



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Preliminary Site Investigation with Limited Sampling

Proposed Residential Rezoning
Part 1675 The Northern Road, Luddenham, NSW

Prepared for
Greenfields Development Company Pty Ltd

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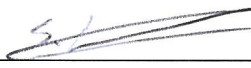
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature	Date
Author  for Rod Gray	2 March 2017
Reviewer  for Mike Nash.	2 March 2017



Executive Summary

This report presents the results of a contaminated land preliminary site investigation with limited sampling (PSI), undertaken for a proposed residential rezoning at Part 1675 The Northern Road, Luddenham, NSW (herein referred to as 'the site'). It is understood that the site is subject to a rezoning request and a PSI is required to support a submission to Liverpool City Council. The rezoning will allow for the proposed relocation or construction of rural workers' dwellings at the site. The site location and layout is shown on Drawing 1, Appendix B.

It is further understood that:

- Current residential dwellings partially located within the site will not be demolished as part of the proposed development; and
- Contaminated land investigations have not previously been undertaken at the site.

The PSI has been undertaken to assess the contamination status of the site with respect to the proposed land use (residential), and recommend further investigation or management, if required.

The PSI included a review of site history information, soil sampling and laboratory analysis. The review indicated that the site has predominantly been used for agricultural purposes since prior to 1947. Two residential dwellings were developed within the north western site boundary prior to 1994. An unsurfaced access road is also present traversing the site. The site walkover identified filling of unknown origin where the access road crossed drainage channels and filling comprising reworked locally derived soil that was located down gradient of two in - ground effluent tanks.

Four test pits were excavated within the site with samples collected and analysed for contaminants of potential concern. Filling within the road crossings and down gradient of the effluent tanks did not contain anthropogenic material. Natural soils were encountered in the other two test pits. All reported concentrations of contaminants of concern in the soil samples collected from test pit locations were within the adopted SAC. Asbestos was not detected at the reporting limit in all soil samples submitted to the laboratory for analysis.

No visual or olfactory evidence of contamination (ground staining, odour or construction and demolition waste) was observed during the investigation. As no soil contamination was detected and there were no known off - site sources of contamination, a groundwater investigation was not considered necessary on the site.

Soil investigations were not conducted adjacent to the two residential dwellings on the understanding that the dwellings will be retained as part of the proposed rezoning and development.

Based on the findings of this PSI, DP considers that the site has a low potential for contamination and is compatible with the proposed rezoning and residential land use. In the event that the two residential dwellings are demolished as part of future works, DP recommends that further intrusive investigation are conducted within the building footprints and adjacent areas to assess potential contamination.

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Report on Preliminary Site Investigation with Limited Sampling Proposed Residential Rezoning Part 1675 The Northern Road, Luddenham, NSW

1. Introduction

This report presents the results of a contaminated land preliminary site investigation with limited sampling (PSI), undertaken for a proposed residential rezoning at Part 1675 The Northern Road, Luddenham, NSW (herein referred to as 'the site'). The investigation was commissioned in an email dated 5 January 2017 by Mr Paul Hume of Greenfields Development Company Pty Ltd and was undertaken in accordance with Douglas Partners' proposal MAC160428, dated 5 January 2017. This report should be read in conjunction with the accompanying notes About This Report provided in Appendix A.

It is understood that the site is subject to a rezoning request and a PSI is required to support a submission to Liverpool City Council for the proposed relocation or construction of rural workers' dwellings at the site.

The site location and layout is shown on Drawing 1, Appendix B.

It is further understood that:

- Current residential dwellings partially located within the site will not be demolished as part of the proposed development; and
- Contaminated land investigations have not previously been undertaken at the site. As such, the PSI has been undertaken to assess the contamination status of the site with respect to the proposed land use (residential), and recommend further investigation or management, if required.

2. Scope of Works

The scope of the works for the PSI comprised:

- A review of site information, comprising:
 - o Published geological, topographical acid sulphate soil (ASS) potential and salinity potential maps / drawings; and
 - o Groundwater bores registered with the NSW Department of Primary Industries.
- A review of readily available site history, comprising:
 - o Current and historic aerial photographs;
 - o Section 149 (2&5) planning certificate; and
 - o Public databases held under the Contaminated Land Management Act 1997 and the Protection of the Environment Operations Act 1997.
- A site walkover and interview with the site owner to identify conditions that may indicate a potential for contamination and determine associated environmental receptors;

- The excavation of four test pits, in both targeted and background locations identified during the site walkover and review of aerial photographs;
- The chemical laboratory analysis of four samples for a selection of the following common contaminants:
 - o Eight priority metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
 - o Polycyclic aromatic hydrocarbons (PAH);
 - o Total recoverable hydrocarbons (TRH);
 - o Benzene, toluene, ethylbenzene and xylene (BTEX);
 - o Phenols;
 - o Organochlorine pesticides (OCP) and organophosphorous pesticides (OPP);
 - o Polychlorinated biphenyls (PCB); and
 - o Asbestos (500 mL samples for the analysis of asbestos).
- The chemical laboratory analysis of one sample for pH and cation exchange capacity (CEC) for the purposes of determining site specific Ecological Investigation Levels;
- The assessment of results in accordance with current NSW EPA endorsed guidelines; and
- The preparation of this PSI report detailing the methodology and the findings of the PSI, commenting on identified areas of environmental concern and associated potential contaminants, the risk of contamination at the site, comment on the compatibility of the site for the proposed development and providing recommendations for further investigation, if considered necessary.

3. Site Description and Regional Geology

The site forms part 1675 The Northern Road, Luddenham, identified as part Lot 11 Deposited Plan 1092165, which forms part of the Leppington Pastoral Company (LPC) Base Farm and is within the local government area of Liverpool City Council. The site location and boundaries are shown on Drawing 1, Appendix B.

The site comprises a triangular shaped area of approximately 5 ha, with maximum north-south and east-west dimensions of 240 m and 440 m respectively. It is bounded to the east and south east by rural residential properties and to north west and south west by the Leppington Pastoral Company Base Farm including rural residential and agricultural structures.

Surface levels generally fall in the north easterly and south easterly direction with the overall difference in level across the site estimated to be about 20 m with the highest part of the site, along the south western boundary, being approximately 105 m Australian Height Datum (AHD), to the lowest part of the site in the north eastern portion of the site, being approximately 85 m AHD.

At the time of the site walkover, the site was generally vacant with the exception of two residential properties that are partially within the north western portion of the site. It is understood that these residential properties will remain and will not be redeveloped as part of the proposed relocation or construction of rural workers' dwellings. Pastoral and cattle grazing land use was evident on the balance of the site. Further observations made during the site investigation are provided in Section 5.

Reference to the Penrith 1:100,000 Soils Landscape Sheet indicates that the site is situated in the Blacktown soils landscape group. These soils are classified as formed through residual soil processes, characterised by gently undulating rises on Wianamatta Group shales with slopes usually <5 % and local relief to 30 m. Soils are shallow to moderately deep (<1 m) red and brown podzolic soils on crests, upper slopes and well drained areas, and deep (1.5 - 3 m) yellow podzolic soils and soloths on lower slopes and in areas of poor drainage. Soils are moderately reactive with low fertility, poor soil drainage and highly plastic subsoil.

Reference to the Penrith 1:100,000 Geology Sheet indicates that the site is predominantly underlain by Bringelly Shale (mapping unit Rwb) of the Wianamatta Group of Triassic age. The Bringelly Shale formation typically comprises shale, carbonaceous claystone, claystone, laminate, fine to medium - grained lithic sandstone, rare coal and tuff.

Reference to the NSW acid sulphate soils risk mapping indicates that the site is classified as having 'no known occurrence of acid sulphate soil'.

Reference to the NSW Salinity Potential of Western Sydney mapping indicates that the site is mapped as having a moderate salinity potential and approximately 250 m south of an area with a high salinity potential.

A search of the NSW Department of Primary Industries Office of Water registered groundwater works, was undertaken on 6 January 2017, with a search radius of 500 m of the site. Two groundwater bores GW105959 and GW106829 were located approximately 490 m north-west and 460 m south west from the site respectively. A brief summary of the groundwater bores is shown in Table 1 with further detail provided in the Work Summary Reports, Appendix D.

Table 1: Summary of Groundwater Bores

Identification	Installation Date	Borehole depth (m) bgl*	Water level (m) bgl	Geology	Authorised Purpose
GW105959	10/12/2002	337	70	Clay/Shale/Sandstone	Irrigation, stock, farming
GW106829	08/04/2003	249	85	Clay/Shale/Sandstone	Stock, domestic

* Below ground level.

Three unnamed tributaries of Badgerys Creek are located within the north eastern and eastern portion of the site. The tributaries generally flow in a north-west to south - east direction towards Badgerys Creek approximately 250 m south - east of the site.

Based on topography and the nearest surface water course, local groundwater is considered to flow in a south easterly direction towards the nearest surface water body. However, regional groundwater is considered to flow in a general easterly direction towards the Tasman Sea approximately 50 km east of the site.

4. Site History

A desktop site history investigation was undertaken by DP to identify potential areas of environmental concern and contaminants of concern which may arise from previous land uses, the presence of demolished or partly demolished buildings, soil stockpiles, land filling, waste disposal and other potentially contaminating activities. The desktop review utilised the most relevant information sources for the site history, comprising, current and historic aerial photographs, a review of the Section 149 planning certificate and a review of the NSW Environmental Protection Authority (NSW EPA) public registers.

It is understood that the site is part of a larger agricultural facility that has been owned by the current owner since early to mid - twentieth century, prior to which the land was most likely used for rural or agricultural purposes. It is further understood that the site itself is mostly, previously undeveloped. As such it is considered that a review of historical land title deed information, council records and SafeWork NSW records would not provide any further beneficial information on potential contaminating activities relevant to the site.

The desktop site history investigation conducted is detailed in Section 4.1 - 4.3.

4.1 Historical Aerial Photography

Aerial photographs were examined to identify any changes to the landscape which may include potentially contaminating land activities or significant environmental features. Ten aerial photographs were examined from the years 1947, 1954, 1961, 1970, 1978, 1986, 1994, 2005, 2010 and a recent photograph from November 2016. Copies are included in Appendix E. A summary of the findings is given below.

1947: The site appears to be undeveloped with the north western portion of the site occupied by an isolated forest stand of thick vegetation and trees. The remainder of the site appears to have been mostly cleared of vegetation. Linear surface features and what appears to be a livestock enclosure are evident in the eastern portion of the site, indicating an agricultural land use. The surrounding land is also undeveloped. What appears to be a dirt track crosses the site in the north eastern corner. Tributaries of Badgerys Creek are evident to the east and south east of the site.

1954: The site and surrounds appear relatively unchanged since the 1947 aerial photograph. The resolution of this aerial photograph is of a lower quality. As such the aerial photograph is at a lesser magnification showing more of the surrounding area, including a road alignment which is at the approximate location of the current Northern Road. Surrounding land use to the east of the site also appears to be of an agricultural nature.

1961: This aerial photograph is of a high resolution and as such shows the site in detail. The site appears relatively unchanged since the previous aerial photographs, with the previously observed livestock enclosure still evident. The land to the north of the site appears to be used for agricultural use. Rural residential and agricultural properties are evident to the north-east and south of the site, with associated access roads also visible.

1970: The site appears relatively unchanged since the 1961 aerial photograph, with the exception that the livestock enclosure is no longer evident. The land to the north of the site still appears to be used for agricultural use, while the land to the north - east, east and south is observed to have undergone further rural residential and agricultural development.

1978: The site appears relatively unchanged since the 1970 aerial photograph, with the exception that the isolated forest stand in the western portion of the site is no longer evident. The land to the north of the site still appears to be used for agricultural use, while the land to the north - east, east and south is observed to have undergone further rural residential and agricultural development.

1986: The site appears relatively unchanged since the 1978 aerial photograph. The land to the north of the site still appears to be used for agricultural use, while the land to the north - east, east and south is observed to have undergone further rural residential and agricultural development.

1994: Two large residential properties, with associated access roads and amenities are now evident within the site. The areas around the residential properties appear to have been disturbed with some light areas in the north eastern portion of the site, and possibly some augmentation or filling of drainage channels in the central portion of the site. Further rural residential and agricultural development is evident in all directions with a large residential property to the south-west of the site, a large clearing evident to the north - west of the site and a large agricultural building is evident to the north - east of the site.

2005: The site appears relatively unchanged since the 1994 aerial photograph. However a linear surface disturbance is evident in the north eastern portion of the site. Further rural residential development is evident in all directions with a number of large agricultural buildings now evident to the northwest of the site at the location of the large cleared area observed in the 1994 aerial photograph. The land to the north of the site still appears to be used for agricultural use.

2010: The site and surrounding areas appear relatively unchanged since the 2005 aerial photograph. However, further linear surface disturbances are evident in the north eastern portion of the site. A significant stockpiling area is also evident in the western portion of the site which appears to be associated with the further development of the residential property in the western portion of the site. A northeast / southwest aligned access road is evident to the southeast of the residential properties (the access road).

2016: The site and surrounding areas appear relatively unchanged since the 2005 aerial photograph. However further linear surface disturbances are evident in the north eastern portion of the site.

Review of the historical aerial photographs indicates that land was vacant and used for agricultural purposes until between 1986 and 1994 when the north western portion of the site was developed for residential purposes. DP considers that the ground disturbances evident in the north eastern portion of the site since 1994 are potentially associated with cattle access (tracks) to feed troughs. Filling of drainage channels in the central portions of the site has potentially occurred since the construction of the residential properties.



Figure 1: Nearmap image (23 January 2017) showing filled drainage channel and the access road.

4.2 Section 149 (2&5) Certificates

The Section 149 Planning Certificate for Lot 11 Deposited Plan 1092165, dated 16 January 2017, was provided by the client. A copy is included in Appendix F.

The certificate indicates that the site is currently zoned RU1 Primary Production - Liverpool LEP 2008.

The purposes for which development may be carried out within the zone without the need for development consent includes environmental protection works; extensive agriculture; home-based child care; and home occupations.

There are no matters listed under Section 59(2) of the *Contaminated Land Management Act 1997* which should be specified on the certificates. Section 59(2) concerns matters that must be included within a Section 149 Planning Certificate in relation to the land being significantly contaminated, regulatory orders applying and the existence of a site audit statement or site audit report pertaining to the property.

Information provided in the Section 149(5) states that Council has no records indicating that the land may be contaminated based on the previous use of the site.

4.3 NSW EPA Public Registers

A search for current Statutory Notices on 6 January 2017, issued under the *Contaminated Land Management Act, 1997* and *Protection of the Environment Operations Act, 1997* available on the NSW EPA website showed that there were no notices or licenses issued for the site or the surrounding area.

5. Site Walkover and Interview

A site walkover was undertaken on 25 January 2017 by a DP environmental scientist. Photographs taken during the investigation are provided in Appendix B. Selected site features discussed below are shown in Drawing 2 (Appendix B). The following main features were noted during the walkover:

- The site layout reflected that shown in the 2016 aerial photograph;
- Non - residential areas of the site were grass covered and included stands of tall (>7 m) trees;
- Dairy cattle were grazing within the non-residential areas of the site;
- The two residential properties and adjacent fenced areas appeared to be in well - kept and good condition (Photographs 1 and 2);
- Evidence of the cattle lots present in the 1961 aerial photographs was not observed during the walkover;
- Cattle feed troughs were present in the north eastern portion of the site. Ground disturbance surrounding the troughs appeared to be associated with cattle access (Photograph 3);
- Filling of unknown origin was evident in two locations to the south of the residential properties where the access road crossed drainage channels (Area A - refer Photographs 4 and 5);
- Two in-ground concrete effluent tanks were observed to the south of the residential properties in one of the drainage channels. Fill was also observed down gradient of the tanks (Area B - refer Photograph 6). The fill appeared to comprise reworked locally derived soil.

Apart from the localised areas of filling, there were generally no other obvious indications of potential contamination observed (i.e. staining, odours, distressed vegetation).

The site walkover was conducted with site owner Mr Ron Perich. DP understands that Mr Perich has occupied the site for approximately 60 years. During the walkover Mr Perich indicated the following:

- With the exception of Area A and Area B, no filling had been imported to the site;
- The filling at Area B was virgin material from another area of the farm. Mr Perich was unaware of the source of filling used at the Area A;
- No burial areas were present within the site; and
- Non-residential areas of the site had continuously been used for grazing during his occupation of the site.

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 (linkages). The CSM provides the framework for identifying how the site became 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 (complete pathways).

6.1 Potential for Contamination

Based on the findings of the site history investigation and site walkover it is considered that the site has low risk for potential contamination to exist at the site primarily through the filling of localised areas of the site.

6.2 Potential Contamination Sources and Contaminants of Concern

Based on the findings of the site history investigation and site walkover, the potential sources (S) of contamination comprise:

- S1 Filling of an unknown or uncertain origin within Area A and Area B.
- S2 – Agricultural activities associated with rural grazing.

Common contaminants of concern associated with the above identified sources of contamination are as follows:

- Metals – arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), lead (Pb), nickel (Ni) and zinc (Zn) – S1 and S2;
- Total recoverable hydrocarbons (TRH) – S1;
- Monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene – BTEX) – S1;
- Polycyclic aromatic hydrocarbons (PAH) – S1 and S2;
- Polychlorinated biphenyls (PCB) – S1;
- Organochlorine pesticides (OCP) – S1;
- Organophosphorus pesticides (OPP) – S1; and
- Phenols – S1; and
- Asbestos in soil (screening test – presence or absence in 500 mL sample) – analysed from test pit samples only – S1 and S2.

6.3 Potential Receptors

Receptors (R) that potentially could be influenced by the potential contaminants at this site include:

Human health receptors:

- R1 - Construction workers during the development.
- R2 - End users (residential).
- R3 - Adjacent users (residential).

Environmental receptors:

- R4 - Groundwater and
- R5 - Surface water.
- R6 - Terrestrial ecology.

6.4 Potential Pathways

Potential pathways (P) for contaminants on the site, with consideration to the site's proposed end use, current condition, and geological, topographical and hydrogeological characteristics, include:

- P1 - Ingestion and dermal contact.
- P2 - Inhalation of dust and / or vapours.
- P3 - Leaching of contaminants and vertical migration into groundwater.
- P4 - Surface water run - off.
- P5 - Lateral migration of groundwater providing base flow to watercourses.
- P6 - Contact with terrestrial ecology.

6.5 Summary of Preliminary CSM

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

Table 2: Potential Complete Pathways

Source	Transport Pathway	Receptor	Action Recommended	Screening Criteria
S1 - Filling of an unknown origin/uncertain associated with localised filling of Area A and Area B.	P1 - Ingestion and dermal contact P2 - Inhalation of dust / vapours	R1 - Construction Workers R2 - End users	An intrusive investigation is required to assess possible contamination including chemical testing of the soils.	Soil SAC as discussed in Section 9
	P2 - Inhalation of dust / vapours	R3 - Adjacent users		
	P3 - Leaching of contaminants	R4 – Groundwater	See Notes 1 and 3.	Soil SAC as an indicator of potential groundwater issues
S2 Agricultural Activities	P4 - Surface water run-off P5 - Lateral migration of groundwater	R5 - Surface water	Nearest surface water body is approximately 400 m from the site, which flows to Elliot Lake and into the Tasman Sea. See Notes 2 and 3.	Soil SAC as an indicator of potential surface water issues
	P6 - Contact with terrestrial ecology	R6 - Terrestrial ecology	An intrusive investigation is required to assess possible contamination including chemical testing of the soils.	Soil SAC as discussed in Section 9

1. Leachability testing was not proposed as part of the current investigation. If significant contamination is encountered leachability testing may be required.
2. Depending on the finalised development details there may or may not exist a pathway for surface water run-off. Surface water receptors may include nearby creeks. If significant contamination is encountered further investigation of potential surface water receptors may be required.
3. Groundwater testing is not proposed as part of the current investigation. If significant contamination is encountered groundwater testing may be required.

7. Sampling Analysis Plan

7.1 Sample Location, Density and Pattern

Based on the preliminary nature of the investigation, and in order to address the objectives of this PSI, it was considered that a limited sampling plan was appropriate to provide comment on the risk of contamination at the site.

The sampling was conducted with reference to Schedule B2 Guideline on Site Characterisation of the National Environment Protection Council's *National Environment Protection (Assessment of Site Contamination) Measure* 1999 as amended 2013 (NEPC, 2013).

Four sample locations, two targeting areas of filling and two from background locations were considered appropriate to indicate the presence of contamination on the site for this investigation. Test pits were used to enable visual inspection and in-situ soil contamination sampling of the filling material.

Sampling was not conducted within the residential properties located along the north-western site boundary due to their ongoing occupation and use and the understanding that they will be retained (not demolished) as part on the proposed rezoning and development.

The sampling locations for this PSI are shown on Drawing 2, Appendix B.

7.2 Sampling Depths

Samples were collected at the surface and from each strata encountered, at regular depth intervals or at signs of contamination, resulting in two samples per test pit (TP1 to TP4) with a total of eight soil samples being obtained. Replicate samples were taken at a rate of 10 % of the total number of primary samples, for QA / QC purposes. Sample depths ranged from 0 - 0.1 m to 0.3 - 0.4 m bgl.

The test pit logs detailing all of the samples collected are provided in Appendix G.

7.3 Sampling Procedure

Environmental sampling was conducted according to standard operating procedures described in the DP *Field Procedures Manual* which included:

- The use of disposable gloves for the collection of soil samples from the backhoe bucket. The gloves were replaced between each sample;
- Labelling of the sample containers with individual and unique identification including Project No., Sample No. and depth;
- Placement of the containers into a chilled, enclosed and secure container for transport to the laboratory;
- Use of chain - of - custody documentation so that sample tracking and custody can be cross - checked at any point in the transfer of samples from the field to hand-over to the laboratory; and
- All samples were screened for potential volatiles using a photo-ionisation detector (PID).

7.4 Analytical Rationale

Four primary samples and one intra-laboratory replicate sample obtained from surface soils and the fill materials encountered were submitted to a NATA accredited laboratory (Envirolab Services Pty Ltd) for analysis of contaminants of concern chosen based on the potential for contamination identified in the preliminary CSM for the site as discussed in Section 6.

One fill and one natural sample were also scheduled for analysis of pH and CEC for the purposes of determining site specific Ecological Investigation Levels (EIL).

8. Site Assessment Criteria

Based on the information provided by the client, it is understood that the proposed development at the site will comprise the relocation or construction of rural workers' dwellings at the site. As such, the generic residential criteria with accessible soils and gardens have been adopted for this PSI.

The Site Assessment Criteria (SAC) applied in the current investigation were informed by the preliminary 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 primarily the investigation and screening levels of Schedule B1 of NEPC (2013). NEPC (2013) is 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).

8.1 Health Investigation and Screening Levels

The generic Health Investigation Levels (HIL) and Health Screening Levels (HSL) are considered to be appropriate for the assessment of contamination at the site. The adopted soil HIL and HSL for the potential contaminants of concern are presented in Table 3 (following page).

Table 3: HIL and HSL in mg/kg unless otherwise indicated

Contaminants		HIL - A and HSL - A Direct Contact	HSL - A Vapour Intrusion ⁴
Metals	Arsenic	100	-
	Cadmium	20	-
	Chromium (VI)	100	-
	Copper	6000	-
	Lead	300	-
	Mercury (inorganic)	40	-
	Nickel	400	-
	Zinc	7400	-
PAH	Benzo(a)pyrene TEQ ¹	3	-
	Naphthalene	1400	4
	Total PAH	300	-
TRH	C6 – C10 (less BTEX) [F1]	4400	40
	>C10-C16 (less Naphthalene) [F2]	3300	230
	>C16-C34 [F3]	4500	-
	>C34-C40 [F4]	6300	-
BTEX	Benzene	100	0.6
	Toluene	14000	390
	Ethylbenzene	4500	NL ³
	Xylenes	12000	95
Phenol	Pentachlorophenol (used as an initial screen)	100	-
OCP	Aldrin + Dieldrin	6	-
	Chlordane	50	-
	DDT+DDE+DDD	240	-
	Endosulfan	270	-
	Endrin	10	-
	Heptachlor	6	-
	HCB	10	-
	Methoxychlor	300	-
OPP	Chlorpyrifos	160	-
PCB ²		1	-

Notes:

1. sum of carcinogenic PAH
2. non dioxin-like PCBs only.
3. The soil saturation concentration (C_{sat}) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds C_{sat}, a soil vapour concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.]
4. The vapour intrusion HSL have been calculated for a silt soil based on clayey silt encountered (Section 9) and an assumed depth to contamination 0 m to <1 m.

8.2 Ecological Investigation Levels

Ecological Investigation Levels (EIL) and Added Contaminant Limits (ACL), 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. The adopted EIL, were derived using the *Interactive (Excel) Calculation Spreadsheet* (Standing Council on Environment and Water (SCEW) website (<http://www.scew.gov.au/node/941>)) and are shown in the following Table 4. The Calculation Spreadsheet is included in Appendix H.

Table 4: EIL in mg/kg

Analyte		EIL	Comments
Metals	Arsenic	100	Measured parameters: pH = 6 CEC = 15 cmol _e /kg Clay content 10% (assumed conservative value) "Aged" (>2 years) source of contamination Low for traffic volumes in NSW (site is rural area)
	Copper	210	
	Nickel	220	
	Chromium III	410	
	Lead	1100	
	Zinc	480	
PAH	Naphthalene	170	
OCP	DDT	180	

1. The ESL have been calculated for a fine soil based on the clay encountered (Section 9) and urban residential and public open space.
2. pH and CEC were measured within fill and natural soils and the most conservative values were used to determine the EILs.

8.3 Ecological Screening Levels

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The ESL adopted, which are considered appropriate for this assessment of contamination at the site, are shown in the following Table 5.

Table 5: ESL in mg/kg

Analyte		ESL	Comments
TRH	C6 – C10 (less BTEX) [F1]	180*	All ESLs are low reliability apart from those marked with * which are moderate reliability
	>C10-C16 (less Naphthalene) [F2]	120*	
	>C16-C34 [F3]	1300	
	>C34-C40 [F4]	5600	
BTEX	Benzene	65	
	Toluene	105	
	Ethylbenzene	125	
	Xylenes	45	
PAH	Benzo(a)pyrene	0.7	

3. The ESL have been calculated for a fine soil based on the clay encountered (Section 9) and urban residential and public open space

8.4 Management Limits

In addition to appropriate consideration and application of the HSL and ESL, 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; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

The management limits adopted from Schedule B1 of NEPC (2013) are shown in the following Table 6.

Table 6: Management Limits in mg/kg

	Analyte	Management Limit	
TRH	C6 – C10 (F1) #	800	The management limits have been calculated for a fine soil based on clayey silt encountered (Section 9) and residential, parkland and public open space
	>C10-C16 (F2) #	1000	
	>C16-C34 (F3)	3500	
	>C34-C40 (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

8.5 Asbestos in Soils

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 asbestos-containing materials (ACM) in sound condition represents a low human health risk, whilst both fibrous asbestos (FA) and asbestos fines (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 was not undertaken as part of these works as asbestos was not identified as a primary contaminant of concern at the time of writing the proposal. Therefore, the presence or absence of asbestos at a limit of reporting of 0.1 g/kg has been adopted for this assessment as an initial screen.

9. Results

9.1 Field Work Observations

The test pit logs are included in Appendix G, together with notes defining classification methods and descriptive terms.

Relatively uniform conditions were encountered across most of the Site, with filling observed in two of the four test pit locations. The general strata across the Site is summarised as follows:

- FILLING – brown and red clayey silt and silty clay filling with ironstone and siltstone gravel were observed within TP2 and TP3 to depths of between 0.1 m and 0.4 m bgl. The filling also comprised galvanised iron in TP3;
- FILLING – brown clayey silt with rootlets (former topsoil) was encountered in TP3 to a depth of between 0.2 m to 0.3 m;
- TOPSOIL - brown clayey silt with rootlets was encountered in TP1 and TP4 to depths of 0.1 m bgl;
- CLAYEY SILT – dark brown clayey silt with rootlets was observed in TP1 and TP3 to a depth of 0.15 m and 0.3 m bgl; and
- SILTY CLAY – red and brown silty clay was observed in all test pits to depths of 0.5 m to 0.9 m bgl.

No free groundwater was observed in the pits or boreholes during excavation for the short time that they were left open. It is noted, however, that the pits were immediately backfilled following excavation which precluded longer term assessment of any groundwater levels that might be present. Groundwater levels are affected by factors such as soil permeability and weather conditions and will vary with time.

9.2 Analytical Results

The analytical results for the soil samples collected during the investigation are summarised in Table I1 in Appendix I, together with the adopted SAC. Laboratory certificates of analysis are provided in Appendix J.

A summary of the results is provided below:

- Concentrations of heavy metals were below the SAC for all samples submitted for analysis;
- Concentrations of phenols, BTEX, PAH, OCP, OPP and PCB were reported below their respective laboratory limits of reporting in all samples submitted for analysis; and
- Asbestos was not detected at the limit of reporting in the soil samples submitted for analysis.

It is noted that concentrations of TRH were reported above laboratory LOR in all samples, however were below the adopted SAC.

9.3 Quality Assurance and Quality Control

A review of the adopted QA / QC procedures and results (Appendix K) indicates that the DQIs have generally been met. On this basis, the sampling and laboratory methods used during the investigation were found to meet DQOs for this project.

10. Discussion

The PSI included a review of site history information, soil sampling and laboratory analysis. The review indicated that the site has predominantly been used for agricultural purposes since prior to 1947. Two residential dwellings were developed within the north western site boundary prior to 1994. An access road is also present traversing the site. The site walkover identified filling of unknown origin where the access road crossed drainage channels (Area A).

Four test pits were excavated within the site with samples collected and analysed for COPC. Two of the test pits (TP2 and TP3) targeted fill in Area A and Area B, with the other two test pits located to provide general site coverage. Filling in Area A and Area B did not contain anthropogenic inclusions and is considered most likely to have been locally sourced. Natural (in situ) soils were encountered underlying the fill in Area A and Area B and immediately beneath the topsoil in the other two test pits (TP1 and TP4).

All reported concentrations of contaminants of concern in the soil samples collected from test pit locations were within the adopted SAC. Asbestos was not detected at the reporting limit in all soil samples submitted to the laboratory for analysis.

No visual or olfactory evidence of contamination (ground staining, odour or construction and demolition waste) was observed during the investigation. As no soil contamination was detected and there were no known off - site sources of contamination, a groundwater investigation was not considered necessary on the site.

Soil investigations were not conducted adjacent to the two residential dwellings on the understanding that the dwelling will be retained as part of the proposed rezoning and development.

11. Conclusion and Recommendations

Based on the findings of this PSI, DP considers that the site has a low potential for contamination and is compatible with the proposed residential land use.

In the event that the two residential dwellings are demolished as part of future works, DP recommends that further intrusive investigations are conducted within the building footprints and adjacent areas to assess potential contamination.

Notwithstanding the above, the potential remains for isolated pockets of contamination to be present at the site. To appropriately manage any unexpected potential contamination issues (staining, odours, and asbestos) encountered during any future development works, DP recommends that an Unexpected Finds Protocol be implemented during redevelopment. Additionally, any materials requiring off-site disposal will need to be classified, managed and disposed in accordance with the Protection of the Environment Operations Act (NSW) 1997.

If the current structures are to be demolished, it is recommended that a pre demolition hazardous building materials assessment is undertaken.

12. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Part 1675 The Northern Road, Bringelly in accordance with DP's proposal MAC160428, dated 5 January 2017 and acceptance received from Mr Paul Hume of Greenfields Development Company Pty Ltd dated 5 January 2017. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Greenfields Development Company Pty Ltd for this project only and for the purposes 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 surface and sub-surface conditions on the site only at the specific sampling 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 sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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

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

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners



Introduction

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

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

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.

Appendix B

Drawings



Legend

 Site Boundary

 Site Locality



Legend

- Site Boundary
- Test Pit Location
- Area A
- Area B

Appendix C

Site Photographs



Photograph 1 - View facing north towards residential property 1



Photograph 2 - View facing west toward residential property 2



Photograph 3 - View facing east towards the cattle troughs



Photograph 4 - View facing south west toward Area A



Photograph 5 - View looking at Area A filling



Photograph 6 - View north toward Area B filling

Appendix D

Groundwater Bore Work Summary Reports

NSW OFFICE OF WATER

Work Summary

GW105959

Licence :10BL161488			Licence Status Cancelled		
Work Type :Bore			Authorised Purpose(s)		Intended Purpose(s)
Work Status :			FARMING		FARMING
Construct. Method :Rotary			IRRIGATION		IRRIGATION
Owner Type :			STOCK		STOCK
Commenced Date :			Final Depth :		337.00 m
Completion Date :10-Dec-2002			Drilled Depth :		337.00 m
Contractor Name :STD					
Driller :1603			RITCHIE, Roger Charles		
Assistant Driller's Name :					
Property : - BILLAGONG STATION			Standing Water Level :		70.00 m
GWMA : -			Salinity :		
GW Zone : -			Yield :		0.50 L/s

Site Details

Site Chosen By		County		Parish		Portion/Lot DP	
Geologist		Form A :CUMBERLAND		BRINGELLY		104 812653	
		Licensed :CUMBERLAND		BRINGELLY		11 1092165	
Region :10 - SYDNEY SOUTH COAST				CMA Map :9030-3S		WARRAGAMBA	
River Basin :212 - HAWKESBURY RIVER				Grid Zone :56/1		Scale :1:25,000	
Area / District :							
Elevation :		0.00		Northing :6244446		Latitude (S) :33° 55' 8"	
Elevation Source :(Unknown)				Easting :286738		Longitude (E) :150° 41' 35"	
GS Map :		MGA Zone :56		Coordinate Source :			

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	155.00	340			Down Hole Hammer
1		Hole	Hole	155.00	337.00	205			Down Hole Hammer
1	1	Casing	Steel	-0.50	6.00	219	205		
1	1	Casing	(Unknown)	-0.50	154.00	219			C: 0-155m

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
143.00	144.00	1.00		70.00		1.53		0.50	
256.00	259.00	3.00				0.47		0.50	
272.00	273.00	1.00				0.50		0.50	

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	5.00	5.00	SOIL AND CLAY	Soil	
5.00	143.00	138.00	SHALE	Shale	
143.00	173.00	30.00	SANDSTONE	Sandstone	
173.00	185.00	12.00	SANDSTONE WITH SHALE	Sandstone	
185.00	315.00	130.00	SANDSTONE	Sandstone	
315.00	318.00	3.00	SHALE AND SANDSTONE	Shale	
318.00	322.00	4.00	SANDSTONE AND SHALE	Sandstone	
322.00	330.00	8.00	SHALE	Shale	
330.00	337.00	7.00	WHITE SANDSTONE	Invalid Code	

Remarks

*** End of GW105959 ***

NSW OFFICE OF WATER

Work Summary

GW106829

Licence :10BL161394			Licence Status :Active		Intended Purpose(s) DOMESTIC STOCK	
Work Type :Bore			Authorised Purpose(s) DOMESTIC STOCK			
Work Status :Abandoned - Backfilled						
Construct. Method :Rotary						
Owner Type :Private						
Commenced Date :			Final Depth : 249.00 m			
Completion Date :08-Apr-2003			Drilled Depth : 249.00 m			
Contractor Name :Britt's Water Solutions						
Driller :1488 BRITT, Thomas Garry						
Assistant Driller's Name :						
Property : - N/A			Standing Water Level :		85.00 m	Salty
GWMA : -			Salinity :			
GW Zone : -			Yield :		1.18 L/s	

Site Details

Site Chosen By		County	Parish	Portion/Lot DP
Driller		Form A :CUMBERLAND	BRINGELLY	130//27550
		Licensed :CUMBERLAND	BRINGELLY	130 27550
Region :10 - SYDNEY SOUTH COAST			CMA Map :9030-3S	WARRAGAMBA
River Basin :212 - HAWKESBURY RIVER			Grid Zone :56/1	Scale :1:25,000
Area / District :				
Elevation :			Northing :6243826	Latitude (S) :33° 55' 28"
Elevation Source :			Easting :287457	Longitude (E) :150° 42' 3"
GS Map :		MGA Zone :56	Coordinate Source :GIS - Geographic Information System	

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	12.00	200			Rotary
1		Hole	Hole	12.00	153.00	162			Rotary
1		Hole	Hole	153.00	249.00	150			Rotary
1		Backfill	Cement grout	3.00	150.00				
1		Backfill	Drilled cuttings	150.00	249.00				

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.00	18.10	0.10		6.00		0.04			Salty
136.00	136.10	0.10		85.00		0.04			Salty
194.00	194.15	0.15		85.00		1.10		1.00	Salty

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	topsoil	Topsoil	
0.30	8.00	7.70	clay, red	Clay	
8.00	12.00	4.00	shale, weathered	Shale	
12.00	138.00	126.00	shale, blue	Shale	
138.00	249.00	111.00	sandstone, bands black shale	Sandstone	

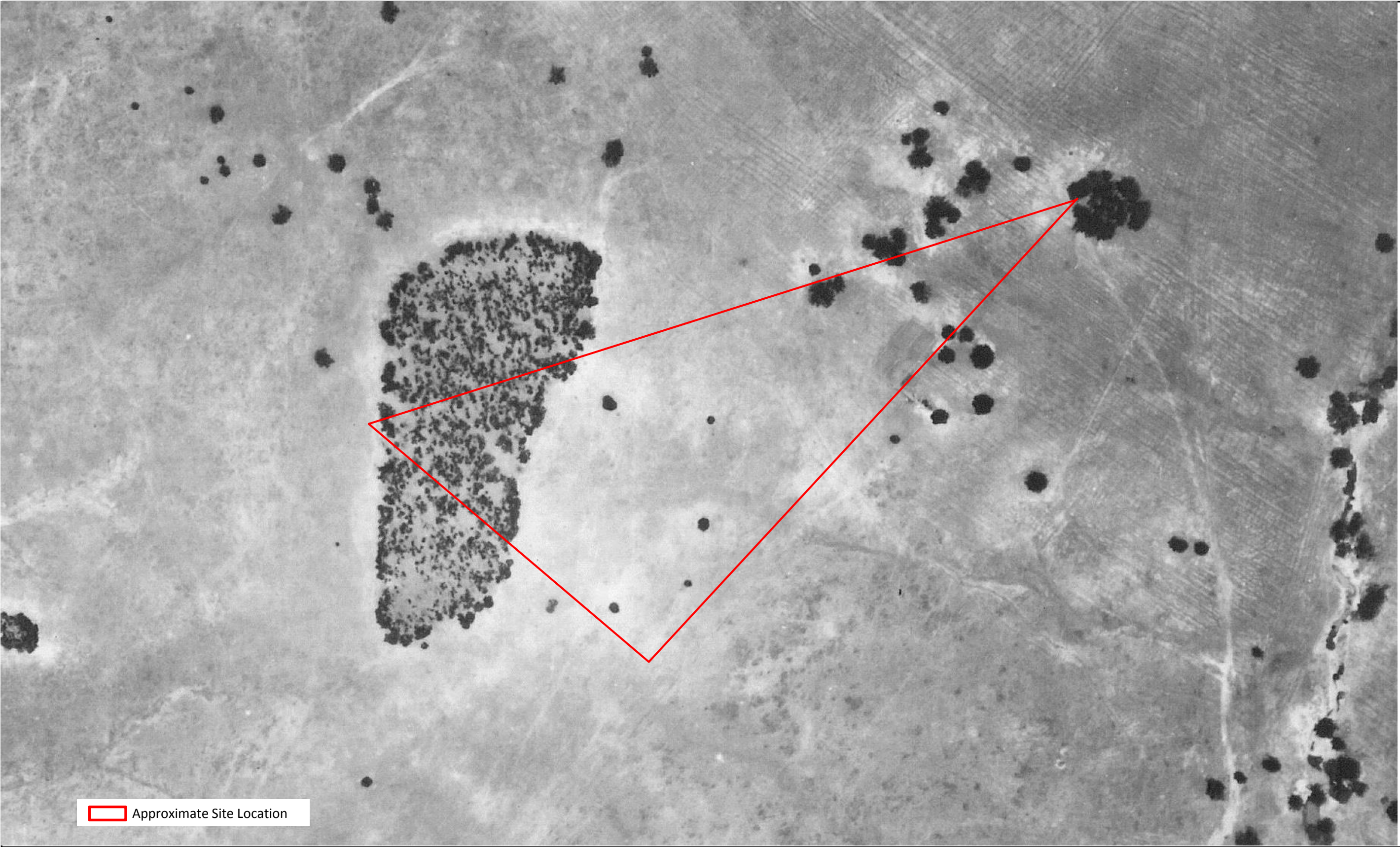
Remarks

updated from original form a

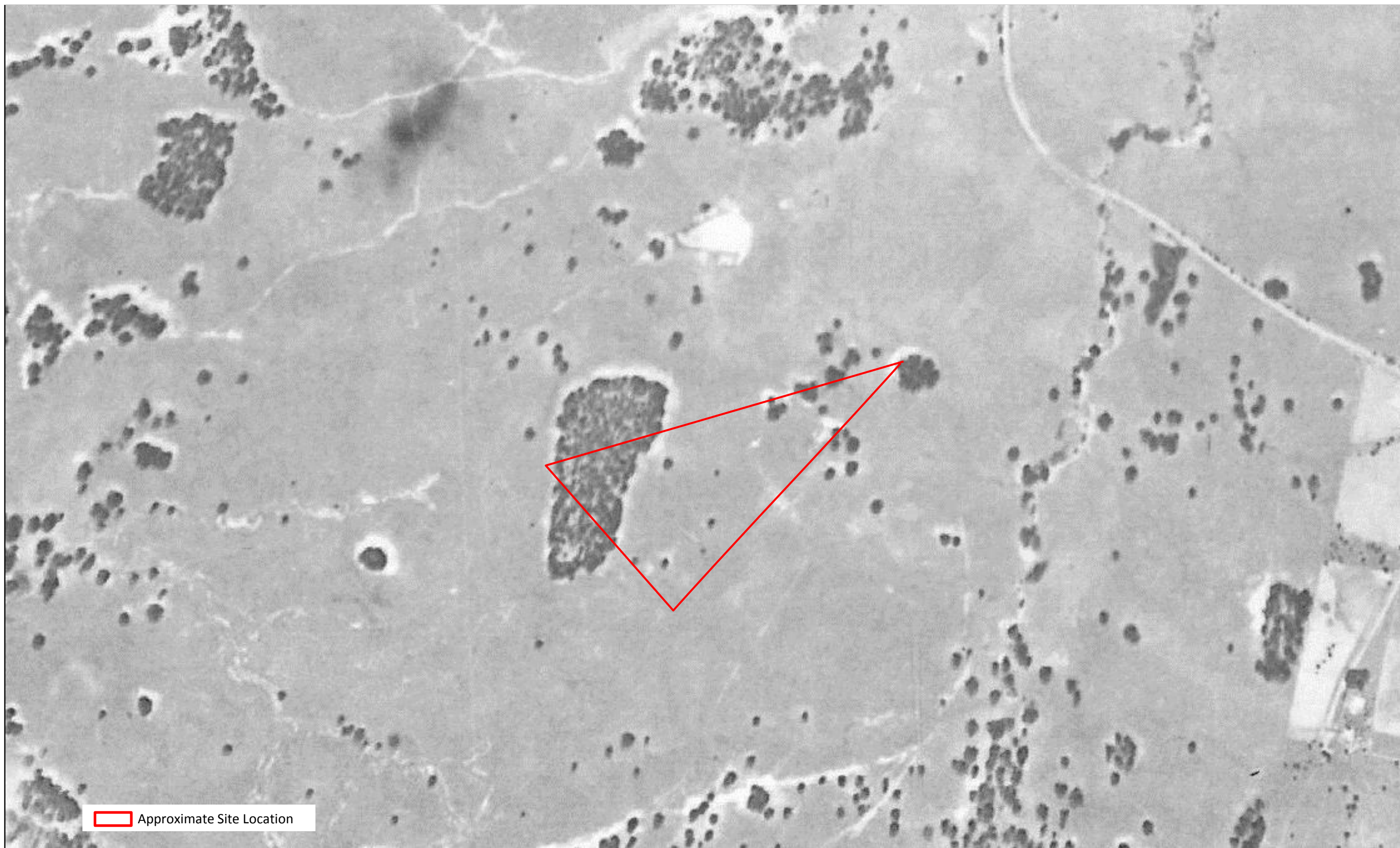
*** End of GW106829 ***

Appendix E

Historical Aerial Photography



 Douglas Partners <i>Geotechnics Environment Groundwater</i>	Client: Greenfields Development Company Pty Ltd		Aerial Photograph - 1947 Preliminary Site Investigation with Limited Sampling Proposed Residential Rezoning	Project No. 92207.00
	Office: Macarthur	Drawn by: MG		Drawing No. 2
	Scale: NTS	Date: 13 Jan 2017		Revision: A



 Approximate Site Location



 Approximate Site Location



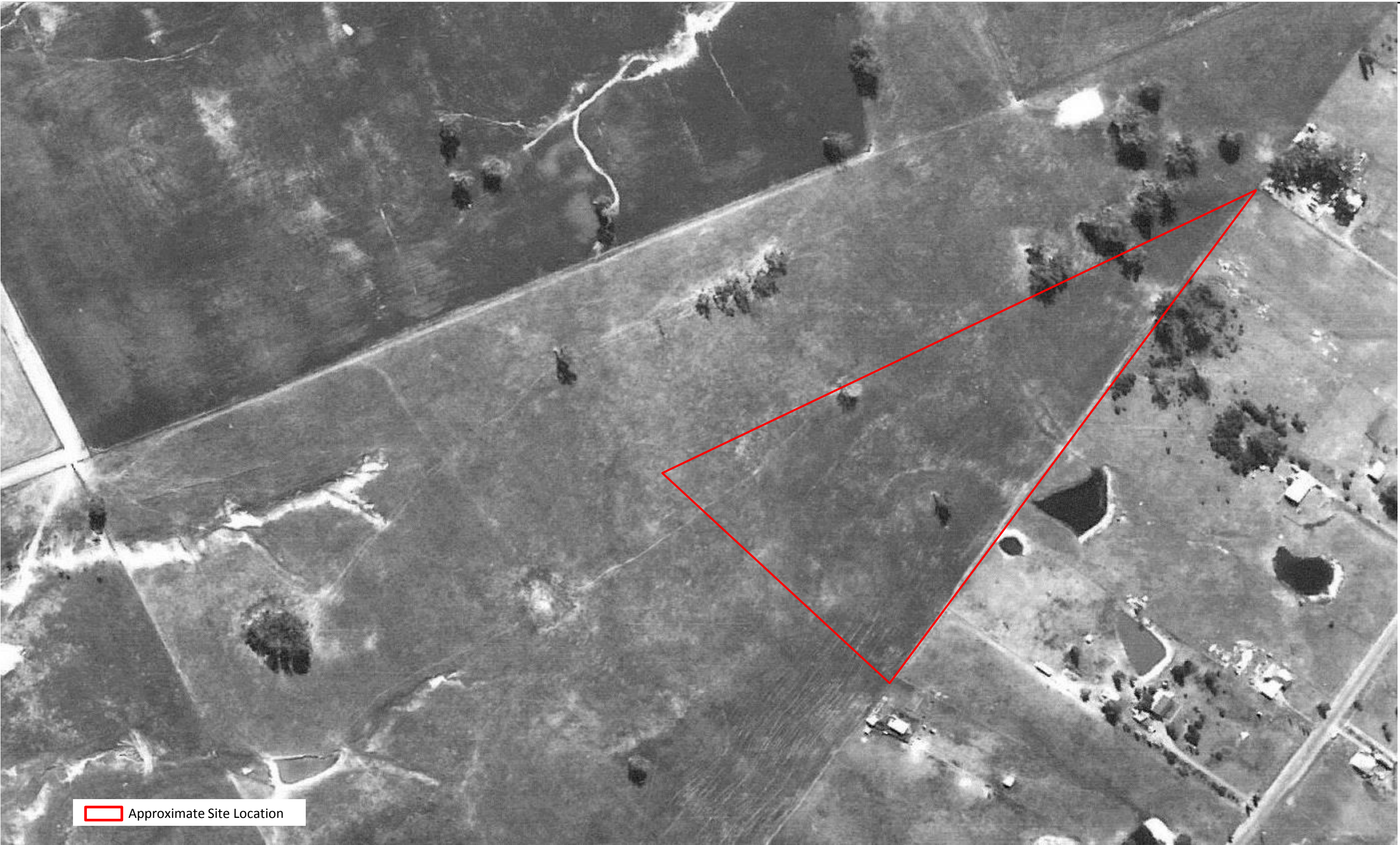
Client: Greenfields Development Company Pty Ltd	
Office: Macarthur	Drawn by: MG
Scale: NTS	Date: 13 Jan 2017

Aerial Photograph - 1961
Preliminary Site Investigation with Limited Sampling
Proposed Residential Rezoning

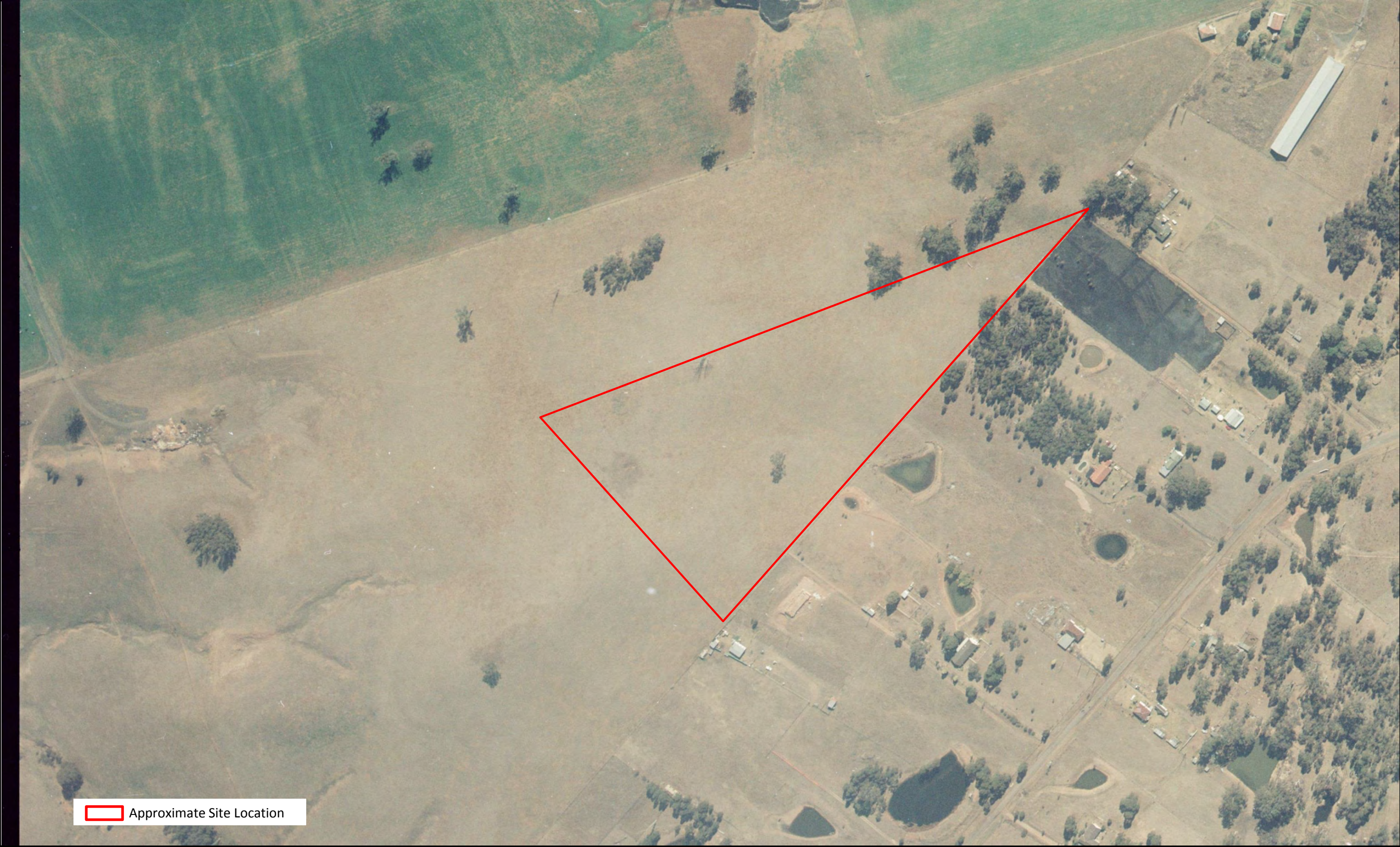
Project No.	92207.00
Drawing No.	4
Revision:	A



	Client: Greenfields Development Company Pty Ltd		Aerial Photograph - 1970 Preliminary Site Investigation with Limited Sampling Proposed Residential Rezoning	Project No. 92207.00
	Office: Macarthur	Drawn by: MG		Drawing No. 4
	Scale: NTS	Date: 13 Jan 2017		Revision: A



 Douglas Partners Geotechnics Environment Groundwater	Client: Greenfields Development Company Pty Ltd		Aerial Photograph - 1978 Preliminary Site Investigation with Limited Sampling Proposed Residential Rezoning	Project No. 92207.00
	Office: Macarthur	Drawn by: MG		Drawing No. 5
	Scale: NTS	Date: 13 Jan 2017		Revision: A



 Approximate Site Location



Client: Greenfields Development Company Pty Ltd

Office: Macarthur

Scale: NTS

Drawn by: MG

Date: 13 Jan 2017

Aerial Photograph - 1986

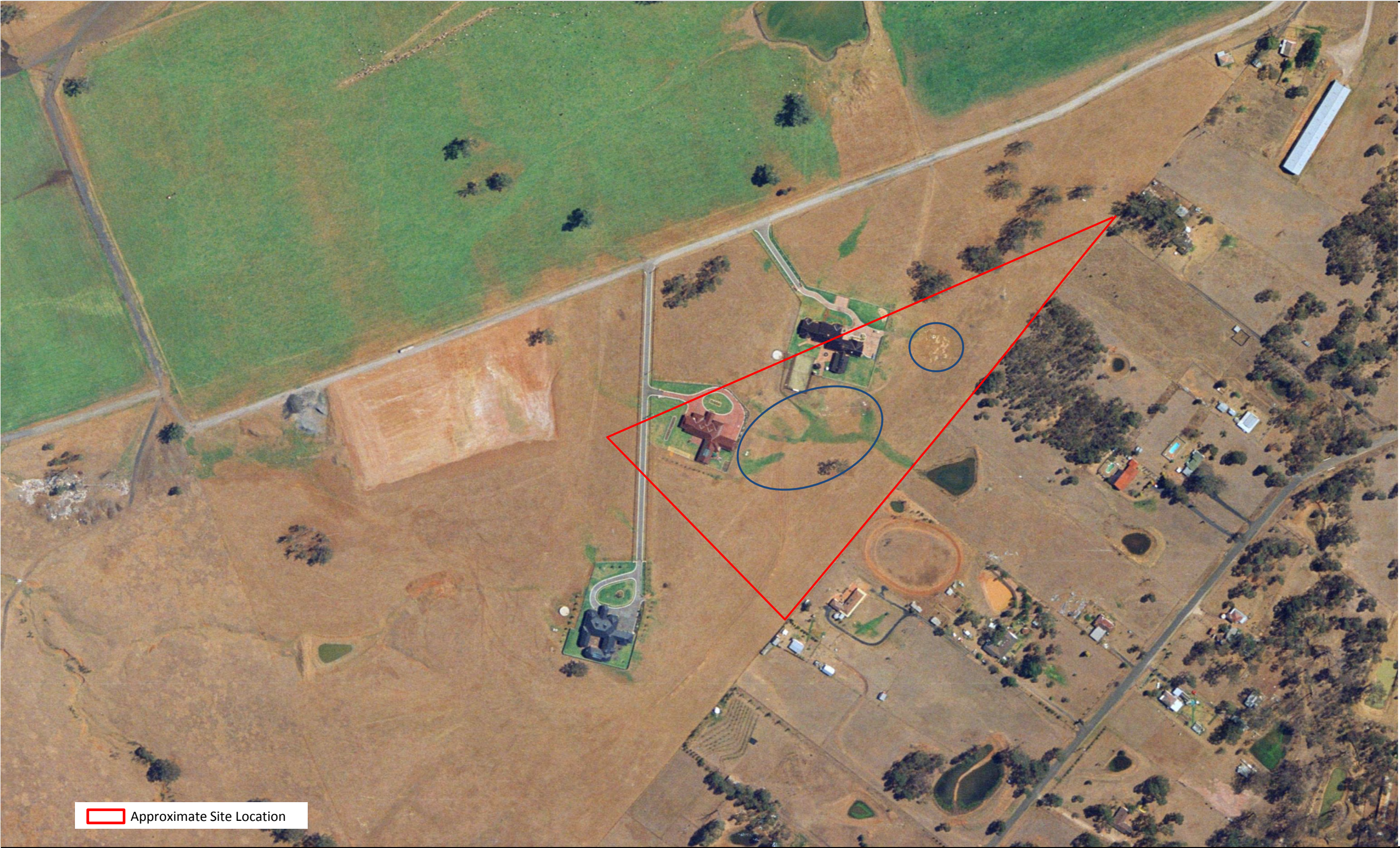
Preliminary Site Investigation with Limited Sampling

Proposed Residential Rezoning

Project No. 92207.00

Drawing No. 6

Revision: A



Approximate Site Location



Client: Greenfields Development Company Pty Ltd

Office: Macarthur

Scale: NTS

Drawn by: MG

Date: 13 Jan 2017

Aerial Photograph - 1994

Preliminary Site Investigation with Limited Sampling

Proposed Residential Rezoning

Project No. 92207.00

Drawing No. 7

Revision: A



Approximate Site Location



Client: Greenfields Development Company Pty Ltd

Office: Macarthur

Scale: NTS

Drawn by: MG

Date: 13 Jan 2017

Aerial Photograph - 2005

Preliminary Site Investigation with Limited Sampling

Proposed Residential Rezoning

Project No. 92207.00

Drawing No. 8

Revision: A



 Approximate Site Location



Client: Greenfields Development Company Pty Ltd

Office: Macarthur

Scale: NTS

Drawn by: MG

Date: 13 Jan 2017

Aerial Photograph - 2010

Preliminary Site Investigation with Limited Sampling

Proposed Residential Rezoning

Project No. 92207.00

Drawing No. 9

Revision: A



Appendix F

Section 149 (2&5) Certificates

PLANNING CERTIFICATE UNDER SECTION 149
ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

Ref.: 92207.00:42640

Ppty: 167706

Cert. No.: 3691

Page No.: 1 of 12

Applicant:

DOUGLAS PARTNERS

18 WALER CRS

SMEATON GRANGE NSW 2567

Receipt No.: 3524688

Receipt Amt.: 133.00

Date: 09-Jan-2017

The information in this certificate is provided pursuant to Section 149(2)&(5) of the Environmental Planning and Assessment Act (EP&A Act) 1979, as prescribed by Schedule 4 of the Environmental Planning and Assessment Regulation (EP&A Regulation) 2000. The information has been extracted from Council's records, as they existed at the date listed on the certificate. Please note that the accuracy of the information contained within the certificate may change after the date of this certificate due to changes in Legislation, planning controls or the environment of the land.

The information in this certificate is applicable to the land described below.

Legal Description: LOT 11 DP 1092165

Street Address: 1675 THE NORTHERN ROAD, LUDDENHAM NSW 2745

Note: Items marked with an asterisk () may be reliant upon information transmitted to Council by a third party public authority. The accuracy of this information cannot be verified by Council and may be out-of-date. If such information is vital for the proposed land use or development, applicants should instead verify the information with the appropriate authority.*

Note: Commonly Used Abbreviations:

LEP: Local Environmental Plan

DCP: Development Control Plan

SEPP: State Environmental Planning Policy

EPI: Environmental Planning Instrument

1. Names of relevant planning instruments and DCPs

(a) The name of each EPI that applies to the carrying out of development on the land is/are listed below:

LEPs:

Liverpool LEP 2008

SEPPs*:

**SEPP No 19 – Bushland in Urban Areas
SEPP No 21 – Caravan Parks
SEPP No 30 – Intensive Agriculture
SEPP No 33 – Hazardous and Offensive Development
SEPP No 44 – Koala Habitat Protection
SEPP (Exempt and Complying Development Codes) 2008
SEPP No 62 – Sustainable Aquaculture
SEPP No 65 – Design Quality of Residential Flat Development
SEPP No 50 – Canal Estate Development
SEPP (Building Sustainability Index: BASIX) 2004
SEPP No 55 – Remediation of Land
SEPP No. 70 – Affordable Housing (Revised Schemes)
SEPP No 64 – Advertising and Signage
SEPP (Infrastructure) 2007
SEPP (Mining, Petroleum Production and Extractive Industries) 2007
SEPP (Miscellaneous Consent Provisions) 2007
SEPP (Affordable Rental Housing) 2009
SEPP (Housing for Seniors or People with a Disability) 2004
SEPP (State and Regional Development) 2011**

Deemed SEPPs*:

SREP No 20 – Hawkesbury – Nepean River (No. 2 – 1997)

(b) The name of each draft EPI, or Planning Proposal (which has been subject to community consultation).

Draft LEPs:

N/A

Draft SEPPs*:

Draft SEPP (Competition) 2010

(c) The name of each DCP that applies to the carrying out of development on the land.

Liverpool DCP 2008

2. Zoning and land use under relevant LEPs and /or SEPPs

This section contains information required under subclauses 2 and 2A of Schedule 4 of the EP&A Regulation 2000. Subclause 2 of the regulation requires Council to provide information with respect to zoning and land-use in areas zoned by, or proposed to be zoned by, a LEP. Subclause 2A of Schedule 4 of the regulation requires Council to provide information with respect to zoning and land-use in areas which are zoned by, or proposed to be zoned by, the SEPP (Sydney Region Growth Centres) 2006. The land use and zoning information under any EPI applying to the land is given below.

(a) Name of zone, and the EPI from which the land zoning information is derived.

RU1 Primary Production - Liverpool LEP 2008

(b) The purposes for which development may be carried out within the zone without the need for development consent

Environmental protection works; Extensive agriculture; Home-based child care; Home occupations

(c) The purposes for which development may not be carried out within the zone except with development consent

Agriculture; Airstrips; Animal boarding or training establishments; Bed and breakfast accommodation; Building identification signs; Business identification signs; Cemeteries; Community facilities; Crematoria; Dual occupancies; Dwelling houses; Environmental facilities; Extractive industries; Farm buildings; Farm stay accommodation; Flood mitigation works; Forestry; Hazardous storage establishments; Health consulting rooms; Helipads; Heliports; Home businesses; Home industries; Landscaping material supplies; Offensive storage establishments; Open cut mining; Plant nurseries; Recreation areas; Recreation facilities (outdoor); Roads; Roadside stalls; Rural industries; Rural supplies; Rural workers' dwellings; Secondary dwellings; Veterinary hospitals; Water recreation structures

(d) The purposes for which the instrument provides that development is prohibited within the zone

Any development not specified in item (b) or (c)

(e) If a dwelling house is a permitted use, are there any principal development standards applying to the land that fix minimum land dimensions for the erection of a dwelling house?

No

(f) Does the land include or comprise critical habitat?

No

(g) Is the land is in a conservation area (however described):

No

(h) Is there an item of environmental heritage (however described) situated on the land

No

3. Complying development

The information below outlines whether complying development is permitted on the land as per the provisions of clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18(1) (c3) and 1.19 SEPP of the (Exempt and Complying Development Codes) 2008.

The first column identifies the code(s). The second column describes the extent of the land in which exempt and complying development is permitted for the code(s) given to the immediate left. The third column indicates the reason as to why exempt and complying development is prohibited on some or all of the land, and will be blank if such development is permitted on all of the land.

Code	Extent of the land for which development is permitted:	The reason(s) as to why development is prohibited:
General Housing Code and Rural Housing Code	Part	Part of the land is identified as being within an ANEF contour of greater than or equal to 25, unless the development is only for the erection of ancillary development, the alteration of or an addition to ancillary development or the alteration of a dwelling house (Clause 1.19(1)(h))
Commercial and Industrial (New Buildings and Additions) Code	All	

Code	Extent of the land for which development is permitted:	The reason(s) as to why development is prohibited:
General Development Code, Fire Safety Code, Housing Alterations Code, Commercial and Industrial Alterations Code, Subdivisions Code, and Demolition Code	All	

Note: If council does not have sufficient information to ascertain the extent to which complying development may or may not be carried out on the land, a statement below will describe that a restriction applies to the land, but it may not apply to all of the land, and that council does not have sufficient information to ascertain the extent to which complying development may or may not be carried out on the land.

Nil

4. Coastal protection*

Has the Department of Finance, Services and Innovation notified Council of the land being affected by 38 or 39 of the Coastal Protection Act, 1979?

No

4A. Certain information relating to beaches and coasts*

(a) Has an order has been made under Part 4D of the Coastal Protection Act 1979 on the land (or on public land adjacent to that land)?

No

(b) Has Council been notified under section 55X of the Coastal Protection Act 1979 that temporary coastal protection works have been placed on the land (or on public land adjacent to that land), and if works have been so placed, is council is satisfied that the works have been removed and the land restored in accordance with that Act?

Not applicable

4B. Annual charges under Local Government Act 1993 for coastal protection services that relate to existing coastal protection works*

Has the owner (or any previous owner) of the land consented, in writing, that the land is subject to annual charges under section 496B of the Local Government Act 1993 for coastal protection services that relate to existing coastal protection works (within the meaning of section 553B of that Act)?

No

5. Mine subsidence*

Is the land a proclaimed to mine subsidence district within the meaning of section 15 of the Mine Subsidence Compensation Act 1961?

No

6. Road widening and road realignment

Is the land is affected by any road widening or road realignment under:

(a) Division 2 of Part 3 of the Roads Act 1993?*

No

(b) An EPI?

No

(c) A resolution of the council?

No

7. Council and other public authority policies on hazard risk restrictions

The following table lists hazard/risk policies that have been adopted by Council (or prepared by another public authority and subsequently adopted by Council). The right-most column indicates whether the land is subject to those policies.

Hazard/Risk	Adopted Policy	Does this hazard/risk policy apply to the land?
Landslip hazard	Nil	No
Bushfire hazard	Liverpool DCP 2008	Yes
	Liverpool Growth Centre Precincts DCP*	No
	Edmondson Park South DCP 2012	No

Hazard/Risk	Adopted Policy	Does this hazard/risk policy apply to the land?
	Planning for Bushfire Protection (Rural Fire Services, 2006)*	Yes
	Pleasure Point Bushfire Management Plan	No
Tidal inundation	Nil	No
Subsidence	Nil	No
Acid Sulphate Soils	Liverpool LEP 2008	No
	Liverpool DCP 2008	No
Potentially Contaminated Land	Liverpool DCP 2008	Yes , see section 10 of Part 1 of the Liverpool DCP 2008
	Liverpool Growth Centre Precincts DCP*	No
Potentially Saline Soils	Liverpool DCP 2008	Yes
	Liverpool Growth Centre Precincts DCP*	No

Note: Land for which a policy applies does not confirm that the land is affected by that hazard/risk. For example, all land for which the Liverpool DCP applies is subject to controls relating to contaminated land, as this policy contains triggers and procedures for identifying potential contamination. Applicants are encouraged to review the relevant policy, and other sections of this certificate, to determine what effect, if any, the policy may have on the land.

7A. Flood related development controls information

- (a) For the purpose of residential accommodation (excluding group homes or seniors housing), is the land, or part of the land, within the flood planning area and subject to flood planning controls?

No

For details of these controls, please refer to the flooding section of the relevant DCP(s) as specified in Section 1(c) of this certificate.

- (b) Is development on that land, or part of the land, for any other purpose subject to flood related development controls?

No

For details of these controls, please refer to the flooding section of the relevant DCP(s) as specified in Section 1(c) of this certificate.

Note: Words and expressions in this clause have the same meanings as in the instrument set out in the Schedule to the Standard Instrument (Local Environmental Plans) Order 2006.

8. Land reserved for acquisition

Does a LEP, draft LEP, SEPP or draft SEPP identify the acquisition of the land, or part of the land, by a public authority, as referred to in section 27 of the Act?

No

9. Contribution Plans

Liverpool Contributions Plan 2009

9A. Biodiversity certified land*

Is the land, or part of the land, biodiversity certified land (within the meaning of Part 7AA of the Threatened Species Conservation Act 1995)?

No

10. Biobanking agreements*

Is the land subject to a bio-banking agreement under Part 7A of the Threatened Species Conservation Act 1995, as notified to Council by the Chief Executive of the Office of Environment and Heritage?

No

11. Bushfire prone land

Is the land or part of the land, bushfire prone land as defined by the EP&A Act 1979?

Yes, part of the land is bushfire prone land

12. Property vegetation plans*

Is Council aware of the land being subject to a Property Vegetation Plan under the Native Vegetation Act 2003?

No, Liverpool is excluded from the operation of the Native Vegetation Act 2003

13. Orders under Trees (Disputes between Neighbours) Act 2006*

Does an order, made under the Trees (Disputes Between Neighbours) Act 2006 in relation to carrying out of work in relation to a tree on the land, apply?

No, Council has not been notified of an order

14. Directions under Part 3A*

Is there a direction (made by the Minister) that a provision of an EPI in relation to a development does not have effect?

No

15. Site compatibility certificates and conditions for seniors housing*

(a) Is there is a current site compatibility certificate (seniors housing), in respect of proposed development on the land?

No, Council has not been notified of an order.

16. Site compatibility certificates for infrastructure*

(a) Is there is a current site compatibility certificate (infrastructure), in respect of proposed development on the land?

No, Council has not been notified of an order

17. Site compatibility certificates and conditions for affordable rental housing*

Is there is a current site compatibility certificate (Affordable housing), in respect of proposed development on the land?

No, Council has not been notified of an order.

18. Paper subdivision information*

Does any development plan adopted by a relevant authority (or proposed plan subject to a consent ballot) apply to the land? If so the date of the subdivision order that applies to the land.

No

19. Site verification certificates*

Does a current site verification certificate, apply to the land?

No, Council is not aware of a site verification certificate

20. Loose-fill asbestos insulation *

Is a dwelling on the land listed on the register (maintained by the NSW Department of Fair Trading) as containing loose-fill asbestos insulation?

No

Note: despite any listing on the register, any buildings constructed before 1980 may contain loose-fill asbestos insulation or other asbestos products.

21. Contaminated land

Is the land:

(a) Significantly contaminated land within the meaning of that Act?

No

(b) Subject to a management order within the meaning of that Act?

No

(c) Subject of an approved voluntary management proposal within the meaning of that Act?

No

(d) Subject to an ongoing maintenance order within the meaning of that Act?

No

(e) Subject of a site audit statement within the meaning of that Act? *

No

Note: in this clause 'the Act' refers to the Contaminated Land Management Act 1997.

THE FOLLOWING INFORMATION IS PROVIDED PURSUANT TO SECTION 149(5) OF THE
ENVIRONMENTAL PLANNING AND ASSESSMENT ACT (EP&A ACT) 1979

1. Controlled access road

Does the land have a boundary to a controlled access road?

No

2. Sewer Access and On-site Management

On-Site Sewerage Management System/s

Council's records indicate that the property may not be connected to Sydney Water's sewerage system.

If the property is not connected and emits any waste water (sewerage) it must have an On-Site Sewerage Management System that is operating satisfactorily. It is the ongoing responsibility of the current owner(s) of the property (at any given time) to ensure that any On-Site Sewerage Management System continually operate in compliance with the relevant provisions of the Local Government Act 1993, and the Protection of the Environment Operations Act 1997 (including regulations made there under).

It is recommended that any applicant intending to purchase the property make enquires to ascertain if the property has an On-Site Sewerage Management System and engage the services of a suitably qualified wastewater engineer or plumber to assess the condition and compliance status of those system(s).

3. Other Information in Relation to Water Restrictions

Nil

4. Contaminated Land

Nil

5. Airport Noise Affectation*

The land is identified as being within an ANEF (Australian Noise Exposure Forecast) contour; as such, the development of the land may be restricted.

6. Environmentally Significant Land

Nil

7. Archaeological Management Plan

Nil

8. Offensive Odour and Rural Land Uses

Nil



For further information, please contact
CALL CENTRE – 1300 36 2170

Luke West
Administration Services Coordinator
Liverpool City Council

Appendix G

Test Pit Logs

TEST PIT LOG

CLIENT: Greenfields Development Company 2 Pty Ltd
PROJECT: Residential Rezoning
LOCATION: Part 1675 The Northern Road
 Bringelly, NSW

SURFACE LEVEL: 98.0 mAHD
EASTING: 293510
NORTHING: 6231910

PIT No: 1
PROJECT No: 92207.00
DATE: 25/1/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
98.0	0.0	TOPSOIL - dark brown and grey clayey silt with rootlets		D*	0.0							
	0.1	CLAYEY SILT - dark brown clayey silt			0.1							
	0.2	SILTY CLAY - red and brown silty clay, MC<PL			0.3							
	0.4			D	0.4							
	0.5	Pit discontinued at 0.5m - limit of investigation										
	1											
	2											
	3											

RIG: Backhoe - 300mm bucket

LOGGED: SJL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * Replicate sample BD1/250117 collected

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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	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	sp	Standard penetration test
E	Environmental sample	≡	Water level	S	Shear vane (kPa)
				V	Shear vane (kPa)

TEST PIT LOG

CLIENT: Greenfields Development Company 2 Pty Ltd
PROJECT: Residential Rezoning
LOCATION: Part 1675 The Northern Road
 Bringelly, NSW

SURFACE LEVEL: 97.0 mAHD
EASTING: 287424
NORTHING: 6244473

PIT No: 2
PROJECT No: 92207.00
DATE: 25/1/2017
SHEET 1 OF 1

[illegible]

RIG: Backhoe - 300mm bucket

LOGGED: SJL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * Replicate sample BD1/250117 collected

- ☐ Sand Penetrometer AS1289.6.3.3
- ☐ Cone Penetrometer AS1289.6.3.2

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



TEST PIT LOG

CLIENT: Greenfields Development Company 2 Pty Ltd
PROJECT: Residential Rezoning
LOCATION: Part 1675 The Northern Road
 Bringelly, NSW

SURFACE LEVEL: 99.0 mAHD
EASTING: 287381
NORTHING: 6244476

PIT No: 3
PROJECT No: 92207.00
DATE: 25/1/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
98		FILLING - dark brown clayey silt with ironstone gravel and a trace of anthropogenics comprising galvanised iron		D	0.0							
	0.1				0.1							
	0.2	TOPSOIL - dark brown clayey silt with a trace of rootlets										
	0.3	CLAYEY SILT - dark brown clayey silt			0.3							
	0.4	SILTY CLAY - red and brown silty clay, MC<PL		D	0.4							
	0.6	Pit discontinued at 0.6m - limit of investigation										
98	1											
97	2											
96	3											

RIG: Backhoe - 300mm bucket

LOGGED: SJL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * Replicate sample BD1/250117 collected

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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 _s	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	W _s	Water seep	S	Standard penetration test
E	Environmental sample	W _l	Water level	V	Shear vane (kPa)

TEST PIT LOG

CLIENT: Greenfields Development Company 2 Pty Ltd
PROJECT: Residential Rezoning
LOCATION: Part 1675 The Northern Road
 Bringelly, NSW

SURFACE LEVEL: 101.0 mAHD
EASTING: 287345
NORTHING: 6244395

PIT No: 4
PROJECT No: 92207.00
DATE: 25/1/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
101	0.1	TOPSOIL - dark brown clayey silt with a trace of rootlets		D	0.0							
		SILTY CLAY - red and brown silty clay, MC<PL			0.1							
					0.3							
				D	0.4							
	0.6	Pit discontinued at 0.6m - limit of investigation										
100	1											
99	2											
98	3											

RIG: Backhoe - 300mm bucket

LOGGED: SJL

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS: * Replicate sample BD1/250117 collected

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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	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)

Appendix H

EIL Calculation Spreadsheet

Inputs
Select contaminant from list below
As
Below needed to calculate fresh and aged ACLs
Below needed to calculate fresh and aged ABCs
or for fresh ABCs only
or for aged ABCs only

Outputs		
Land use	Arsenic generic EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	20	40
Urban residential and open public spaces	50	100
Commercial and industrial	80	160

Inputs
Select contaminant from list below
Cr III
Below needed to calculate fresh and aged ACLs
Enter % clay (values from 0 to 100%)
10
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Cr III soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	130	140
Urban residential and open public spaces	230	410
Commercial and industrial	340	670

Inputs
Select contaminant from list below
Cu
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
15
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.4
Enter organic carbon content (%OC) (values from 0 to 50%)
1
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Cu soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	70	85
Urban residential and open public spaces	130	220
Commercial and industrial	180	310

Inputs
Select contaminant from list below
DDT
Below needed to calculate fresh and aged ACLs
Below needed to calculate fresh and aged ABCs
or for fresh ABCs only
or for aged ABCs only

Outputs		
Land use	DDT generic EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	3	3
Urban residential and open public spaces	180	180
Commercial and industrial	640	640

Inputs
Select contaminant from list below
Naphthalene
Below needed to calculate fresh and aged ACLs
Below needed to calculate fresh and aged ABCs
or for fresh ABCs only
or for aged ABCs only

Outputs		
Land use	Naphthalene generic EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	10	10
Urban residential and open public spaces	170	170
Commercial and industrial	370	370

Inputs
Select contaminant from list below
Ni
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
15
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Ni soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	35	40
Urban residential and open public spaces	95	220
Commercial and industrial	160	380

Inputs
Select contaminant from list below
Pb
Below needed to calculate fresh and aged ACLs
Below needed to calculate fresh and aged ABCs
or for fresh ABCs only
or for aged ABCs only

Outputs		
Land use	Lead generic EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	110	470
Urban residential and open public spaces	270	1100
Commercial and industrial	440	1800

Inputs
Select contaminant from list below
Zn
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
15
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.4
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Zn soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	85	200
Urban residential and open public spaces	250	630
Commercial and industrial	370	930

Appendix I

Laboratory Results Summary Table

Table I1 - Summary of Soil Sampling and Chemical Analysis Results (Results in mg/kg - unless specified)

Sample Location	Sample Depth (m)	Sampling Date	Sample Target	Heavy Metals								PAH					TRH				BTEX				OCPs, OPPs & PCBs												
				As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	B(a)P TEQ	B(a)P	Total PAH	Naphthalene	Phenols	C6-C10 less BTEX [F1]	>C10-C16 (less Naphthalene) [F2]	>C16-C24	>C34-C40	Benzene	Toluene	Ethylbenzene	Total Xylenes	Aldrin + dieldrin	Chlordane	DDT + DDE + DDD	Endosulfan	Endrin	Heptachlor	HCB	Methoxychlor	OPP (Chlorpyrifos)	PCBs	Asbestos		
Practical Quantitation Limit				4	0.4	1	1	1	0.1	1	1	0.5	0.05	0.1	1	5	25	50	100	100	0.2	0.5	1	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
Assessment Criteria																																					
HIL - As per Table 6.1 of JBS (2010) RAP ¹			100	20	100	1000	300	15	600	7000	NC	1	20	NC	NC	65	NC	1000	NC	NC	NC	1	130	50	25	200	10	50	NC	10	NC	NC	10	NC	NC		
PPIL - As per Table 6.1 of JBS (2010) RAP ¹			20	3	400 ³	100	600	1	60	200	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	1.4	3.1	14	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC		
NEPC (2013) HIL A / HSL A ²			100	20	100	6000	300	40	400	7400	3	ND	300	4 [#]	3000	40 [#]	230 [#]	ND	ND	0.6 [#]	390 [#]	NL	95 [#]	6	50	240	270	10	6	10	300	160	1	ND			
NEPC (2013) EIL / ESL ²			100	ND	410 ^{###}	210 ^{###}	1100	ND	220 ^{###}	480 ^{###}	ND	0.7 ^{##}	ND	170	ND	180 ^{##}	120 ^{##}	1300 ^{##}	5600 ^{##}	65 ^{##}	105 ^{##}	125 ^{##}	45 ^{##}	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
NEPC (2013) Management Limits			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	800	1000	3500	10000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
ANZECC			0.2-30	0.04-2	0.5-110	1-190	<2-200	0.001-0.1	2-400	2-180	ND	ND	0.95-5	ND	ND	ND	ND	ND	ND	0.05-1	0.1-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02-0.1	ND		
Berkman (2001)			1-50	100-300	5-1000	2-100	2-200	0.03	5-500	10-300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Analytical Results of Test Pit Samples																																					
TP1	0-0.1	25/01/2017	Natural Material	6	<0.4	16	35	17	<0.1	11	140	<0.5	<0.05	<0.05	<PQL	-	<25	<50	380	110	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-			
TP2	0-0.1	25/01/2017	Filling	6	<0.4	18	56	14	<0.1	11	72	<0.5	<0.05	<0.05	<PQL	<5	<25	<50	210	150	<0.2	<0.5	<1	<1	<PQL	<PQL	<0.1	<PQL	<PQL	<PQL	<0.1	<0.1	<PQL	<0.1	NAD		
TP3	0-0.1	25/01/2017	Filling	9	<0.4	18	24	17	<0.1	9	51	<0.5	<0.05	0.2	<PQL	<5	<25	<50	120	<100	<0.2	<0.5	<1	<1	<PQL	<PQL	<0.1	<PQL	<PQL	<PQL	<0.1	<0.1	<PQL	<0.1	NAD		
TP4	0-0.1	25/01/2017	Natural Material	8	<0.4	18	31	20	<0.1	14	96	<0.5	<0.05	<0.05	<PQL	-	<25	<50	200	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	-	-			

Notes:

All results in mg/kg on a dry weight basis unless specified

ND - Not Defined

NL - Not Limiting

NAD - No Asbestos Detected

HIL - Health Investigation Level

EIL - Ecological Investigation Level

ESL - Ecological Screening Level

² The HIL A/ HSL A/EIL / ESLs were based on National Environmental Protection Measures (NEPC) 2013

HSL A assuming silt (0m - <1m depth)

ESL for fine grained soil

EIL based on clay content above 10 %, CEC of 15 and a pH of 6.4

Appendix J

Laboratories Chain of Custody, Sample Receipt and Certificates of
Analysis



12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS

160850

Client:

Douglas Partners Pty Ltd Smeaton Grange
18 Waler Crescent
Smeaton Grange
NSW 2567

Attention: Rod Gray / Michael Gol

Sample log in details:

Your Reference:	<u>92207.00, Residential Rezoning</u>
No. of samples:	4 Soils
Date samples received / completed instructions received	25/01/17 / 25/01/17

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:

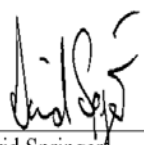
Date results requested by: / Issue Date:	2/02/17 / 1/02/17
Date of Preliminary Report:	Not Issued

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Accredited for compliance with ISO/IEC 17025 - Testing

Tests not covered by NATA are denoted with *.

Results Approved By:



David Springer
General Manager

Envirolab Reference: 160850
Revision No: R 00



vTRH(C6-C10)/BTEXN in Soil					
Our Reference:	UNITS	160850-1	160850-2	160850-3	160850-4
Your Reference	-----	TP1	TP2	TP3	TP4
Depth	-				
Date Sampled	-----	0-0.1	0-0.1	0-0.1	0-0.1
Type of sample		25/01/2017 Soil	25/01/2017 Soil	25/01/2017 Soil	25/01/2017 Soil
Date extracted	-	30/01/2017	30/01/2017	30/01/2017	30/01/2017
Date analysed	-	31/01/2017	31/01/2017	31/01/2017	31/01/2017
TRHC ₆ - C ₉	mg/kg	<25	<25	<25	<25
TRHC ₆ - C ₁₀	mg/kg	<25	<25	<25	<25
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	119	102	109	110

svTRH (C10-C40) in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- - -----	160850-1 TP1 0-0.1 25/01/2017 Soil	160850-2 TP2 0-0.1 25/01/2017 Soil	160850-3 TP3 0-0.1 25/01/2017 Soil	160850-4 TP4 0-0.1 25/01/2017 Soil
Date extracted	-	30/01/2017	30/01/2017	30/01/2017	30/01/2017
Date analysed	-	30/01/2017	30/01/2017	30/01/2017	30/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	mg/kg	170	<100	<100	<100
TRHC ₂₉ - C ₃₆	mg/kg	300	210	110	220
TRH>C ₁₀ -C ₁₆	mg/kg	<50	<50	<50	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH>C ₁₆ -C ₃₄	mg/kg	380	200	120	200
TRH>C ₃₄ -C ₄₀	mg/kg	110	150	<100	<100
Total +ve TRH (>C ₁₀ -C ₄₀)	mg/kg	500	350	120	200
Surrogate o-Terphenyl	%	118	114	114	114

PAHs in Soil Our Reference: Your Reference	UNITS ----- -	160850-1 TP1	160850-2 TP2	160850-3 TP3	160850-4 TP4
Depth	-----	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		25/01/2017	25/01/2017	25/01/2017	25/01/2017
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	30/01/2017	30/01/2017	30/01/2017	30/01/2017
Date analysed	-	01/02/2017	01/02/2017	01/02/2017	01/02/2017
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<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
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	<0.05	<0.05	0.2	<0.05
Surrogate p-Terphenyl-d14	%	92	86	91	94

Organochlorine Pesticides in soil			
Our Reference:	UNITS	160850-2	160850-3
Your Reference	-----	TP2	TP3
	-		
Depth	-----	0-0.1	0-0.1
Date Sampled		25/01/2017	25/01/2017
Type of sample		Soil	Soil
Date extracted	-	30/01/2017	30/01/2017
Date analysed	-	30/01/2017	30/01/2017
HCB	mg/kg	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1
Surrogate TCMX	%	108	107

Organophosphorus Pesticides			
Our Reference:	UNITS	160850-2	160850-3
Your Reference	-----	TP2	TP3
	-		
Depth	-----	0-0.1	0-0.1
Date Sampled		25/01/2017	25/01/2017
Type of sample		Soil	Soil
Date extracted	-	30/01/2017	30/01/2017
Date analysed	-	30/01/2017	30/01/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1
Chlorpyrifos	mg/kg	<0.1	<0.1
Chlorpyrifos-methyl	mg/kg	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1
Surrogate TCMX	%	108	107

PCBs in Soil Our Reference: Your Reference	UNITS ----- -	160850-2 TP2	160850-3 TP3
Depth Date Sampled Type of sample	----- 	0-0.1 25/01/2017 Soil	0-0.1 25/01/2017 Soil
Date extracted	-	30/01/2017	30/01/2017
Date analysed	-	30/01/2017	30/01/2017
Aroclor 1016	mg/kg	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1
Surrogate TCLMX	%	108	107

Acid Extractable metals in soil					
Our Reference:	UNITS	160850-1	160850-2	160850-3	160850-4
Your Reference	-----	TP1	TP2	TP3	TP4
	-				
Depth	-----	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		25/01/2017	25/01/2017	25/01/2017	25/01/2017
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	30/01/2017	30/01/2017	30/01/2017	30/01/2017
Date analysed	-	31/01/2017	31/01/2017	31/01/2017	31/01/2017
Arsenic	mg/kg	6	6	9	8
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	16	18	18	18
Copper	mg/kg	35	39	24	31
Lead	mg/kg	17	13	17	20
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	11	11	9	14
Zinc	mg/kg	140	51	51	96

Misc Soil - Inorg	UNITS	160850-2	160850-3
Our Reference:	-----	TP2	TP3
Your Reference	-		
Depth	-----	0-0.1	0-0.1
Date Sampled		25/01/2017	25/01/2017
Type of sample		Soil	Soil
Date prepared	-	30/01/2017	30/01/2017
Date analysed	-	30/01/2017	30/01/2017
Total Phenolics (as Phenol)	mg/kg	<5	<5

Moisture Our Reference: Your Reference	UNITS ----- -	160850-1 TP1	160850-2 TP2	160850-3 TP3	160850-4 TP4
Depth Date Sampled Type of sample	----- 0-0.1 25/01/2017 Soil	0-0.1 25/01/2017 Soil	0-0.1 25/01/2017 Soil	0-0.1 25/01/2017 Soil	0-0.1 25/01/2017 Soil
Date prepared	-	30/01/2017	30/01/2017	30/01/2017	30/01/2017
Date analysed	-	31/01/2017	31/01/2017	31/01/2017	31/01/2017
Moisture	%	16	8.6	14	8.8

Asbestos ID - soils NEPM Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- - -----	160850-2 TP2 0-0.1 25/01/2017 Soil	160850-3 TP3 0-0.1 25/01/2017 Soil
Date analysed	-	1/02/2017	1/02/2017
Sample mass tested	g	796.64	669.59
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected
Total Asbestos ^{#1}	g/kg	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	—	—
FA and AF Estimation*	g	—	—
FA and AF Estimation ^{**2}	%(w/w)	<0.001	<0.001

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-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. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.
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-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. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	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. For soil results:- 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
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.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PCBs" is simply a sum of the positive individual PCBs.

Method ID	Methodology Summary
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. NOTE ^{#1} Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) NOTE ^{#2} The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
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.

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
vTRH(C6-C10)/BTEXN in Soil						Base II Duplicate II %RPD		
Date extracted	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Date analysed	-			31/01/2017	160850-2	31/01/2017 31/01/2017	LCS-2	31/01/2017
TRHC ₆ - C ₉	mg/kg	25	Org-016	<25	160850-2	<25 <25	LCS-2	109%
TRHC ₆ - C ₁₀	mg/kg	25	Org-016	<25	160850-2	<25 <25	LCS-2	109%
Benzene	mg/kg	0.2	Org-016	<0.2	160850-2	<0.2 <0.2	LCS-2	97%
Toluene	mg/kg	0.5	Org-016	<0.5	160850-2	<0.5 <0.5	LCS-2	102%
Ethylbenzene	mg/kg	1	Org-016	<1	160850-2	<1 <1	LCS-2	113%
m+p-xylene	mg/kg	2	Org-016	<2	160850-2	<2 <2	LCS-2	116%
o-Xylene	mg/kg	1	Org-016	<1	160850-2	<1 <1	LCS-2	116%
naphthalene	mg/kg	1	Org-014	<1	160850-2	<1 <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	122	160850-2	102 127 RPD: 22	LCS-2	109%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
svTRH (C10-C40) in Soil						Base II Duplicate II %RPD		
Date extracted	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Date analysed	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	50	Org-003	<50	160850-2	<50 <50	LCS-2	98%
TRHC ₁₅ - C ₂₈	mg/kg	100	Org-003	<100	160850-2	<100 <100	LCS-2	98%
TRHC ₂₈ - C ₃₆	mg/kg	100	Org-003	<100	160850-2	210 230 RPD: 9	LCS-2	95%
TRH>C ₁₀ -C ₁₆	mg/kg	50	Org-003	<50	160850-2	<50 <50	LCS-2	98%
TRH>C ₁₆ -C ₃₄	mg/kg	100	Org-003	<100	160850-2	200 210 RPD: 5	LCS-2	98%
TRH>C ₃₄ -C ₄₀	mg/kg	100	Org-003	<100	160850-2	150 130 RPD: 14	LCS-2	95%
Surrogate o-Terphenyl	%		Org-003	107	160850-2	114 114 RPD: 0	LCS-2	83%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Soil						Base II Duplicate II %RPD		
Date extracted	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Date analysed	-			01/02/2017	160850-2	01/02/2017 01/02/2017	LCS-2	01/02/2017
Naphthalene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	LCS-2	92%
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	LCS-2	98%
Phenanthrene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	LCS-2	102%
Anthracene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	LCS-2	102%
Pyrene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	LCS-2	102%
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	LCS-2	100%
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	160850-2	<0.2 <0.2	[NR]	[NR]

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Soil						Base II Duplicate II %RPD		
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	160850-2	<0.05 <0.05	LCS-2	94%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	111	160850-2	86 91 RPD: 6	LCS-2	102%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Organochlorine Pesticides in soil						Base II Duplicate II %RPD		
Date extracted	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Date analysed	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
HCB	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	73%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	80%
Heptachlor	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	77%
delta-BHC	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	78%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	81%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	84%
Dieldrin	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	87%
Endrin	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	82%
pp-DDD	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	122%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	LCS-2	70%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	102	160850-2	108 111 RPD: 3	LCS-2	97%

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Organophosphorus Pesticides						Base II Duplicate II %RPD		
Date extracted	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Date analysed	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Chlorpyrifos	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	LCS-2	86%
Chlorpyrifos-methyl	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Diazinon	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	LCS-2	96%
Dimethoate	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	LCS-2	96%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	LCS-2	106%
Malathion	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	LCS-2	73%
Parathion	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	LCS-2	108%
Ronnel	mg/kg	0.1	Org-008	<0.1	160850-2	<0.1 <0.1	LCS-2	111%
Surrogate TCMX	%		Org-008	102	160850-2	108 111 RPD: 3	LCS-2	99%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PCBs in Soil						Base II Duplicate II %RPD		
Date extracted	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Date analysed	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	160850-2	<0.1 <0.1	LCS-2	102%
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	160850-2	<0.1 <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	102	160850-2	108 111 RPD: 3	LCS-2	99%

Client Reference: 92207.00, Residential Rezoning

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Acid Extractable metals in soil						Base Duplicate %RPD		
Date prepared	-			30/01/2017	160850-2	30/01/2017 30/01/2017	LCS-2	30/01/2017
Date analysed	-			31/01/2017	160850-2	31/01/2017 31/01/2017	LCS-2	31/01/2017
Arsenic	mg/kg	4	Metals-020	<4	160850-2	6 6 RPD: 0	LCS-2	112%
Cadmium	mg/kg	0.4	Metals-020	<0.4	160850-2	<0.4 <0.4	LCS-2	105%
Chromium	mg/kg	1	Metals-020	<1	160850-2	18 15 RPD: 18	LCS-2	109%
Copper	mg/kg	1	Metals-020	<1	160850-2	39 56 RPD: 36	LCS-2	110%
Lead	mg/kg	1	Metals-020	<1	160850-2	13 14 RPD: 7	LCS-2	95%
Mercury	mg/kg	0.1	Metals-021	<0.1	160850-2	<0.1 <0.1	LCS-2	92%
Nickel	mg/kg	1	Metals-020	<1	160850-2	11 11 RPD: 0	LCS-2	100%
Zinc	mg/kg	1	Metals-020	<1	160850-2	51 72 RPD: 34	LCS-2	102%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Misc Soil - Inorg						Base Duplicate %RPD		
Date prepared	-			30/01/2017	[NT]	[NT]	LCS-1	30/01/2017
Date analysed	-			30/01/2017	[NT]	[NT]	LCS-1	30/01/2017
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	[NT]	[NT]	LCS-1	102%
QUALITYCONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	Dup. Sm#		Duplicate Base + Duplicate + %RPD		Spike Sm#	Spike % Recovery	
Date extracted	-	[NT]		[NT]		160850-3	30/01/2017	
Date analysed	-	[NT]		[NT]		160850-3	31/01/2017	
TRHC ₆ - C ₉	mg/kg	[NT]		[NT]		160850-3	117%	
TRHC ₆ - C ₁₀	mg/kg	[NT]		[NT]		160850-3	117%	
Benzene	mg/kg	[NT]		[NT]		160850-3	113%	
Toluene	mg/kg	[NT]		[NT]		160850-3	121%	
Ethylbenzene	mg/kg	[NT]		[NT]		160850-3	116%	
m+p-xylene	mg/kg	[NT]		[NT]		160850-3	118%	
o-Xylene	mg/kg	[NT]		[NT]		160850-3	119%	
naphthalene	mg/kg	[NT]		[NT]		[NR]	[NR]	
Surrogate aaa-Trifluorotoluene	%	[NT]		[NT]		160850-3	127%	

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160850-3	30/01/2017
Date analysed	-	[NT]	[NT]	160850-3	30/01/2017
TRHC ₁₀ - C ₁₄	mg/kg	[NT]	[NT]	160850-3	106%
TRHC ₁₅ - C ₂₃	mg/kg	[NT]	[NT]	160850-3	98%
TRHC ₂₉ - C ₃₆	mg/kg	[NT]	[NT]	160850-3	91%
TRH>C ₁₀ -C ₁₆	mg/kg	[NT]	[NT]	160850-3	106%
TRH>C ₁₆ -C ₃₄	mg/kg	[NT]	[NT]	160850-3	98%
TRH>C ₃₄ -C ₄₀	mg/kg	[NT]	[NT]	160850-3	91%
Surrogate o-Terphenyl	%	[NT]	[NT]	160850-3	114%
QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160850-3	30/01/2017
Date analysed	-	[NT]	[NT]	160850-3	01/02/2017
Naphthalene	mg/kg	[NT]	[NT]	160850-3	87%
Acenaphthylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	[NT]	[NT]	160850-3	89%
Phenanthrene	mg/kg	[NT]	[NT]	160850-3	83%
Anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	[NT]	[NT]	160850-3	83%
Pyrene	mg/kg	[NT]	[NT]	160850-3	87%
Benzo(a)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	[NT]	[NT]	160850-3	86%
Benzo(b,j,k)fluoranthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	[NT]	[NT]	160850-3	84%
Indeno(1,2,3-c,d)pyrene	mg/kg	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%	[NT]	[NT]	160850-3	90%

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160850-3	30/01/2017
Date analysed	-	[NT]	[NT]	160850-3	30/01/2017
HCB	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	[NT]	[NT]	160850-3	83%
gamma-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	[NT]	[NT]	160850-3	94%
Heptachlor	mg/kg	[NT]	[NT]	160850-3	81%
delta-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	[NT]	[NT]	160850-3	86%
Heptachlor Epoxide	mg/kg	[NT]	[NT]	160850-3	81%
gamma-Chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	[NT]	[NT]	160850-3	92%
Dieldrin	mg/kg	[NT]	[NT]	160850-3	96%
Endrin	mg/kg	[NT]	[NT]	160850-3	89%
pp-DDD	mg/kg	[NT]	[NT]	160850-3	92%
Endosulfan II	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	[NT]	[NT]	160850-3	73%
Methoxychlor	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%	[NT]	[NT]	160850-3	92%

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL Organophosphorus Pesticides	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160850-3	30/01/2017
Date analysed	-	[NT]	[NT]	160850-3	30/01/2017
Azinphos-methyl (Guthion)	mg/kg	[NT]	[NT]	[NR]	[NR]
Bromophos-ethyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Chlorpyrifos	mg/kg	[NT]	[NT]	160850-3	84%
Chlorpyrifos-methyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Diazinon	mg/kg	[NT]	[NT]	[NR]	[NR]
Dichlorvos	mg/kg	[NT]	[NT]	160850-3	77%
Dimethoate	mg/kg	[NT]	[NT]	[NR]	[NR]
Ethion	mg/kg	[NT]	[NT]	160850-3	130%
Fenitrothion	mg/kg	[NT]	[NT]	160850-3	84%
Malathion	mg/kg	[NT]	[NT]	160850-3	102%
Parathion	mg/kg	[NT]	[NT]	160850-3	109%
Ronnel	mg/kg	[NT]	[NT]	160850-3	110%
Surrogate TCMX	%	[NT]	[NT]	160850-3	103%
QUALITY CONTROL PCBs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	160850-3	30/01/2017
Date analysed	-	[NT]	[NT]	160850-3	30/01/2017
Aroclor 1016	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1221	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1232	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1242	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1248	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1254	mg/kg	[NT]	[NT]	160850-3	113%
Aroclor 1260	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%	[NT]	[NT]	160850-3	103%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	160850-3	30/01/2017
Date analysed	-	[NT]	[NT]	160850-3	31/01/2017
Arsenic	mg/kg	[NT]	[NT]	160850-3	95%
Cadmium	mg/kg	[NT]	[NT]	160850-3	97%
Chromium	mg/kg	[NT]	[NT]	160850-3	103%
Copper	mg/kg	[NT]	[NT]	160850-3	100%
Lead	mg/kg	[NT]	[NT]	160850-3	75%
Mercury	mg/kg	[NT]	[NT]	160850-3	94%
Nickel	mg/kg	[NT]	[NT]	160850-3	97%
Zinc	mg/kg	[NT]	[NT]	160850-3	88%

Report Comments:

Asbestos-ID in soil: NEPM

This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.

This is reported outside our scope of NATA accreditation.

Asbestos ID was analysed by Approved Identifier:

Matt Tang

Asbestos ID was authorised by Approved Signatory:

Paul Ching

INS: Insufficient sample for this test

PQL: Practical Quantitation Limit

NT: Not tested

NR: 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 (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics 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.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Aileen Hie

From: Simon Longhurst <Simon.Longhurst@douglaspartners.com.au>
Sent: Thursday, 16 February 2017 3:38 PM
To: Aileen Hie
Cc: Rod Gray
Subject: RE: Results for Registration 160850 92207.00, Residential Rezoning

Hi Aileen,

-3

Could I please get pH and CEC tested from sample TP3/0-0.1. Could I get this on a 2 day turnaround?

Kind regards

Simon Longhurst | Environmental Scientist Douglas Partners Pty Ltd | ABN 75 053 980 117 |
www.douglaspartners.com.au
18 Waler Crescent Smeaton Grange NSW 2567
P: 02 4647 0075 | F: 02 4646 1886 | E: Simon.Longhurst@douglaspartners.com.au

This email is confidential. If you are not the intended recipient, please notify us immediately and be aware that any disclosure, copying, distribution or use of the contents of this information is prohibited. Please note that the company does not make any commitment through emails not confirmed by fax or letter.

Envirolab Ref: 160850 A
Due: 20/2/17
2 day T/A

-----Original Message-----

From: Rod Gray
Sent: Thursday, 16 February 2017 11:47 AM
To: Simon Longhurst
Subject: FW: Results for Registration 160850 92207.00, Residential Rezoning

Rod Gray | Senior Associate / Environmental Manager Douglas Partners Pty Ltd | ABN 75 053 980 117 |
www.douglaspartners.com.au
18 Waler Crescent Smeaton Grange NSW 2567
P: 02 4647 0075 | F: 02 4646 1886 | M: 0499 028 779 | E: Rod.Gray@douglaspartners.com.au

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-----Original Message-----

From: Nancy Zhang [mailto:NZhang@envirolab.com.au]
Sent: Wednesday, 1 February 2017 5:38 PM
To: Rod Gray; Michael Gol

Aileen Hie

From: Simon Longhurst <Simon.Longhurst@douglaspartners.com.au>
Sent: Thursday, 16 February 2017 3:38 PM
To: Aileen Hie
Cc: Rod Gray
Subject: RE: Results for Registration 160850 92207.00, Residential Rezoning

Hi Aileen,

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www.douglaspartners.com.au
18 Waler Crescent Smeaton Grange NSW 2567
P: 02 4647 0075 | F: 02 4646 1886 | E: Simon.Longhurst@douglaspartners.com.au

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Envirolab Ref: 160850 A
Due: 20/2/17
2 day T/A

-----Original Message-----

From: Rod Gray
Sent: Thursday, 16 February 2017 11:47 AM
To: Simon Longhurst
Subject: FW: Results for Registration 160850 92207.00, Residential Rezoning

Rod Gray | Senior Associate / Environmental Manager Douglas Partners Pty Ltd | ABN 75 053 980 117 |
www.douglaspartners.com.au
18 Waler Crescent Smeaton Grange NSW 2567
P: 02 4647 0075 | F: 02 4646 1886 | M: 0499 028 779 | E: Rod.Gray@douglaspartners.com.au

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-----Original Message-----

From: Nancy Zhang [mailto:NZhang@envirolab.com.au]
Sent: Wednesday, 1 February 2017 5:38 PM
To: Rod Gray; Michael Gol



12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS

160850-A

Client:

Douglas Partners Pty Ltd Smeaton Grange

18 Waler Crescent

Smeaton Grange

NSW 2567

Attention: Rod Gray / Michael Gol

Sample log in details:

Your Reference:

92207.00, Residential Rezoning

No. of samples:

Additional Testing on1 Soil

Date samples received / completed instructions received

25/01/17 / 16/02/17

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:

20/02/17 / 20/02/17

Date of Preliminary Report:

Not Issued

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Accredited for compliance with ISO/IEC 17025 - Testing

Tests not covered by NATA are denoted with *.

Results Approved By:

David Springer
General Manager

Envirolab Reference: 160850-A

Revision No: R 00



Misc Inorg - Soil		
Our Reference:	UNITS	160850-A-3
Your Reference	-----	TP3
	-	
Depth	-----	0-0.1
Date Sampled		25/01/2017
Type of sample		Soil
Date prepared	-	20/02/2017
Date analysed	-	20/02/2017
pH 1:5 soil:water	pH Units	6.4

CEC		
Our Reference:	UNITS	160850-A-3
Your Reference	-----	TP3
	-	
Depth	-----	0-0.1
Date Sampled		25/01/2017
Type of sample		Soil
Date prepared	-	20/02/2017
Date analysed	-	20/02/2017
Exchangeable Ca	meq/100g	9.1
Exchangeable K	meq/100g	0.7
Exchangeable Mg	meq/100g	5.4
Exchangeable Na	meq/100g	0.29
Cation Exchange Capacity	meq/100g	15

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Misc Inorg - Soil						Base II Duplicate II %RPD		
Date prepared	-			20/02/2017	[NT]	[NT]	LCS-1	20/02/2017
Date analysed	-			20/02/2017	[NT]	[NT]	LCS-1	20/02/2017
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-1	102%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
CEC						Base II Duplicate II %RPD		
Date prepared	-			20/02/2017	[NT]	[NT]	LCS-1	20/02/2017
Date analysed	-			20/02/2017	[NT]	[NT]	LCS-1	20/02/2017
Exchangeable Ca	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	100%
Exchangeable K	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	102%
Exchangeable Mg	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	98%
Exchangeable Na	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	105%

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
NR: 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 (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics 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.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Simon Song

From: Ken Nguyen
Sent: Tuesday, 28 February 2017 3:02 PM
To: Simon Longhurst
Cc: Rod Gray; Simon Song
Subject: RE: Results for Registration 160850-A 92207.00, Residential Rezoning

Hi Simon,

Shouldn't be an issue, we'll get that organised.

Regards,
Ken

160850-B
Due 1/2

Regards,

Ken Nguyen | Chemist | Envirolab Services Pty Ltd
(Monday to Friday 1pm to 9pm)

Great Science, Great Service.

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 F 612 9910 6201
E knguyen@envirolab.com.au | W www.envirolab.com.au

Please note that all samples submitted to the Envirolab Group laboratories will be analysed under the Envirolab Group Terms and Conditions. The Terms and Conditions are accessible by clicking this link

From: Simon Longhurst [mailto:Simon.Longhurst@douglaspartners.com.au]
Sent: Tuesday, 28 February 2017 15:00
To: Ken Nguyen
Cc: Rod Gray
Subject: RE: Results for Registration 160850-A 92207.00, Residential Rezoning

Hi Ken,

Could I please get TP1 analysed for CEC and pH on a 1 day turnaround?

Kind regards



12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS

160850-B

Client:

Douglas Partners Pty Ltd Smeaton Grange

18 Waler Crescent

Smeaton Grange

NSW 2567

Attention: Rod Gray / Michael Gol

Sample log in details:

Your Reference:	92207.00, Residential Rezoning
No. of samples:	4 Soils
Date samples received / completed instructions received	25/01/17 / 28/02/17

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:

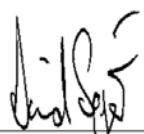
Date results requested by: / Issue Date: 1/03/17 / 1/03/17

Date of Preliminary Report: Not Issued

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Results Approved By:



David Springer
General Manager

Envirolab Reference: 160850-B

Revision No: R 00



Misc Inorg - Soil		
Our Reference:	UNITS	160850-B-1
Your Reference	-----	TP1
	-	
Depth	-----	0-0.1
Date Sampled		25/01/2017
Type of sample		Soil
Date prepared	-	01/03/2017
Date analysed	-	01/03/2017
pH 1:5 soil:water	pH Units	6.0

CEC		
Our Reference:	UNITS	160850-B-1
Your Reference	-----	TP1
	-	
Depth	-----	0-0.1
Date Sampled		25/01/2017
Type of sample		Soil
Date prepared	-	01/03/2017
Date analysed	-	01/03/2017
Exchangeable Ca	meq/100g	15
Exchangeable K	meq/100g	3.8
Exchangeable Mg	meq/100g	7.8
Exchangeable Na	meq/100g	0.20
Cation Exchange Capacity	meq/100g	26

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.

Client Reference: 92207.00, Residential Rezoning

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Misc Inorg - Soil						Base II Duplicate II %RPD		
Date prepared	-			01/03/2017	160850-B-1	01/03/2017 01/03/2017	LCS-1	01/03/2017
Date analysed	-			01/03/2017	160850-B-1	01/03/2017 01/03/2017	LCS-1	01/03/2017
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	160850-B-1	6.0 6.0 RPD: 0	LCS-1	102%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
CEC						Base II Duplicate II %RPD		
Date prepared	-			01/03/2017	[NT]	[NT]	LCS-1	01/03/2017
Date analysed	-			01/03/2017	[NT]	[NT]	LCS-1	01/03/2017
Exchangeable Ca	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	107%
Exchangeable K	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	112%
Exchangeable Mg	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	106%
Exchangeable Na	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	106%

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
NR: 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 (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics 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.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Project Name:	Residential Rezoning		To:	Envirolab Services	
Project No:	92207.00	Sampler:	SJL		
Project Mgr:	RWG	Mob. Phone:	0412 754 162		
Email:	Rod.Gray@douglaspartners.com.au ; Michael.Gol@douglaspartners.com.au		Phone:	(02) 9910 6200	Fax: (02) 9910 6201
Date Required:	Standard		Email:	tnotaras@envirolabservices.com.au	

Sample ID	Lab ID	Date Sampled	Sample Type	Container Type	Analytes									Notes/preservation
			S - soil W - water	G - glass P - plastic	8 Heavy Metals	OCP/OPP PCB	TRH and BTEX	PAH	Total Phenols	Asbestos (500ml)	Asbestos	BTEX		
TP1/0-0.1	1	25.01.17	S	G	X		X	X						
TP2/0-0.1	2	25.01.17	S	G	X	X	X	X	X	X				Combo 6.
TP3/0-0.1	3	25.01.17	S	G	X	X	X	X	X	X				Combo 6.
TP4/0-0.1	4	25.01.17	S	G	X		X	X						
TS/250117		25.01.17	S	G	X		X							
TB/250117		25.01.17	S	G								X		
									</					

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	Address: 18 Waler Crescent Smeaton Grange	Phone: (02) 4647 0075 Fax: (02) 4646 1886
Relinquished by:	SJL	Transported to laboratory by:	
Signed:	Date & Time: 25.01.2017	Received by: <i>ELI P. Ray</i> 25/1/2017	

SAMPLE RECEIPT ADVICE

Client Details	
Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Rod Gray / Michael Gol

Sample Login Details	
Your Reference	92207.00, Residential Rezoning
Envirolab Reference	160850
Date Sample Received	25/01/2017
Date Instructions Received	25/01/2017
Date Results Expected to be Reported	02/02/2017

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	4 Soils
Turnaround Time Requested	Standard
Temperature on receipt (°C)	12.9
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments
Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	Phone: 02 9910 6200
Fax: 02 9910 6201	Fax: 02 9910 6201
Email: ahie@envirolabservices.com.au	Email: jhurst@envirolabservices.com.au

Sample and Testing Details on following page

<i>Sample Id</i>	<i>VTRH(C6- C10)/BTEXN in Soil</i>	<i>svTRH (C10-C40) in Soil</i>	<i>PAHs in Soil</i>	<i>Organochlorine Pesticides in soil</i>	<i>Organophosphorus Pesticides</i>	<i>PCBs in Soil</i>	<i>Acid Extractable metals in soil</i>	<i>Total Phenolics (as Phenol)</i>	<i>Asbestos ID - soils NEPM</i>
TP1-0-0.1	✓	✓	✓				✓		
TP2-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓
TP3-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓
TP4-0-0.1	✓	✓	✓				✓		

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Appendix K

Quality Assurance and Quality Control Assessment

Appendix G

Data Quality Assurance and Quality Control Assessment

G1 Data Quality Indicators

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

Table G1: Data Quality Indicators

DQI	Performance Indicator	Acceptable Range
Precision		
Field considerations Laboratory considerations	SOPs appropriate and complied with	Field staff follow SOPs in the DP <i>Field Procedures Manual</i>
	field replicates	Precision average relative percent difference (RPD) result <5 times PQL, no limit; results >5 times PQL, 0% - 30%
	laboratory duplicates	Precision average RPD result <5 times PQL, no limit; results >5 times PQL, 0% - 50%
	laboratory-prepared volatile trip spikes	Recovery of 60-140%
Accuracy (bias)		
Field considerations Laboratory considerations	SOPs appropriate and complied with	Field staff to follow SOPs in the DP <i>Field Procedures Manual</i>
	Analysis of:	
	laboratory-prepared volatile trip spikes	Recovery of 60-140%
	Laboratory-prepared trip blanks (field blanks)	<PQL
	method blanks (laboratory blanks)	Recovery of 60-140%
	matrix spikes	Recovery of 70-130% (inorganics); 60-140% (organics)
	matrix spike duplicates	Recovery of 70-130% (inorganics); 60-140% (organics); Recovery 70 "low" to 130% "high" indicates interference
	surrogate spikes	Recovery of 70-130% (inorganics); 60-140% (organics)
	laboratory control samples	Recovery of 70-130% (inorganics); 60-140% (organics)
Completeness		
Field considerations	All critical locations sampled	All critical locations sampled in accordance with the DQO's (Section 6.1)
	SOPs appropriate and complied with	Field staff to follow SOPs in the DP <i>Field Procedures Manual</i>
	Experienced sampler	Experienced DP Environmental Engineer to conduct field work and sampling
	Documentation correct	Maintain COC documentation at all times
	Sample holding times complied with	Sample holding times complied with

DQI	Performance Indicator	Acceptable Range
Laboratory considerations	All critical samples analysed according to DQO's	All critical locations analysed in accordance with the DQO's
	Appropriate methods and PQLs	Appropriate methods and PQLs have been used by the contract laboratory
	Sample documentation complete	Maintain COC documentation at all times
Comparability		
Field considerations	Same SOPs used on each occasion	Field staff to follow SOPs in the DP <i>Field Procedures Manual</i>
	Experienced sampler	Experienced DP Environmental Scientist/Engineer to conduct field work and sampling
	Same types of samples collected	Same types of samples collected
Laboratory considerations	Sample analytical methods used (including clean-up)	Methods to be NATA accredited
	Sample PQLs (justify/quantify if different)	Consistent PQLs to be used
	Same laboratories (justify/quantify if different)	Same analytical laboratory for primary samples to be used
Representativeness		
Field considerations	Appropriate media sampled according to DQO's (Section 6.1)	Appropriate media sampled according to DQO's (Section 6.1)
	All media identified in SAQP sampled	All media identified in SAQP sampled
Laboratory considerations	All samples analysed according to DQO's	All samples analysed according to DQO's

Notes to Table 1:

SOP – Standard Operating Procedure

DQO – Data Quality Objectives (Section 6.1)

G2 Field Quality Assurance and Quality Control

The field QC procedures for sampling as prescribed in the standard operating procedures (SOPs) in the Douglas Partners *Field Procedures Manual* were followed at all times during the assessment. All sample locations and media were in accordance with the DQO (i.e. as per scope of work in DP's proposal).

G2.1 Sampling Team

Sampling was undertaken by an experienced DP Environmental Engineer.

G2.2 Sample Collection and Weather Conditions

Sample collection procedures and dispatch are reported in body of the report. Sampling was undertaken during sunny and mild conditions.

G2.3 Logs

Logs for each soil sampling location were recorded in the field. The individual samples were recorded on the field logs along with the sample identity, location, depth, initials of sampler, duplicate locations, duplicate type and site observations. Logs are presented in Appendix G.

G2.4 Chain – of - Custody

Chain - of - custody information was recorded on the Chain - of - Custody (COC) sheets and accompanied samples to the analytical laboratory. Signed copies of COCs are presented in Appendix J, prior to the laboratory certificates.

G2.6 Duplicate Frequency

Field sampling comprised intra-laboratory duplicate sampling, at a rate of approximately one duplicate sample for every ten primary samples. As only four samples were collected, duplicate sampling was not considered necessary.

G3 Laboratory Quality Assurance and Quality Control

Envirolab Services was used as the primary laboratory. Appropriate methods and PQLs were used by the laboratory. Sample methods were NATA accredited (noting the exception for fibrous asbestos (FA) and asbestos fines (AF) quantification to 0.001% w/w).

G3.1 Surrogate Spike

This sample is prepared by adding a known amount of surrogate, which behaves similarly to the analyte, prior to analysis to each sample. The recovery result indicates the proportion of the known concentration of the surrogate that is detected during analysis and is used to assess data 'accuracy'. Results within acceptance limits indicate that the extraction technique was effective.

G3.2 Reference and Daily Check Sample Results – Laboratory Control Sample (LCS)

This sample comprises spiking either a standard reference material or a control matrix (such as a blank of sand or water) with a known concentration of specific analytes. The LCS is then analysed and results compared against each other to determine how the laboratory has performed with regard to sample preparation and analytical procedure and is used to assess data 'accuracy'. LCSs are analysed at a frequency of one in 20, with a minimum of one analysed per batch.

G3.3 Laboratory Duplicate Results

These are additional portions of a sample which are analysed in exactly the same manner as all other samples and is used to assess data 'precision'. The laboratory acceptance criteria for duplicate samples is: in cases where the level is $<5 \times \text{PQL}$ - any RPD is acceptable; and in cases where the level is $>5 \times \text{PQL}$ - 0-50 % RPD is acceptable.

G3.4 Laboratory Blank Results

The laboratory blank, sometimes referred to as the method blank or reagent blank is the sample prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus and is used to assess data 'accuracy'. This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, it can be determined by processing solvents and reagents in exactly the same manner as for samples. Laboratory blanks are analysed at a frequency of 1 in 20, with a minimum of one per batch.

G3.5 Matrix Spike

This is a sample duplicate prepared by adding a known amount of analyte prior to analysis, and then treated exactly the same as all other samples. The recovery result indicates the proportion of the known concentration of the analyte that is detected during analysis and is used to assess data 'accuracy'. The laboratory acceptance criteria for matrix spike samples is generally 70 – 130 % for inorganic / metals; and 60 – 140 % for organics; and 10 – 140 % for SVOC and speciated phenols.

G3.6 Results of Laboratory QC

The laboratory QC for surrogate spikes, LCS, laboratory duplicate results, laboratory blanks and matrix spikes results are reported in the laboratory certificate of analysis.

The laboratory quality control samples were within the laboratory acceptance criteria. It is considered that an acceptable level of laboratory precision and accuracy was achieved and that surrogate spikes, LCS, laboratory duplicate results, laboratory blanks and matrix spike results were of an acceptable level overall. On the basis of this assessment, the laboratory data set is considered to have complied with the DQIs.

G3.7 Overall Assessment of QA / QC

Specific limits associated with sample handling and laboratory QA / QC were assessed against the DQIs and a summary of compliance is presented in the following table.

Table G5: Data Quality Indicators

DQI	Performance Indicator	Acceptable Range	Compliance
Precision			
Field considerations Laboratory considerations	SOPs appropriate and complied with	Field staff follow SOPs in the DP <i>Field Procedures Manual</i>	C
	field replicates	Precision average relative percent difference (RPD) result <5 times PQL, no limit; results >5 times PQL, 0% - 30%	NA
	laboratory duplicates	Precision average RPD result <5 times PQL, no limit; results >5 times PQL, 0% - 50%	C
	laboratory-prepared volatile trip spikes	Recovery of 60-140%	NA
Accuracy (bias)			
Field considerations Laboratory considerations	SOPs appropriate and complied with	Field staff to follow SOPs in the DP <i>Field Procedures Manual</i>	C
	Analysis of:		
	laboratory-prepared volatile trip spikes	Recovery of 60-140%	NA
	laboratory-prepared trip blanks (field blanks)	<PQL	NA
	method blanks (laboratory blanks)	Recovery of 60-140%	C
	matrix spikes	Recovery of 70-130% (inorganics); 60-140% (organics)	C
	matrix spike duplicates	Recovery of 70-130% (inorganics); 60-140% (organics); Recovery 70 "low" to 130% "high" indicates interference	C
	surrogate spikes	Recovery of 70-130% (inorganics); 60-140% (organics)	C
	laboratory control samples	Recovery of 70-130% (inorganics); 60-140% (organics)	C
Completeness			
Field considerations	All critical locations sampled	All critical locations sampled in accordance with the SAQP	C
	SOPs appropriate and complied with	Field staff to follow SOPs in the DP <i>Field Procedures Manual</i>	C
	Experienced sampler	Experienced DP Environmental Scientist/Engineer to conduct field work and sampling	C
	Documentation correct	Maintain COC documentation at all times	C
	Sample holding times complied with	Sample holding times complied with	C

DQI	Performance Indicator	Acceptable Range	Compliance
Laboratory considerations	All critical samples analysed according to SAQP	All critical locations analysed in accordance with the SAQP	C
	Appropriate methods and PQLs	Appropriate methods and PQLs have been used by the contract laboratory	C
	Sample documentation complete	Maintain COC documentation at all times	C

Comparability			
Field considerations	Same SOPs used on each occasion	Field staff to follow SOPs in the DP <i>Field Procedures Manual</i>	C
	Experienced sampler	Experienced DP Environmental Scientist/Engineer to conduct field work and sampling	C
	Same types of samples collected (filtered)	Field filtering for metals	NA
Laboratory considerations	Sample analytical methods used (including clean-up)	Methods to be NATA accredited	C
	Sample PQLs (justify/quantify if different)	Consistent PQLs to be used	C
	Same laboratories (justify/quantify if different)	Same analytical laboratory for primary samples to be used	C
Representativeness			
Field considerations	Appropriate media sampled according to DQOs	Appropriate media sampled according to DQOs	C
	All media identified in DQOs sampled	All media identified in DQOs sampled	C
Laboratory considerations	All samples analysed according to DQOs	All samples analysed according to DQOs	C

Notes to Table 5:

- C – Compliance
- PC – Partial Compliance
- NC – Non-Compliance
- NA – Not Applicable
- SOP – Standard Operating Procedure
- DQO – Data Quality Objectives

A review of the adopted QA / QC procedures and results indicates that the DQIs have generally been met with compliance and a minor partial-compliance. On this basis, the sampling and laboratory methods used during the investigation were found to meet DQOs for this project.