs as B(a)P TPE	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Phenolics Total	Pyrene	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	C6-C10
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
EQL	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1		0.1	0.1	0.1	0.1	0.1	0.1	1	0.1	50	0.1	2	2	2	2	2	2	2	0.05	0.1	0.1	0.05	10	50	100	100		0.01
HSL-D, 2m to <4m, GW in Sand Soils																																								6.2
NEPM 2013 Commercial/ Industrial GW HSL D Vapour Intrusion, 2m to <																																								
NEPM 2013 GILs, Drinking Water(B)	4	7	4	7						0.01																														
NEPM 2013 GILs, Fresh Waters(A)	0.01	0.15		0.2															16								0.3		0.01										

LocCode	WellCode	Sampled_Date-Time																																							
BH1		16/07/2014	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.722	<0.1	<0.1	<0.1	<0.1	<0.1	<1 - 0.1	0.1	<0.1	<50	<0.1	<2	<2	<2	<2	<2	<2	<2	<0.05	0.45	<0.1	<0.05	23	<50	410	<100	485	0.023
BH7		16/07/2014	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.722	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1	<50	<0.1	<2	<2	<2	<2	<2	<2	<2	<0.05	<0.1	<0.1	<0.05	<10	<50	<100	<100	<250	<0.01
BH8		16/07/2014	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	0.1	0.4	0.5	0.7	0.4	1.629	0.5	<0.1	1	0.3	0.3	<1 - 0.3	6.1	0.7	<50	1	<2	<2	<2	<2	<2	<2	<2	0.17	0.54	<0.1	0.17	16	140	480	150	770	0.021

Douglas Partners

Table 16: Acid Sulphate Soil Screening and Laboratory Results

Sample ID	Soil Description	Screening Tests				SPOCAS Suite Test Results							
		pH_F	pH_{FOX}	pH change (pH_{FOX}-pH_F)	Observed Reaction Strength [a]	pH_{KCl}	Total Potential Acidity (s-TPA)	Titr. Sulphidic Acidity (s-TSA)	Total Actual Acidity (s-TAA)	Potential Sulphidic Acidity (S_{POS})	Excess Acid Neutralising Capacity (s-ANC_E)	Net Acidity based on sPOS [b]	Laboratory Calculated Liming Rate
		pH units			-	pH units	(%w/w S)					mole H+/t	kg $CaCO_3$/t
BH1/0.1-0.2	light brown sand	7.68	6.17	-1.51	1	-	-	-	-	-	-	-	-
BH1/1.0-1.1	yellow sand	8.07	6.19	-1.88	1F	-	-	-	-	-	-	-	-
BH1/2.5-2.6	dark brown sand	7.92	5.35	-2.57	1	-	-	-	-	-	-	-	-
BH1/4.0-4.1	dark brown and orange sand	7.33	5.06	-2.27	1	-	-	-	-	-	-	-	-
BH1/5.4-5.5	orange sand	6.63	3.97	-2.66	1F	-	-	-	-	-	-	-	-
BH1/6.9-7.0	brown sand	6.16	3.93	-2.23	1	4.6	0.04	0.02	0.02	<0.005	<0.05	16	1.2
BH2/0.1-0.2	pale yellow sand	7.18	6.53	-0.65	1F	-	-	-	-	-	-	-	-
BH2/1.1.45	light brown sand	7.90	6.60	-1.30	1	-	-	-	-	-	-	-	-
BH2/2.9-3.0	light brown sand	7.55	6.26	-1.29	1	-	-	-	-	-	-	-	-
BH3/0.1-0.2	light brown sand	7.24	5.46	-1.78	1F	-	-	-	-	-	-	-	-
BH3/0.9-1.0	grey and orange silty clay	7.15	5.47	-1.68	1F	-	-	-	-	-	-	-	-
BH3/2.4-2.5	grey and orange silty clay	6.45	4.58	-1.87	1	-	-	-	-	-	-	-	-
BH3/3.9-4.0	brown sand	5.89	4.39	-1.50	1F	-	-	-	-	-	-	-	-
BH3/5.4-5.5	brown mottled light grey sand	6.08	4.46	-1.62	1F	-	-	-	-	-	-	-	-
BH4/0.1-0.2	light yellow sand	7.00	4.38	-2.62	2F	5.4	<0.01	<0.01	<0.01	0.006	<0.05	<10	<0.75
BH4/1.0-1.45	light yellow sand	6.22	4.83	-1.39	2F	-	-	-	-	-	-	-	-
BH4/2.4-2.5	orange and grey sandy clay	4.78	4.38	-0.40	1F	-	-	-	-	-	-	-	-
BH4/3.9-4.0	light brown sand	5.26	4.22	-1.04	1F	-	-	-	-	-	-	-	-
BH5/0.1-0.2	light brown and orange silty sand	7.20	6.53	-0.67	1F	-	-	-	-	-	-	-	-
BH5/2.4-2.5	brown and red clayey sand	7.03	6.00	-1.03	2F	-	-	-	-	-	-	-	-
BH5/3.9-4.0	brown and red clayey sand	6.89	4.79	-2.10	2F	-	-	-	-	-	-	-	-
BH5/5.4-5.5	grey clayey sand	6.63	4.85	-1.78	2F	-	-	-	-	-	-	-	-
BH6/0.1-0.2	white sand	6.51	5.87	-0.64	1F	-	-	-	-	-	-	-	-
BH6/1.0-1.45	red and grey sandy clay	5.75	4.44	-1.31	2F	-	-	-	-	-	-	-	-
BH6/3.4-3.5	red and grey weatered sandstone	7.35	4.42	-2.93	1F	-	-	-	-	-	-	-	-
BH7/0.1-0.2	light brown and grey clayey sand	6.61	6.19	-0.42	1F	-	-	-	-	-	-	-	-
BH7/0.9-1.0	brown, red and grey sandy clay	5.80	4.76	-1.04	1F	-	-	-	-	-	-	-	-
BH7/2.4-2.5	brown, red and grey sandy clay	6.37	5.37	-1.00	1	-	-	-	-	-	-	-	-
BH7/3.9-4.0	red, orange and grey sandy clay	5.82	6.54	0.72	1	-	-	-	-	-	-	-	-
BH7/5.4-5.5	orange sandy clay	6.29	5.68	-0.61	1	-	-	-	-	-	-	-	-
BH7/6.9-7.0	orange and light grey clayey sand	5.73	5.21	-0.52	1F	-	-	-	-	-	-	-	-
BH7/8.5-8.95	red clayey sand	5.89	6.41	0.52	1F	-	-	-	-	-	-	-	-
BH8/0.1-0.2	light brown silty sand	6.40	5.05	-1.35	1F	-	-	-	-	-	-	-	-
BH8/0.9-1.0	brown and red sandy clay	5.66	4.68	-0.98	1F	-	-	-	-	-	-	-	-
BH8/2.4-2.5	red, white and orange sandstone	4.92	4.13	-0.79	1F	-	-	-	-	-	-	-	-
BH8/3.9-4.0	red, white and orange sandstone	5.72	3.96	-1.76	1	4.3	0.07	<0.01	0.07	<0.005	<0.05	**43**	3.2
ASSMAC (1998) Action Criteria													
Action Criteria (1 to <1,000 tonnes)		-	-	-	-	-	-	-	-	-	-	18	-

Notes:

a Observed reaction strength:

1 - denotes no or slight effervescence

2 - denotes moderate effervescence

3 - denotes vigorous effervescence

4 - denotes "volcano" ie. very vigorous effervescence,

F - after reaction number indicates a bubling/frothy

H - heat given off during reaction

b Calculated based on the Acid Base Accounting equation provided in the report body

BOLD Equal to or above the Action Criteria

Appendix 4
Easement Plan

M.G.A

(A) EASEMENT FOR ACCESS AND MAINTENANCE 10 WIDE

(B) EASEMENT FOR PIPELINE 4.57 WIDE (APPROX. LOCATION ONLY) VIDE DP512865 & J859462

(W) PROPOSED EASEMENT FOR DRAINAGE OF WATER 4 WIDE

SURVEYING AND SPATIAL INFORMATION REGULATION 2012: CLAUSES 61(2) & 35(1)(B)

MARK	MGA CO-ORDINATES EASTING	MGA CO-ORDINATES NORTHING	ZONE	CLASS	ORDER	METHOD	ORIGIN
PM 54955	309774.899	6245386.420	56	B	2	SCIMS	FOUND
PM 54956	310170.358	6245329.366	56	B	2	SCIMS	FOUND
SSM 176031	310475.900	6245310.000	56	E	5	SCIMS	FOUND

COMBINED SEA LEVEL AND SCALE FACTOR 1.000041

OBTAINED FROM SCIMS (21/06/2015)

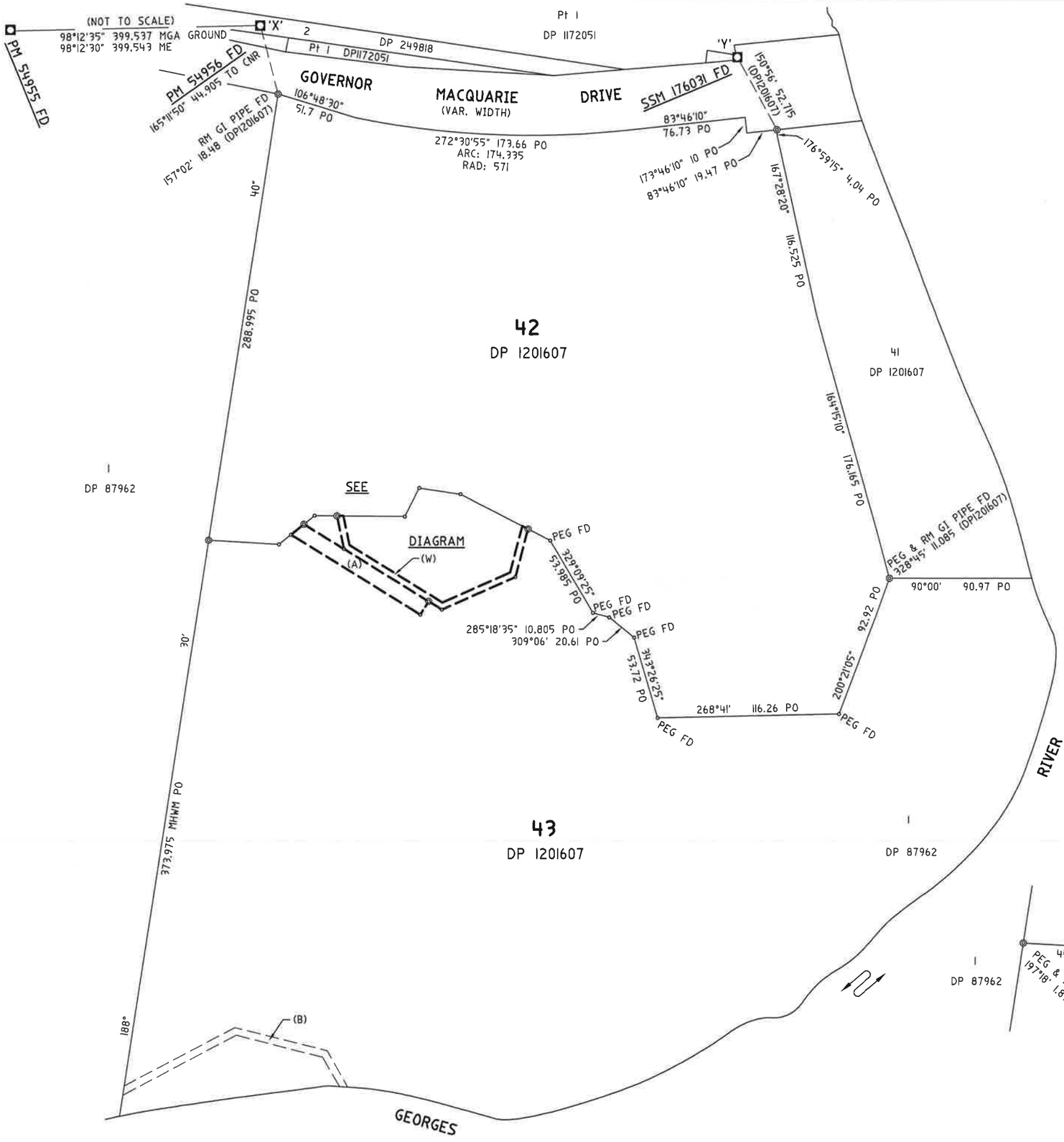
CONNECTIONS

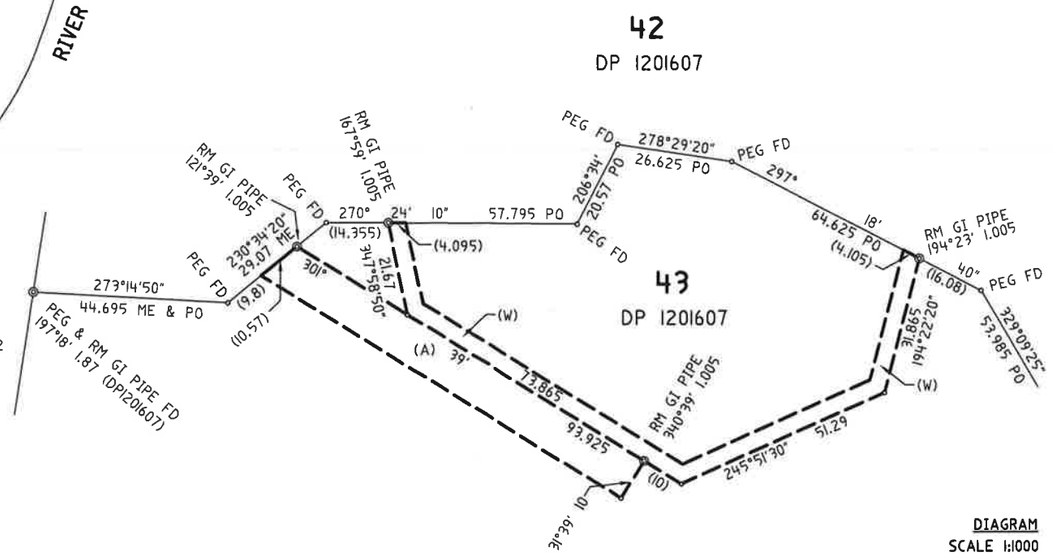
'X' - 'Y'

PM 54956 - SSM 176031

273°37'36" 306.142 MGA GROUND

273°37'36" 306.144 ME





Surveyor: GREGORY OXLEY Date of Survey: 22/06/2015 Surveyor's Ref: SY073199-SV1	PLAN OF PROPOSED EASEMENT FOR DRAINAGE OF WATER WITHIN LOT 43 IN DP1201607	LGA: LIVERPOOL Locality: WARWICK FARM Subdivision No. Lengths are in metres. Reduction Ratio 1: 2000	Registered	DP

Our Ref: A15009B2: NVD/JT
Council Ref: DA-233/2015 & DA333/2015

Monday 15th June, 2016

Attention: Mr George Nehme
Via email: G.Nehme@liverpool.nsw.gov.au

Travers bushfire & ecology

Dear George

Re: Request for additional information – Industrial development at Coopers Paddock Governor Macquarie Drive, Warwick Farm

Travers bushfire & ecology (TBE) has been engaged to provide a response to Councils request for further information as outlined below.

> *The applicant's Bushfire Assessment requires a 23 metre Asset Protection Zone on the eastern boundary. Council's Liverpool Development Control Plan 2008 states that Asset Protection Zones (APZ) is to be contained wholly within the boundary of the development to be proposed. Council does not support APZ's on council land or future council land. The application needs to demonstrate compliance with Councils LDCP 2008 Part 1 Section 5 Bush Fire Risk.*

TBE can advise that we prepared a bushfire protection assessment for the site (Ref: A15009B) dated 26 March 2015.

Page 8 of the report stipulates that there are no predetermined minimum APZ requirements for industrial development under *Planning for Bushfire Protection 2006 (PBP)*. The report provides a performance based assessment to support the proposed development design to achieve compliance with the aims and objectives of PBP. This assessment is based on the provision of a minimum 6-8m APZ contained wholly within the development site. The report does not recommend that the APZ extend within Council Land.

The report recommends a 6 - 8m APZ (as identified in Schedule 1 of the report), coupled with a 3m high radiant heat barrier. Due to the non-combustible materials used for the building construction the impact of ember attack and radiant heat are moderated. *TBE* can therefore confirm that the proposal complies with *Councils Liverpool Development Control Plan 2008 Part 1 Section 5 Bush Fire Risk.*

Should you require further information please do not hesitate to contact the undersigned on 4340 5331 or info@traversecology.com.au.

Yours faithfully

John Travers
BA Sc. / Ass Dip / Grad Dip / BPAD-Level 3-15195 (FPA)
Managing Director – ***Travers bushfire & ecology***

FPA AUSTRALIA
Certified Business Bushfire Planning & Design

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