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Logan Greyhound Facility



CONTAMINATED SITE INVESTIGATION

- Final
- June 2010





Logan Greyhound Facility Cronulla Park

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1. Introduction

Greyhounds Queensland Limited (GQL) is planning the development of the Logan Greyhound Facility ("the Project") at Cronulla Park, Slacks Creek ("the site"). Cronulla Park was formerly used a landfill ("the Landfill") between the 1970s and 1980s. A plan showing the location of the site is provided in **Figure 1, Appendix A**.

The proposed development includes:

- main facilities building with an open air viewing stand;
- kennel block;
- maintenance shed;
- greyhound racing track;
- car park with 70 spaces;
- trailer park for trainers with 50 spaces; and
- internal access roads with connections to Kingston Road and Compton Road.

Plans of the proposed development are provided in **Appendix B**.

GQL has engaged Sinclair Knight Merz (SKM) to undertake a Contaminated Site Investigation ("the Investigation") of the site. The aims of the Investigation were to establish:

- whether the site in its current condition poses an unacceptable risk to human health and/or the receiving environment; and
- whether remediation will be required to enable the site to be used for a commercial land use (greyhound racing facility), and if so, the required remedial measures.

The primary objectives of the Investigation were:

- to investigate the quality of groundwater entering and exiting the site, and whether the groundwater exiting the site poses an unacceptable risk to the receiving environment;
- to investigate the presence of groundwater underlying the site, and whether the site is likely to pose an unacceptable risk to this aquifer;
- to investigate the risk to human health from the material used in the capping of the site, and the permeability of this material;
- to investigate the concentration of landfill gas in shallow ground deposits on the periphery of the Landfill; and
- to investigate the risk to human health from shallow ground conditions (<0.3 m below ground level or bgl).

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This report provides a summary of the findings of the Investigation and should be read in conjunction with the limitations described in **Appendix I**.

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2. Background Information

2.1. Site Description

The site comprises 10.24 hectares of Crown Land located at the corner of Compton Road and Kingston Road, Slacks Creek, Queensland. The land is described as Lot 658 on Plan SL12298. Current title records show that the site is held in trust by Logan City Council (LCC), as gazetted on the 25 June 1988. The designated purpose of the site is local government (entertainment and recreation). A copy of the current certificate of title and registered plan is provided in **Appendix H**.

2.2. Surrounding Land Uses

Light industrial and commercial properties are located on the northern, eastern, and southern boundaries of the site. Kingston Road bounds the western portion of the site, and light industrial and commercial properties are located to the west of Kingston Road.

Land uses within the vicinity of the site with the potential to cause contamination include the following:

- Up-gradient:
 - service station across Kingston Road
 - two car service centres across Kingston Road
 - two car yards and a car rental agency across Kingston Road¹
- Cross-gradient:
 - smash repairs adjacent to the northern boundary
 - two car body repairs workshops adjacent to the southern boundary
 - air conditioning repairs workshop adjacent to the southern boundary
- Down-gradient:
 - exhaust repair workshop
 - panel beater workshop
 - suspension workshop
 - commercial bakery and truck parking facility
 - radiator repair workshop.

¹ These land uses have the potential for petroleum product storage.



2.3. Environmental Management Register

The site is listed on the Environmental Management Register (EMR) for the notifiable activity "Landfill". The Queensland Department of Environment and Resource Management (DERM) has advised that the site is not managed under a Site Management Plan (SMP).

The site is not listed on the Contaminated Land Register (CLR).

A copy of the EMR search result is provided in **Appendix H**.

2.4. Topography and Drainage

The site and surrounding land slopes in an easterly direction towards Slacks Creek. Surface water discharges to Slacks Creek which is located approximately 320 m east of the site.

The topography and overland flow drainage of the site is shown in **Figure 3, Appendix A**.

The highest point of the site is approximately 34.5 m Australian Height Datum (AHD) close to Kingston Road and falls to approximately 22.2 m AHD close to the north east corner industrial lots. The average gradients on the site are relatively flat ranging from 0.8 % to 2.0 %. The main form of drainage is a combination of overland sheet flows and open channel flows. The north east corner is steeper than the majority of the site with grades up to a maximum of 12.5 % towards the east.

Several low bunds have been placed across the predominant gradient of the site (in a north-south configuration) which intercept and divert the overland flow towards the north and south into existing open channel drains.

An open channel drain to the south and east separates the site from the adjoining industrial lots. The open channel drain conveys surface runoff from Kingston Road, cross-catchment flows from across Kingston Road, and from several culverts from the south. The open channel eventually discharges into a large open chamber with its invert level (base) well below the level of the open channel base of 20.4 m AHD.

The north eastern portion of the site falls to the north and north east into an earth drain alongside Compton Road and into existing stormwater gully pits along Cronulla Court.

Water quality in Slacks Creek is not monitored by LCC or DERM. The Healthy Waterways initiative of the Queensland Government provides a long-term data set for Logan River (Slacks Creek is a tributary of the Logan River) (South-east Queensland Healthy Waterways Partnership 2007). The overall Waterway Report Card indicates that Logan Catchment is generally in a poor condition. Both nutrient cycling and physico-chemical indicators suggest that there is some level of degradation to the ecosystem, and has resulted in a rating of "D" (South-east Queensland Healthy



Waterways Partnership 2009). This rating has been relatively consistent since monitoring of the Catchment began in 1999, and has been based on high nutrient loading in the Catchment. High nutrient loads have historically been attributed to a range of factors such as urban (residential, commercial, and industrial) and rural land uses, and discharges from sewage treatment plants.

2.5. Regional Geology

The regional geology of the site is described in the Beenleigh area (1:100,000 series) as: alluvium soils, mainly clay, silt and gravel overlaying shale, siltstone and sandstone (with possible coal seams). The regional geology is part of the tertiary Oxley Group, a subset of the early tertiary continental basins of the area (Moreton Regional Geology Map 1980) (CMPS&F Environmental, May 1995. *Preliminary Site Investigation and Management Plan for The Former Compton Road Landfill Site* ("the CMPS&F Report")).

The geology encountered on the site during the investigation is described in **Section 6.1**. A cross-section showing the conceptual geology on the site is provided in **Figure 5, Appendix A**.

2.6. Regional Hydrogeology

A review of the Groundwater Resources Map of Queensland (1987) indicates that regional groundwater yield is hosted in sedimentary strata and is expected to be less than 5 L/sec. The total dissolved solids (TDS) in groundwater is generally within the range of 500-1500 mg/L, and is suitable for domestic applications (e.g. potable water, recreation, irrigation) and stock watering. Further information on groundwater encountered in sedimentary on the site is provided in **Section 6.2**.

Based on topography groundwater flow direction across the site is expected to be northeast towards Slacks Creek.

A search of the DERM groundwater bore records indicates that there are no registered operational bores (groundwater users) in the vicinity of the site. The closest operational registered bore is approximately 0.7 km north of the site (registration number – 134259). This bore is sub-artesian and although registered as a potable water source, notes on the bore card indicate that it supplies water for garden irrigation only. The screened interval of this bore is between 8 m bgl and 30 m bgl.

2.7. Historical Land Use

The CMPS&F Report states that the site was used as a municipal landfill from the 1970s to 1983. This is consistent with historical aerial photography which shows the site in use as a landfill during this time period. Further information regarding the operation and closure of the Landfill is provided in **Section 2.8**.

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Following closure of the Landfill, the site has been used for open space recreational purposes by the general public, such as bike riding, and dog walking. The current configuration of the site does not provide park facilities such as seating, cooking, and playgrounds which would encourage frequent use of the site from families and small children.

Prior to the use of the site as a landfill in the 1970s, the site was vegetated and undeveloped. Further information on the history of the site based on a review of the historical aerial photography is provided in **Table 2-1**. A copy of the historical aerial photographs reviewed is provided in **Appendix H**.

■ **Table 2-1 Historical Aerial Photography**

Year	Site Description
1955	The site is covered in trees and other vegetative cover. A small valley can be seen running to the east toward Slacks Creek. This is presumed to be the tributary aforementioned.
1968	The site is predominantly covered in trees. A dirt track runs west to east across the site, and there is a small clearing present in the middle.
1973	Distinct zones of activity (areas of disturbed land) can be seen across the site, however the nature of activity (e.g. type of waste material being disposed) within each zone cannot be determined. These zones generally align with the known differing disposal areas. There are several buildings visible in the south western corner of the site, consistent with the area used for washdown. There is a heavily vegetated strip to the south and west of the site.
1983	The site is bare soil, with few areas of what appears to be weed and grass growth. A small area of concrete or roofing is present in the south western corner, consistent with the area used for washdown. Tree cover to the south and west of the site has thinned. The date of this photo coincides with the closure of the facility.
1993	The site is grassed, and several dirt access roads pass across the property. No buildings are visible on-site. No vegetative cover exists along the southern border of the site.
1997	The entire surface of the site has been cleared and appears to have been re-capped.
2002	As per the 1993 aerial photography. The general location of access roads has changed across the site.

2.8. Landfill Operation and Closure

The following provides a summary of the operation and closure of the Landfill, and is based on the CMPS&F Report.

2.8.1. Landfill Operation

A tributary of Slacks Creek historically ran through site. Prior to the commencement of the construction of the Landfill, the tributary was diverted around the site in an open drain located on



the southern and eastern boundary of the site. The location of the former tributary is shown as Area 7 in **Figure 4, Appendix A**.

The Landfill was operated by Albert Shire Council (now LCC), and JJ Richards & Sons Pty Ltd. The Landfill was formed using a method which involved the excavation of trenches, and then the placement and compaction of wastes within each trench. The quantity of waste received at the site is not known. The maximum depth of waste was said to be 4 m in the CMPS&F Report. The Investigation however found the depth of waste to be up to approximately 10 m bgl, and waste has been placed directly over natural ground strata including weathered sandstone, and sandstone (refer to **Section 6.1**).

Based on the CMPS&F Report it is understood that the construction of the Landfill did not include the installation of a liner, or leachate and landfill gas collection system. This was confirmed during the undertaking of the Investigation.

Waste Acceptance

Based on the CMPS&F Report, wastes which were accepted at the Landfill included:

- domestic waste;
- commercial and light industrial solid waste;
- sanitary solid waste; and
- construction and demolition waste.

The Landfill may have also received asbestos, and hazardous domestic wastes (e.g. paints and pesticides). The Landfill received approximately 2,000 to 3,000 animal carcasses including dogs, cats, cows and horses; these were placed in Area 3 and Area 4 (refer to **Figure 4, Appendix A**).

Wastes which were not accepted at the Landfill included:

- heavy industrial waste;
- hazardous solid waste;
- medical waste; and
- liquid waste (hazardous and non-hazardous).

Landfill Layout

The layout of the Landfill can be divided into 10 areas based on the type of waste received, and when the areas was utilised. These areas are shown in **Figure 4, Appendix A**, and are summarised in **Table 2-2**.

■ **Table 2-2 Landfill Layout**

Area No.	Wastes Received	Comments
1	Domestic refuse	Wastes were placed in north-south aligned trenches
2	Domestic refuse	Wastes were placed in east-west aligned trenches
3	Sanitary waste and animal remains	Wastes were placed in east-west aligned trenches
4	Sanitary waste and animal remains	Wastes were placed in small trenches located between existing trees
5	Steel and tyres	None
6	None	None
7	Domestic refuse and light industrial	Historical creek alignment which was filled with wastes
8	None	Workshop and washdown area
9	General waste	None
10	None	None

Other Infrastructure

Infrastructure located at the site which was decommissioned following closure of the Landfill included a sewerage line and sewage holding tank, site buildings, hardstanding, and the washdown area.

2.8.2. Landfill Closure

The Landfill was capped using a clay based soil. After the closure of the Landfill in 1983, Albert Shire Council used the site for the stockpiling of soil and concrete demolition wastes. These wastes were subsequently removed.

In 1991 a new sewerage line was installed at the northern boundary of the site. The installation of the sewer line required trenches to be cut into the northern and southern embankments of the Landfill. It was stated in the CMPS&F Report that geofabric was laid over the trenches to contain exposed waste and act as a drainage medium for leachate collection into the sewerage line.

The CMPS&F Report made a number of recommendations for the retrofitting of the Landfill post closure. **Table 2-3** provides a summary of these measures, and whether they were implemented based on discussions with LCC (B. Lee, 2009), and site observations.

■ **Table 2-3 CMPS&F Recommended Landfill Retrofit Measures**

CMPS&F Recommendation	Implementation
1. Install a landfill gas venting system	LCC has installed four landfill gas vents. LCC however does not have records on how and when the vents were installed. A review of the aerial photography suggests that they may have been installed between 1997 and 2003.



CMPS&F Recommendation	Implementation
2. Install a leachate collection system to collect leachate seeping from embankments	The CMPS&F Report states that sewer lines installed on the northern boundary of the site included a mechanism to enable the collection of leachate in the line. It is not known whether the system installed is effective; however, seepage from the eastern embankment of the landfill was observed during the investigation.
3. Install a surface water drainage system to direct rainfall runoff off the surface layer	LCC has installed diversion drains over the surface to assist with the shedding of rainfall runoff off the surface layer. Additional surface material is said to have been placed over the Landfill in 1998 ² however LCC has no records to confirm whether this occurred.
4. Remove the stockpiled soil and concrete demolition waste	LCC has removed the stockpiled material.
5. Remove the remaining landfill infrastructure including hardstanding and a building	LCC has removed the remaining infrastructure.
6. Place additional surface material over the eastern and northern embankment to cover over exposed waste, and vegetate embankments	LCC has placed additional surface material over a majority of the embankments; exposed waste is no longer visible. The embankments have been revegetated.
7. Remove the underground fuel tank located in Area 3	LCC has advised that the tank has been removed, however no record of its removal is available. The need to verify the removal of the tank is discussed in Section 9.

2.9. Historical Analytical Data

This section provides a summary of the soil, groundwater and landfill gas data for the site. This includes data collected by CMPS&F in 1995, and data collected by LCC from July 2000 to August 2008.

2.9.1. Soil Data

Six samples of the Landfill surface material were collected by CMPS&F in 1995. The location of the soil samples is shown in **Figure 2, Appendix A**.

The samples were analysed for metals, asbestos, and organochlorine pesticides. All samples had metal analytes with concentrations which were below the health-based NEPM³ HIL-F guidelines for a commercial/industrial land use (refer to **Section 4.3.1**). Asbestos and organochlorine pesticides were not detected in any soil samples analysed.

² CPR Group. 2004. Regional Trail Bike Site Survey Site Assessment, Cronulla Park, Kingston Road and Compton Road, Slacks Creek

³ the National Environment Protection (Assessment of Site Contamination) Measure 1999 ("the NEPM")



2.9.2. Groundwater Data

LCC has monitored groundwater quality from three monitoring wells (CR13, CR14 and CR15, "the LCC Wells") since July 2000. The location of the LCC wells is shown in **Figure 2, Appendix A**. LCC has advised that records of how the wells were installed are not available. The depths of these wells are approximately 4.4, 8.4, and 5.0 m bgl respectively. Based on the location of the wells either on the other side of the drainage channel or within the vegetated area to the west of the site, it is considered likely that the monitoring wells targeted groundwater in the weathered sandstone.

Data has been compared to a combination of the following guidelines:

- Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000, Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters ("ANZECC Guideline").
- The Netherlands Ministry of Housing, Spatial Planning and Environment's *Circular on target values and intervention values for soil remediation* (2000) ("the Dutch Guidelines") which consider both the risk to human health and the environment;
- The National Health and Medical Research Council (2004) *Australian Drinking Water Guidelines* ("the Australian Drinking Water Guidelines"); and
- United States Environmental Protection Agency (2009) *Region 9 Preliminary Remediation Goals* ("the USEPA guidelines").

A full description of the Human Health Assessment Criteria and Environmental Assessment Criteria adopted in this investigation has been included in **Sections 4.3.1** and **4.3.2** respectively.

The following provides a summary of the analytical data for the LCC wells, and a comparison of these with the Human Health Assessment Criteria and Environmental Assessment Criteria. A full tabulation of the analytical results is provided in **Appendix D.2.1**.



Monitoring Well CR13

Monitoring well CR13 is located down gradient and east of the Landfill. Table 2-4 provides a summary of the groundwater monitoring results for CR13. The analytes copper, lead, zinc, ammonia, total phosphorus, and TPH exceeded the Environmental Assessment Criteria in some of the samples analysed. Ammonia exceeded the Human Health Assessment Criteria in all of the samples analysed. TPH exceeded the Human Health Assessment Criteria in some of the samples analysed.

■ Table 2-4 CR13 Groundwater Results 2000 to 2008

Analyte	No. of Samples	Minimum Value	Maximum Value	Quartile Range	Average ± Standard Deviation	Environmental Assessment Criteria	No. of Samples Exceeding Environmental Assessment Criteria	Human Health Assessment Criteria	No. of Samples Exceeding Human Health Assessment Criteria
Inorganics (mg/L)									
pH (pH units)	30	4.82	6.21	5.48 - 5.6	5.47 ± 0.27	6.5-8.0			
Aluminium	1	0.05	0.05	0.05 - 0.05	n/a ± n/a				
Iron	30	<0.01	8.3	1.42 - 3	1.84 ± 1.86				
Copper	6	<0.001	0.012	0.001 - 0.008	0.004 ± 0.005	0.0025	1	1	
Manganese	30	0.03	0.08	0.04 - 0.05	0.05 ± 0.01	3.6		0.5	
Nickel	6	0.003	0.006	0.005 - 0.006	0.005 ± 0.001	0.017		0.1	
Lead	6	<0.001	0.03	0.001 - 0.002	0.006 ± 0.012	0.0094	1	0.05	
Zinc	30	<0.003	0.069	0.01 - 0.015	0.014 ± 0.013	0.031	2	5	
Ammonia	30	6.5	39.3	13 - 15.7	13.8 ± 6.3	2.3	30	0.5	30
Nitrate	30	<0.002	1.9	0.02 - 0.095	0.181 ± 0.418	17		10000	
Phosphate	17	<0.1	<0.1	n/a	n/a				
Total Phosphorus	6	0.03	1.21	0.4 - 0.7	0.48 ± 0.46	0.05	5		
Organics (µg/L)									
TPH (C6-C9)	6	<50	<20		n/a				
TPH (C10-C14)	6	<50	293		131 ± 95				
TPH (C15-C28)	6	<100	1230		437 ± 435				
TPH (C29-C36)	6	<50	265		97 ± 85				
TPH (C10-C36)	6	<220	1788		663 ± 609	600	3	600	3

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.



Monitoring Well CR14

Monitoring well CR14 is located in the south western corner (up-gradient) of the Landfill. Table 2-5 provides a summary of the groundwater monitoring results for CR14. The analytes copper, nickel, lead, zinc, and total phosphorus exceeded the Environmental Assessment Criteria in some of the samples analysed.

■ Table 2-5 CR14 Groundwater Results 2000 to 2008

Analyte	No. of Samples	Minimum Value	Maximum Value	Quartile Range	Average $\pm$ Standard Deviation	Environmental Assessment Criteria	No. of Samples Exceeding Environmental Assessment Criteria	Human Health Assessment Criteria	No. of Samples Exceeding Human Health Assessment Criteria
Inorganics (mg/L)									
pH (pH units)	28	3.35	6.86	4.44 - 4.73	4.54 $\pm$ 0.65	6.5-8.0			
Aluminium	1	0.08	0.08	0.08 - 0.08	n/a $\pm$ n/a				
Iron	28	<0.002	41	0.071 - 0.133	1.59 $\pm$ 7.726				
Copper	6	0.003	0.089	0.008 - 0.015	0.021 $\pm$ 0.034	0.0025	6	1	
Manganese	28	<0.003	0.21	0.026 - 0.031	0.034 $\pm$ 0.036	3.6		0.5	
Nickel	6	0.002	0.027	0.003 - 0.004	0.007 $\pm$ 0.01	0.017	1	0.1	
Lead	6	<0.001	0.017	0.001 - 0.001	0.004 $\pm$ 0.007	0.0094	1	0.05	
Zinc	28	<0.003	0.031	0.011 - 0.019	0.013 $\pm$ 0.007	0.031	1	5	
Ammonia	28	<0.01	0.12	0.1 - 0.1	0.07 $\pm$ 0.04	2.3		0.5	
Nitrate	28	<0.004	0.06	0.02 - 0.033	0.029 $\pm$ 0.024	17		10000	
Phosphate	15	<0.1	<0.1	n/a	n/a				
Total Phosphorus	6	0.28	1.02	0.6 - 0.83	0.62 $\pm$ 0.29	0.05	6		
Organics (μg/L)									
TPH (C6-C9)	6	<20	<50		n/a				
TPH (C10-C14)	6		<50		n/a				
TPH (C15-C28)	6		105		101 $\pm$ 2				
TPH (C29-C36)	6	<20	55		46 $\pm$ 13				
TPH (C10-C36)	6	<160	160		210 $\pm$ 24	600		600	

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.



Monitoring Well CR15

Monitoring well CR15 is located along the southern boundary of the Landfill. **Table 2-6** provides a summary of the groundwater monitoring results for CR15. Total phosphorus exceeded the Environmental Assessment Criteria in some of the samples analysed. Ammonia exceeded the Human Health Assessment Criteria in the majority of the samples analysed.

■ **Table 2-6 CR15 Groundwater Results 2000 – 2008**

Analyte	No. of Samples	Minimum Value	Maximum Value	Quartile Range	Average ± Standard Deviation	Environmental Assessment Criteria	No. of Samples Exceeding Environmental Assessment Criteria	Human Health Assessment Criteria	No. of Samples Exceeding Human Health Assessment Criteria
Inorganics (mg/L)									
pH (pH units)	28	5.31	6.77	5.92 - 6.13	5.97 ± 0.36	6.5-8.0			
Aluminium	1	0.2	0.2	0.2 - 0.2	n/a ± n/a				
Iron	28	<0.02	78	9.3 - 14	10.99 ± 14.55				
Copper	4	<0.001	0.001	0.001 - 0.003	n/a ± n/a	0.0025		1	
Manganese	28	0.022	0.08	0.039 - 0.045	0.039 ± 0.011	3.6		0.5	
Nickel	4	<0.001	0.009	0.002 - 0.004	n/a ± n/a	0.017		0.1	
Lead	4	<0.001	0.002	0.001 - 0.001	n/a ± n/a	0.0094		0.05	
Zinc	28	<0.001	0.025	0.007 - 0.01	0.007 ± 0.005	0.031		5	
Ammonia	28	0.06	0.8	0.6 - 0.7	0.58 ± 0.16	2.3		0.5	23
Nitrate	28	<0.01	0.16	0.02 - 0.03	0.03 ± 0.03	17		10000	
Total Phosphorus	4	<0.01	0.7	0.13 - 0.31	n/a ± n/a	0.05	3		
Organics (µg/L)									
TPH (C6-C9)	4	<20	<20		n/a				
TPH (C10-C14)	4		89		n/a ± n/a				
TPH (C15-C28)	4		165		n/a ± n/a				
TPH (C29-C36)	4		99		n/a ± n/a				
TPH (C10-C36)	4	<55	353		n/a ± n/a	600		600	

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

Summary of Groundwater Data

pH

Although there was some variation in pH between July 2000 and August 2008 (particularly in CR14), the overall change in pH has been small in all three wells (-0.08 in CR13, -0.3 in CR14 and +0.34 in CR15). All wells consistently reported pH levels which were mildly acidic and below the Environmental Assessment Criteria range of 6.5 to 8.0.



Metals

The concentration of zinc exceeded the Environmental Assessment Criteria of 0.008 mg/L in samples from all three groundwater monitoring wells. There are generally no trends in zinc concentration over time.

Copper exceeded the Environmental Assessment Criteria in all samples from CR14. The concentration of copper in samples from CR13 and CR15 were generally below the LOR and/or the Environmental Assessment Criteria.

In general no other metals analytes regularly exceeded the Environmental Assessment Criteria.

Ammonia

Ammonia concentrations were reported above the Environmental Assessment Criteria of 2.3 mg/L in CR13 (down-gradient of the Landfill). The concentrations of ammonia in CR13 were consistently higher than the samples from CR14 and CR15. The monitoring data indicates that the concentration of ammonia in CR13 has decreased over time, from 39.9 mg/L in October 2000 to 12 mg/L in August 2008.

Ammonia concentrations exceeded the Human Health Assessment Criteria (0.01 mg/L) in all of the samples from CR13 and CR15, and approximately half the samples in CR14.

Nitrate

Nitrate concentrations were below the Environmental Assessment Criteria in all samples from CR13, CR14, and CR15. Although variable over time, higher concentrations of nitrate have generally been found in the samples from CR13 in comparison to the groundwater samples from monitoring wells CR14 and CR15.

Total Phosphorus and Phosphate

The majority of samples analysed from CR13, CR14, and CR15 had concentrations of total phosphorus which exceeded the Environmental Assessment Criteria in monitoring events in 2002. Total phosphorus has not been monitored since 2002. Phosphate was included in the monitoring program from 2004-2008 and was found to be below laboratory detection limits in all monitoring wells.

Total Petroleum Hydrocarbons (TPH)

TPH was included in the monitoring program from July 2000 to January 2002. During this time period TPH was reported in the samples from CR13 at concentrations which exceeded the Environmental Assessment Criteria (600 µg/L). TPH was detected in some of the samples from CR14 and CR15 with concentrations which were below the Environmental Assessment Criteria.



Additional testing to confirm the nature or species of the hydrocarbons was not undertaken as part of the LCC monitoring program. However it should be noted that through the investigation undertaken in 2009, the TPH measured may be comprised of non-polar based organic substances present in landfill leachate which were being generated through the decomposition of putrescible waste materials rather than petroleum products, for reasons outlined in **Section 7.2.3**.

2.9.3. Groundwater Levels

Groundwater levels were monitored in 2003 and 2004. Based on this data the inferred groundwater flow direction is to the north east towards Slacks Creek.

2.9.4. Landfill Gas Data

A landfill gas assessment was undertaken by CMPS&F in 1995. The investigation included the sampling and analysis of landfill gas from the monitoring wells G1, G2, G3, G5, G6, G7 and GW3. The CMPS&F Report indicates that these wells were constructed to allow gas monitoring, and included measures such as appropriately screened intervals and specialised free-venting well caps. The gas assessment detected elevated concentrations of methane from monitoring wells within the Landfill with concentrations which exceeded the lower explosive limit (LEL) for methane (5%⁴). However the concentrations of methane in the monitoring wells located around the boundary of the Landfill were below the LEL.

LCC has monitored landfill gas concentrations from monitoring wells located around the boundary of the site since July 2000. The monitoring wells which have been monitored include GW1, G2, G3, CR13, CR14 and CR15. The location of the monitoring wells is show in **Figure 2, Appendix A**. Since monitoring commenced in July 2000, the concentrations of methane in all boundary monitoring wells have been found to be less than the LEL.

The monitoring data is summarised in **Appendix D.3.1**.

⁴ ERA 75 – Waste Disposal, Landfill Siting, Design, Operation and Rehabilitation.

3. Conceptual Site Model

3.1. Contaminants of Concern

Based on the site history described in **Section 2.8** and previous investigations of the site (refer to **Section 2.9**), potential contaminants of concern include the following:

- A broad range of metals (including arsenic, cadmium, chromium, nickel, lead, and zinc) associated with a range of materials potentially disposed at the site.
- Ammonia and other landfill leachate products formed during the decomposition of organic materials (e.g. fatty acids).
- Organochlorine/organophosphate pesticides (OCP/OPP) discarded as agricultural wastes.
- Volatile or semi-volatile organic compounds (VOCs/SVOCs), including polycyclic aromatic hydrocarbons (PAHs), associated with the disposal of lubricants, paints, oils and fumigants; and the burning of various wastes.
- Total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylenes (BTEX compounds) associated with the disposal of fuels, lubricants and oils.
- Polychlorinated biphenyls (PCBs) associated with transformers, refrigerants and fluorescent lighting.
- Asbestos containing materials (ACM) such as fibrous sheeting.

3.2. Potential Pathways

Potential pathways for which contamination may cause a risk to specific receptors include:

- Human health:
 - inhalation of soil through dust;
 - ingestion of soil through handling;
 - dermal absorption from soils through handling; and
 - inhalation of vapours and landfill gases.
- Environmental:
 - migration of potential contaminants in surface water runoff; and
 - migration of potential contaminants in groundwater.

3.3. Receptors

The current potential on and off-site receptors include:



- On-site:
 - members of the public; and
 - future users of the site (including construction workers, staff, and patrons).
- Off-site:
 - down gradient properties;
 - groundwater which is expected to provide to provide a base flow to Slacks Creek; and
 - surface water (Slacks Creek).

Slacks Creek is a highly disturbed system which has been heavily modified from its natural state. Slacks Creek is not a recreational water body or used as a source of potable water.

Groundwater within the region is generally not used as a potable resource. The closest operational registered bore is approximately 0.7 km to the north of the site. This bore is sub-artesian and although registered as a potable water source, notes on the bore card indicate that it supplies water for garden irrigation only.

3.4. Potential Pollutant Linkages

Table 3-1 provides a summary of the potential source-pathway-receptor (pollutant) linkages with respect to human health.

■ **Table 3-1 Potential Pollutant Linkages With Respect to Human Health**

Source	Pathways	Receptors
Potential contaminants in soil, landfill leachate	Ingestion of soil through handling	1) Members of the public accessing the site
	Dermal absorption through skin through handling	2) Future site workers
	Inhalation of airborne dust and vapours, and build up landfill gases in confined spaces	3) Users of down gradient Properties

Table 3-2 provides a summary of the potential source-pathway-receptor (pollutant) linkages with respect to the environment.



■ Table 3-2 Potential Pollutant Linkages With Respect to the Environment

Source	Pathways	Receptors
Potential contaminants in soil	Migration of landfill leachate to shallow groundwater and Slacks Creek	1)Surface Water
	Migration of potential contaminants as sediment in rainfall runoff	2)Shallow Groundwater

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4. Regulatory Framework

This Section highlights the key elements employed from the relevant regulatory framework in preparing and implementing the investigation methodologies, assessing the data gathered and recommending remediation / management approaches.

4.1. Commonwealth Legislation

4.1.1. National Environmental Protection Measure

The National Environment Protection Council, in co-operation with environmental health agencies, prepared national guidelines for contaminated land matters in the National Environment Protection (Assessment of Site Contamination) Measure 1999 ("the NEPM").

The purpose of the NEPM is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, contaminated land auditors, land owners, developers and industry.

The NEPM contains two schedules:

- Schedule A which identifies the recommended process for the Assessment of Site Contamination, indicating guiding principles to be applied to preliminary and detailed site investigations; and
- Schedule B which comprises 10 general guidelines for the Assessment of Site Contamination, including outlines for assessment criteria, field activities and health and ecological risk assessments.

The key element applicable from the NEPM is the nomination of investigation levels (HILs) for contaminant concentrations above which potential health or environmental risks may occur and require further investigation. The HILs adopted for the investigation are discussed further in Section 4.3.

4.2. State Legislation

4.2.1. Environmental Protection Act 1994

In Queensland, the Environmental Protection Agency (EPA) administers the *Environmental Protection Act 1994* (EP Act). The EP Act's emphasis is on managing Queensland's environment within the principles of ecologically sustainable development. Chapter 7, Part 8 of the EP Act details matters relating to the investigation and management of contaminated land. Further, current



Queensland guidelines for contaminated land include the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (DoE, 1998) ("the Draft Guidelines").

The key elements applicable from the EP Act and the Draft Guidelines include:

- Environmental Management Register (EMR): land that has been or is being used for a Notifiable Activity or has been contaminated by a hazardous contaminant, and about which the EPA is notified, is recorded on the EMR. Sites recorded on the EMR pose a potential risk to human health and the environment under the current land use. Entry on the EMR does not mean the land must be cleaned up or that the current land use must cease.
- Disposal Permit: Section 424 of the EP Act states that a Disposal Permit must be obtained for soil that is contaminated and originates at a site listed on the EMR prior to removal of that soil from the subject site. If the chosen remediation option includes the removal of contaminated soil from the subject site to an EPA-licensed landfill, then appropriate sampling and analysis results must be forwarded to the EPA, together with supporting documentation and the appropriate application form, to obtain a Disposal Permit. In the case where the subject site is not listed on the EMR, the EPA may exercise its discretion to issue an 'approval letter' or similar document to acknowledge that the appropriate contaminated soil management approach is being taken in the soil removal.

4.2.2. Environmental Relevant Activity Guidelines (ERA)

Regulations governing aspects of proposed, operational and decommissioned landfills (incorporating landfills) are outlined in the *Qld EPA Guidelines ERA 75 (Waste Disposal) – Landfill Siting, Design, Operation and Rehabilitation* (ERA 75). The Guidelines are designed to create a unified approach to landfill management in Queensland.

Specific to this Project, relevant stipulations on the management and rehabilitation of landfills have been discussed below.

- Landfill Gas Criteria: The guideline defines a Lower Explosive Limit (LEL) of 5% and Upper Explosive Limit (UEL) of 15% for methane based on safety requirements.
- Site Management Plan (SMP): The ERA 75 outlines triggers for long-term management of decommissioned landfills through an SMP (pursuant to Chapter 7, Part 8, Division 5 of the EP Act). This also includes future land use planning and ongoing environmental monitoring constraints.



4.2.3. Waste Regulations

The Environmental Protection (Waste Management) Policy 2000 and the *Environmental Protection (Waste Management) Regulation 2000* clarify waste management practices in Queensland and provide improved environmental safeguards. Developed in conjunction with local government and industry, the legislation benefits Queensland communities through safer disposal practices and cost savings from improved planning and management of waste services.

In relation to the identification and evaluation of remediation options for this Project, the key elements considered from this legislation are:

- The waste management hierarchy of reduce, reuse, recycle also applies to contaminated land management, the management options (in order of decreasing preference) being:
 - Treatment of contaminated soil on-site, followed by on-site reuse;
 - Management of contaminated soil on-site with appropriate mitigation measures to protect human health and the environment;
 - Off-site treatment; and
 - Off-site disposal.
- The setting of Waste Acceptance Criteria specific to individual landfill sites and differentiation between contaminated soil and regulated wastes.

4.3. Assessment Criteria

4.3.1. Risk to Human Health

Potential Contaminants in Soils

The HILs in *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999* (“the NEPM”) ‘HIL-F for Commercial/Industrial Land’ have been adopted as the assessment criteria (“the Human Health Assessment Criteria”) for the Investigation. These guidelines are considered appropriate on the basis that the proposed use of the site is commercial and the site and public access within the site post-development will be controlled.

The soil Human Health Assessment Criteria adopted for the Investigation are summarised in **Table 4-1**.

■ **Table 4-1 Human Health Assessment Criteria (Soil)**

Analyte	Assessment Criteria (mg/kg)	Assessment Criteria Source
Lead	1500	NEPM HIL-F
Arsenic	500	
Cadmium	100	

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Analyte	Assessment Criteria (mg/kg)	Assessment Criteria Source
Chromium (III+VI)	500	
Copper	5000	
Mercury	75	
Nickel	3000	
Zinc	35000	

Potential Contaminants in Groundwater

As discussed in **Section 2.6** there are no registered operational bores (groundwater users) in the vicinity of the site. This is likely to be due to the low yield of groundwater, which occurs in the vicinity of the site and the presence of other reliable and higher quality water sources (i.e. reticulated water). The nearest registered bore is located 700 m north of the site and north of Slacks Creek. Accordingly the site would not influence groundwater at the location of this bore.

Groundwater is not planned to be used on the site post development (e.g. for irrigation) due to the low yield and presence of landfill leachate (refer to **Section 8.2**). Whilst the majority of leachate from the landfill is discharged into groundwater via sub-surface flow, a small portion of leachate from the landfill seeps from the eastern embankment into the drain. Post development access to the eastern embankment will be controlled by fencing and is not expected to be accessed by human receptors (e.g. for recreational use).

Landfill leachate from the site discharges to Slacks Creek located 320 m east of the site via seepages into the drain and groundwater migration. Parts of Slacks Creek down-gradient of the site are within parks and accessible by the public for recreational purposes. Accordingly the analytical results have been compared to the Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000, *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters* ("ANZECC Guideline") for secondary contact recreational use.

A number of potential contaminants were detected for which there is no ANZECC Guideline. In the absence of an ANZECC Guideline in order of decreasing preference the following Assessment Criteria have been applied.

- The Netherlands Ministry of Housing, Spatial Planning and Environment's *Circular on target values and intervention values for soil remediation* (2000) ("the Dutch Guidelines") which consider both the risk to human health and the environment;
- The National Health and Medical Research Council (2004) *Australian Drinking Water Guidelines* ("the Australian Drinking Water Guidelines"); and

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- United States Environmental Protection Agency (2009) *Region 9 Preliminary Remediation Goals* ("the USEPA guidelines")

In summary, the Human Health Assessment Criteria adopted for this Investigation and their source are summarised in **Table 4-4**.

Table 4-2 Human Health Assessment Criteria (Water)

Analyte (µg/L unless stated)	Assessment Criteria	Assessment Criteria Source
Ammonia as N (mg/L)	0.5	Australian Drinking Water Guidelines 2004
Arsenic (mg/L)	0.05	ANZECC 2000 Recreational Water Quality
Cadmium (mg/L)	0.005	ANZECC 2000 Recreational Water Quality
Chromium (mg/L)	0.05	ANZECC 2000 Recreational Water Quality
Copper (mg/L)	1	ANZECC 2000 Recreational Water Quality
Lead (mg/L)	0.05	ANZECC 2000 Recreational Water Quality
Nickel (mg/L)	0.1	ANZECC 2000 Recreational Water Quality
Zinc (mg/L)	5	ANZECC 2000 Recreational Water Quality
TPH C10-C40	600	Dutch Guidelines
Benzene	10	ANZECC 2000 Recreational Water Quality
Toluene	1000	Dutch Guidelines
Ethylbenzene	150	Australian Drinking Water Guidelines 2004
meta- & para-Xylene	200	USEPA 2009 Region 9 Tap Water
ortho-Xylene	1400	USEPA 2009 Region 9 Tap Water
Isopropylbenzene	150	Dutch Guidelines (aromatic solvents)
n-Propylbenzene	150	Dutch Guidelines (aromatic solvents)
1,2,4-Trimethylbenzene	15	USEPA 2009 Region 9 Tap Water
p-Isopropyltoluene	-	-
Dichlorodifluoromethane	390	USEPA 2009 Region 9 Tap Water
Chlorobenzene	300	Australian Drinking Water Guidelines 2004
1,4-Dichlorobenzene	40	Australian Drinking Water Guidelines 2004
1,2-Dichlorobenzene	1500	Australian Drinking Water Guidelines 2004
Naphthalene	70	Dutch Guidelines
Phenanthrene	-	-
2-Methylphenol	200	Dutch Guidelines (Cresols)
3- & 4-Methylphenol	200	Dutch Guidelines (Cresols)
2,4-Dimethylphenol	730	USEPA 2009 Region 9 Tap Water
2,4-Dichlorophenol	200	Australian Drinking Water Guidelines 2004
4-Chloro-3-methylphenol	350	Dutch Guidelines
2,4,5-Trichlorophenol	1	ANZECC 2000 Recreational Water Quality



Landfill Gases

Volatile organic gas data has been compared to the *National Occupational Health and Safety Commission (NOHSC) 1995, Exposure Standards for Atmospheric Contaminants in the Occupational Environment* ("the NOHSC Guidelines"). Guideline values provide both a time weighted average (TWA) and short-term exposure limit (STEL) for human exposure to ambient gas concentrations within an enclosed building or space, assuming a standard workplace scenario.

The NOHSC Guidelines do not include methane which is a volatile gas produced during the degradation of putrescible wastes in landfills. Methane is an asphyxiant and is highly flammable. As an asphyxiant in an unventilated enclosed space, methane at 7 % concentration can displace normal air and reduce oxygen concentrations to levels below the US Occupational Safety & Health Administration (OSHA) allowable level (19.5 % O₂) (Doyle, 2001). At 5 % concentration in air (the LEL, refer to **Section 4.2.2**) methane is flammable. Accordingly a Human Health Assessment Criteria of 5 % concentration of methane in air has been used on the basis that it considers both safety (LEL) and health (asphyxiant) concerns.

The NOHSC Guidelines are summarised in Table 4-3.

■ **Table 4-3 NOHSC Guidelines**

Analyte	NOHSC Guideline	
	TWA (mg/m ³)	STEL (mg/m ³)
n-pentane	1770	2210
n-hexane	176	-
cyclohexane	1035	-
methylcyclohexane	1610	-
n-heptane	1640	2050
n-octane	1400	1750
n-nonane	1050	-
chlorobenzene	46	-
benzene	16	-
ethylbenzene	434	543
1,2,3-trimethylbenzene	123	-
1,2,4-trimethylbenzene		
1,3,5-trimethylbenzene		
p/m-xylene	350	655
o-xylene		
acetone	1185	2375



4.3.2. Risk to the Environment

Potential Contaminants in Soils

Soil guidelines for the protection of ecological health, such as the NEPM ecological-based investigation levels (EILs) are not recommended for application at this site on the basis that the ecological sensitivity of the site is considered to be low (i.e. the site does not support ecosystems with high ecological value), and the site in its current condition does not appear to be impairing plant growth. It should also be noted that the NEPM acknowledges in Schedule B(1) Section 3.2 that the EILs for an urban setting "have not been derived to protect nominated ecological values and are somewhat arbitrary". For these reasons the use of the EILs is not recommended. It should be noted that the CSIRO is currently working on a methodology to give more scientifically robust and ecologically relevant EILs⁵.

Potential Contaminants in Groundwater

A qualitative assessment of groundwater receptors at the site indicates that the nearest receiving water body is Slacks Creek. As Slacks Creek is a freshwater system, the appropriate primary screening criteria are the Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000, *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters* ("ANZECC Guideline").

On the basis that the current ecological condition of Slacks Creek is a highly disturbed and heavily modified system, the 80% trigger value for freshwater ecosystems has been used.

A number of potential contaminants were detected for which there is no ANZECC Guideline. In the absence of an ANZECC Guideline, the following Assessment Criteria have been applied.

- United States Environmental Protection Agency (2009) *Region 9 Preliminary Remediation Goals* ("the USEPA Guidelines"); and
- the Dutch Guidelines.

The Dutch Guideline for hydrocarbon in groundwater has been derived for mineral-based (petroleum) hydrocarbons. The guideline value was used to compare samples of Total Petroleum Hydrocarbons (TPH) where the source of the hydrocarbons was petroleum based. This applied to TPH analytes which had been prepared using a silica gel clean-up to remove interference from polar organics⁶.

⁵ CSIRO, 2008, *Draft Proposal for an Australian Methodology to Derive Ecological Investigation Levels in Contaminated Soils*. Report 18/08

⁶ Polar organics such as lipids, proteins, sugars etc. are removed by running the sample extract over a charged



It should be noted that the NEPM includes Groundwater Investigation Levels (GILs) for freshwater ecosystems. These however are based on the *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC, 1992) for the protection of freshwater ecosystems which have now been withdrawn. Accordingly the NEPM GILs have not been used.

The extraction of groundwater for use (e.g. irrigation) is considered unlikely for reasons outlined in **Section 4.3.1**). Accordingly ecological risks associated with extractive uses are considered to be low and do not require further consideration.

In summary, the Environmental Assessment Criteria adopted for this investigation and their source are summarised in **Table 4-4**.

■ **Table 4-4 Environmental Assessment Criteria**

Analyte (µg/L unless stated)	Assessment Criteria	Assessment Criteria Source
Ammonia as N (mg/L)	2.3	ANZECC 2000 Freshwater Ecosystems (80%)
Arsenic (mg/L)	0.36	ANZECC 2000 Freshwater Ecosystems (80%)
Cadmium (mg/L)	0.0008	ANZECC 2000 Freshwater Ecosystems (80%)
Chromium (mg/L)	0.04	ANZECC 2000 Freshwater Ecosystems (80%)
Copper (mg/L)	0.0025	ANZECC 2000 Freshwater Ecosystems (80%)
Lead (mg/L)	0.0094	ANZECC 2000 Freshwater Ecosystems (80%)
Nickel (mg/L)	0.017	ANZECC 2000 Freshwater Ecosystems (80%)
Zinc (mg/L)	0.031	ANZECC 2000 Freshwater Ecosystems (80%)
TPH C10-C40	800	Dutch Guidelines
Benzene	2000	ANZECC 2000 Freshwater Ecosystems (80%)
Toluene	180	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems
Ethylbenzene	80	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems
meta- & para-Xylene	340	ANZECC 2000 Freshwater Ecosystems (80%)
ortho-Xylene	640	ANZECC 2000 Freshwater Ecosystems (80%)
Isopropylbenzene	30	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems
n-Propylbenzene	128	USEPA Ecological Risk Assessment Freshwater Screening Benchmarks
1,2,4-Trimethylbenzene	33	USEPA Ecological Risk Assessment Freshwater Screening Benchmarks
p-Isopropyltoluene	85	USEPA Ecological Risk Assessment Freshwater Screening Benchmarks
Dichlorodifluorometh-ane	390	USEPA 2009 Region 9 Tap Water
Chlorobenzene	55	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems
1,4-Dichlorobenzene	60	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems
1,2-Dichlorobenzene	160	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems
Naphthalene	85	ANZECC 2000 Freshwater Ecosystems (80%)

silica gel. Non-polar petroleum components then remain in the sample extract for analysis.

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Analyte (µg/L unless stated)	Assessment Criteria	Assessment Criteria Source
Phenanthrene	2	ANZECC 2000 Trigger Value Freshwater/Marine (95% protection)
2-Methylphenol	13	USEPA Ecological Risk Assessment Freshwater Screening Benchmarks
3- & 4-Methylphenol	543	USEPA Ecological Risk Assessment Freshwater Screening Benchmarks
2,4-Dimethylphenol	2	ANZECC 2000 Trigger Value Freshwater/Marine (95% protection)
2,4-Dichlorophenol	120	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems
4-Chloro-3-methylphenol	350	Dutch Guidelines
2,4,5-Trichlorophenol	0.5	ANZECC 2000 Trigger Value for Freshwater Slightly-Moderately Disturbed Systems

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5. Investigation Methodology

5.1. Scope of Investigation

The scope of the Investigation comprised:

- 1) a site inspection.
- 2) the review of historical aerial photography obtained from the Department of Environment and Resource Management (DERM).
- 3) the review data provided by Logan City Council (LCC) including:
 - CMPS&F Environmental, May 1995. *Preliminary Site Investigation and Management Plan for The Former Compton Road Landfill Site*. Prepared for the Logan City Council ("the CMPS&F Report").
 - groundwater and landfill gas monitoring data from July 2000 to August 2008 ("LCC Environmental Data") including an assessment of historical groundwater trends within three previously installed monitoring wells ("the LCC wells").
- 4) the undertaking of a groundwater monitoring event from monitoring wells present at the site, and the collection of a water sample from the drain exiting the site.
- 5) the preparation of a Sampling and Analysis Plan (SAP) based on the findings of 1) to 3) above for the undertaking of further intrusive ground investigation to establish whether the site in its current condition poses an unacceptable risk to human health and/or the receiving environment.
- 6) the undertaking of the intrusive ground investigation which comprised:
 - a review of the "Dial Before You Dig Records" of the site and confirmation of service locations by a Telstra Accredited Underground Service Locator;
 - the installation and development of nine groundwater monitoring wells around the periphery of the site, including:
 - a total of five combined shallow groundwater/landfill gas wells intersecting the perched leachate water ("the perched wells") within materials contained within the Landfill ("the waste material").
 - A total of four deeper groundwater wells intersecting the natural groundwater table below the Landfill ("the groundwater wells").
 - the excavation of ten shallow test pits within the surface material and sampling of shallow surface soils for contamination testing at a National Association of Testing Laboratories (NATA) Accredited Laboratory;
 - the undertaking of four Talsma-Hallam Permeameter (permeability) tests from four of the shallow test pits.

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- 7) the undertaking of two rounds of landfill gas and groundwater monitoring comprising:
 - landfill gas monitoring from the perched wells and the Landfill vents; and
 - groundwater monitoring and sampling from the four groundwater wells and five perched wells (collectively referred to as "the monitoring wells") and from the discharge point of the drainage channel and the testing of the samples collected at a NATA Accredited Laboratory.
- 8) the preparation of an Interim Report on the findings of the intrusive ground investigation following completion of the two monitoring rounds referred to in 6) above.
- 9) the undertaking of a further four rounds of landfill gas monitoring and two rounds of groundwater monitoring comprising:
 - landfill gas monitoring from the perched wells and the Landfill vents; and
 - one round of volatile gas sampling from the perched wells by SIMTARS, and the testing of the samples collected for a range of volatile organic contaminants; and
 - groundwater monitoring and sampling from the four groundwater wells and five perched wells (collectively referred to as "the monitoring wells") and from the discharge point of the drainage channel and the testing of the samples collected at a NATA Accredited Laboratory.
- 10) the preparation of an interpretative report (this report) on the findings of the Investigation.

A Preliminary Geotechnical Investigation was undertaken in October 2009 which comprised the drilling of 10 boreholes over the site to provide preliminary characterisation of ground conditions in the vicinity of the proposed buildings, the car/trailer park, and racing track. Ground conditions encountered during the Preliminary Geotechnical Investigation have been summarised in this report.

5.2. Installation of Monitoring Wells

A total of nine monitoring wells were installed as part of the Investigation. All monitoring wells were installed based on the requirements of the *Minimum Construction Requirements for Water Bores in Australia (2003)*. Bore logs of the groundwater wells installed as part of the investigation have been presented in **Appendix C**.

Perched Wells

The perched wells only intersected the waste material and not the natural materials beneath the Landfill. The five perched wells were screened across the static water level and into the waste material above to intersect phase separated hydrocarbons and allow for landfill gas monitoring.



A bentonite plug⁷ was used to seal the perched wells through the surface material.

A summary of the perched well construction details is provided in **Table 5-1**.

■ **Table 5-1 Perched Well Installation Details**

Monitoring Well	Total Depth (m bgl)	Screened Interval (m bgl)
MW03	2.0	1.0-2.0
MW04	5.0	2.0-5.0
MW05	6.0	1.0-6.0
MW07	5.0	1.0-5.0
MW08	3.0	1.0-3.0

Groundwater Wells

The four groundwater wells were installed through the waste material, and screened within natural ground below the waste materials.

Where the groundwater wells intersected loose or wet waste material, the hole was advanced to the base of the waste material. The hole was then cased with a concrete-bentonite slurry and allowed to cure overnight. Following this, a second auger was advanced through the concrete casing and into the natural material below.

The groundwater wells were screened through the natural material only. A bentonite plug⁸ was installed at the base of the concrete casing to ensure that an adequate seal between the waste material and natural material was achieved.

A summary of the groundwater well construction details is provided in **Table 5-1**.

■ **Table 5-2 Groundwater Well Installation Details**

Monitoring Well	Total Depth (m bgl)	Screened Interval (m bgl)
MW01	7.0	5.0-7.0
MW02	7.5	4.5-7.5
MW06	9.0	8.0-9.0
MW09	8.0	5.0-8.0

Well Development

All monitoring wells at the site were developed by removing a minimum of three well volumes of water (or until well purged dry), until groundwater parameters stabilised.

⁷ of a minimum thickness of 1 m

⁸ of a minimum thickness of 1 m.



5.3. Soil Sampling

During the installation of monitoring wells, samples of surface soils were collected incrementally until the intersection of the waste material, and from trial pits excavated over the capping layer.

Soil samples were screened using a photo-ionisation detector (PID)⁹ for the presence of volatile hydrocarbons. No detects were noted in any sample across the site.

Samples were immediately placed in appropriately preserved containers and placed on ice for transportation to the laboratory.

Selected soil samples from within the shallow soil profile¹⁰ were submitted for analysis of a broad range of potential contaminants including:

- Inorganic analytes:
 - Metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury);
 - pH;
 - Asbestos;
- Organic analytes:
 - Total petroleum hydrocarbon (TPH);
 - Volatile Organic Compounds (VOC) including BTEX (benzene, toluene, ethylbenzene and xylenes);
 - Semi-volatile Organic Compounds including:
 - Polycyclic Aromatic Hydrocarbons (PAH);
 - Phenols;
 - Polychlorinated Biphenyls (PCB);
 - Organochlorine Pesticides (OCP); and
 - Organophosphate Pesticides (OPP).

5.4. Landfill Gas Monitoring and Analytical Testing

Perched wells were fitted with gas monitoring well caps to allow for landfill gas¹¹ monitoring.

⁹ Calibration certificates are included in Appendix D.

¹⁰ Depths less than 0.3 m bgl.

¹¹ Including methane, oxygen, carbon dioxide, carbon monoxide and hydrogen sulphide



Wells were sealed for a minimum of 48 hours prior to monitoring. A landfill gas meter (GA2000 or similar)¹² was used to monitor gas concentrations from within the monitoring wells for three consecutive minutes. Peak and average landfill gas readings were recorded.

Four existing landfill vents at the site were also monitored for three consecutive minutes from sampling ports at the base of the vent.

5.5. Groundwater Sampling

Groundwater levels were recorded using a Solonist Oil-Water Interface Probe¹³. Wells were then purged until groundwater parameters stabilised, or until the well was dry. Post purge groundwater physico-chemical parameters¹⁴ of recharging water were recorded.

Samples were collected using a disposable bailer. Samples were placed into appropriately preserved sample containers and placed on ice for transportation to the laboratory.

Samples for metals analysis were filtered to 0.45 µm prior to placing in a sample container.

Groundwater samples were submitted for analysis of a broad range of potential contaminants including:

- Inorganic analytes:
 - Metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury);
 - pH;
- Organic analytes:
 - Total petroleum hydrocarbon (TPH) fractions;
 - Volatile Organic Compounds (VOC) including BTEX (benzene, toluene, ethylbenzene and xylenes);
 - Semi-volatile Organic Compounds including:
 - Polycyclic Aromatic Hydrocarbons (PAH);
 - Phenols;
 - Polychlorinated Biphenyls (PCB);
 - Organochlorine Pesticides (OCP); and
 - Organophosphate Pesticides (OPP).

¹² Calibration certificates are included in Appendix D.

¹³ Calibration certificates are included in Appendix D.

¹⁴ Including pH, dissolved oxygen (DO), reduction potential, total dissolved solids (TDS) and temperature



6. Site Conditions

6.1. Ground Conditions

A conceptualisation of the ground conditions at the site is provided in **Figure 5, Appendix A**. Exploratory bore logs, including the logs from the Preliminary Geotechnical Investigation are included in **Appendix B**.

Surface Material

For the majority of the Landfill, the surface material was found to be comprised of a layer of silty sand (0-0.1 m thickness) and an underlying clay based material comprised of sandy clay to clayey sand (0.2-0.8 m thickness).

The surface material layer of the eastern embankment of the Landfill was found to be comprised of well compacted clayey sand (0.2-0.5 m thickness).

Waste Materials

The thickness of waste materials encountered varied from 1.2 m to 10.5 m. Where encountered, waste materials (30-90%) were found to be mixed in a damp to saturated grey unconsolidated clay or sandy clay matrix (10-70%). The waste intersected in the investigation was domestic in origin, and appeared to contain infrequent residual putrescible materials. Common items noted in the waste materials included plastic packaging, plastic bags, metal fragments and glass bottles. No regulated wastes were noted in the waste material intersected.

The waste materials have been placed directly over natural materials in the majority of exploratory boreholes.

Natural Material

The natural material was generally a sandy or silty clay of weathered sandstone. This was underlain by the coarse grained red and white low strength sandstone. The sandstone was incised with a medium strength siltstone in several locations across the site.

In background locations across the site (including in locations within the wooded area along the western portion of the site), the soil profile was a silty sandy clay material consistent with the weathered sandstone.

6.2. Groundwater

Two groundwater systems have been observed on the site. These include:

- groundwater within the weathered sandstone beneath the Landfill; and
- perched water within the Landfill.

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Perched water within the Landfill is expected to be recharged from the lateral migration of groundwater entering the Landfill and the vertical migration of rainwater through the surface material.

The CMPS&F Report describes the Landfill as being constructed using a method which involved the excavation of trenches, and the placement and compacting of waste within the trench. The report does not describe the construction of a liner system.

The absence of an engineered liner was confirmed during the Preliminary Geotechnical Investigation which involved the drilling of 10 boreholes over the former landfill site. The Preliminary Geotechnical Investigation confirmed that waste materials have been placed directly over natural materials. This was found to be the sandy clay strata (weathered sandstone) in the majority of boreholes. In BH4 waste materials were found to have been placed directly over the sandstone. Consequently it is considered highly likely that the perched water within the Landfill is in connection with groundwater in the weathered sandstone.

Evidence of a connection between the two groundwater systems within the site can be drawn from the presence of organic contaminants and ammonia from groundwater samples taken from MW06 and MW09. MW06 and MW09 are monitoring wells which target groundwater in the weathered sandstone beneath and at the eastern (down-gradient) boundary of the Landfill (refer to **Appendix D.2.2**). If there was not a connection between the perched water within the Landfill and the groundwater in the weathered sandstone, elevated concentrations of organics and ammonia would not have been expected to be found in the samples from MW06 and MW09.

Figure 6, Appendix A provides a summary of the groundwater levels monitored during the investigation. Both the groundwater within the weathered sandstone and perched groundwater within the Landfill flow in a north easterly direction towards Slacks Creek. The perched groundwater within the Landfill is expected to combine with the groundwater in the weathered sandstone down gradient of the site. This is evident from ammonia and organic contaminants detected in CR13 which is a groundwater monitoring well installed by LCC down gradient of the Landfill.

Perched water within the Landfill potentially seeps into the drain on the eastern boundary of the site, as the elevation of the drain is below perched water levels within the Landfill. In addition seepages from the eastern embankment of the Landfill were observed in the north eastern corner of the site.

Appendix D.4 provides a summary of groundwater observations made during the undertaking of the investigation. Odours and sheens were observed in some of the monitoring wells within the



site. Further discussion on the quality of the perched water within the Landfill and groundwater within the weathered sandstone is provided in **Section 7.2**.

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7. Analytical Results

This Section provides a summary of the analytical results of the investigation. A complete tabulation of the analytical results and a comparison of these with the Human Health and Environmental Assessment Criteria are provided in **Appendix D**. A copy of the laboratory analytical reports is provided in **Appendix E**. An assessment of the quality of the data is provided in **Appendix F**. A discussion of implications of the analytical results in regard to the risk to the environment and human health is provided in **Section 8**, and the remedial requirements in **Section 9**.

7.1. Soil Analytical Results

Seventeen samples of capping material (0-0.1 m or 0.2-0.3m) were analysed for a range of potential contaminants including metals¹⁵, asbestos, and/or organic analytes¹⁶. **Table 7-1** provides a summary of the analytical results for metals.

■ **Table 7-1 Metals, Surface Material**

Analyte (mg/kg)	Human Health Assessment Criteria	Minimum Value	Maximum Value
Arsenic	500	<5	<5
Cadmium	100	<1	<1
Chromium	500	2	28
Copper	5000	<5	16
Lead	1500	<5	18
Nickel	3000	<2	10
Zinc	35000	<5	31
Mercury	75	<0.1	<0.1

Note: The Human Health Assessment Criteria are defined in Section 4.3.

Metals (chromium, copper, lead, nickel and zinc) were found in some of the samples analysed in low concentrations which were well below the Human Health Assessment Criteria.

Asbestos fibres were not detected in any of the samples analysed.

All organic analytes were below laboratory detection limits in the samples analysed.

¹⁵ metals included arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury

¹⁶ organics included total petroleum hydrocarbons (TPH); BTEX – benzene, toluene, xylene isomers, and ethyl benzene; polycyclic aromatic hydrocarbons (PAH); phenolic compounds; total polychlorinated biphenyls (PCBs); and organochlorine / organophosphate pesticides (OCPs/OPPs).



Permeability and Drainage of Surface Material

In-situ Talsma-Hallam Permeameter tests of the clay based material within the surface material indicates that the permeability of this material varies between 10^{-6} and 10^{-8} m/s. The test results, and an estimated permeability of the clay based material based on particle size analysis are summarised in Table 7-2.

■ Table 7-2 Permeability Test Results

Exploratory Location	Depth to Clay Based Material (m bgl)	Thickness of Clay Based Material (m)	Talsma-Hallam Permeameter Result of Clay Based Material	Estimated Permeability Based on Particle Size Distribution Testing
TP2	0.2	0.4	$k = 4.0 \times 10^{-7}$ m/s	$(k = 10^{-8}$ m/s) Estimate only
TP3	0.1	0.8	$k = 1.1 \times 10^{-8}$ m/s	
TP4	0.1	0.5	$k = 1.4 \times 10^{-7}$ m/s	
TP5	0.1	0.5	$(k = 4.4 \times 10^{-8}$ m/s)	
TP9	0.15	0.2	Not measured	-

Low bunds have been constructed over parts of the site to assist with the shedding of rainfall runoff off the surface material into the drains on the northern and southern boundaries of the site (refer to Section 2.4). These surface water drainage measures and the low permeability of the clay based surface material will assist with limiting the infiltration of rainfall into the Landfill. The temporary ponding of water has been observed on the site in some locations following rainfall in capping areas which have formed depressions following ground subsidence.

7.2. Groundwater Analytical Results

Five rounds of groundwater monitoring have been undertaken at the site. Groundwater samples collected were tested for a range of inorganic¹⁷ and organic¹⁸ analytes.

¹⁷ inorganic analytes included metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury) and ammonia

¹⁸ organic analytes included:

- total petroleum hydrocarbons (TPH)
- volatile organic compounds: BTEX – benzene, toluene, xylene isomers, and ethyl benzene; monocyclic aromatic hydrocarbons; oxygenated compounds, fumigants, halogenated aliphatic/aromatic compounds; trihalomethanes; naphthalene)
- semi-volatile organic compounds: polycyclic aromatic hydrocarbons (PAH); phenolic compounds; total polychlorinated biphenyls (PCBs); and organochlorine / organophosphate pesticides (OCs/OPs).



7.2.1. Physico-Chemical Parameters and Ammonia

Table 7-3 provides a summary of the physico-chemical parameters and ammonia analytical results for the on-site monitoring wells.

■ Table 7-3 Physico-Chemical Parameters and Ammonia, On-site Locations

Analyte	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill				Perched Water Within Former Landfill			
			Cross-gradient (MW02)		Down-gradient (MW06, MW09)		Cross-gradient (MW03, MW04, MW08)		Down-gradient (MW05, MW07)	
			Min	Max	Min	Max	Min	Max	Min	Max
Dissolved Oxygen (mg/L)			1.1	5.8	1.1	5.0	0.1	7.1	0.1	1.9
Total Dissolved Solids (ppK)			2.9	4.9	0.3	2.4	0.4	2.2	1.1	3.2
pH			3.4	4.1	3.6	6.4	4.4	7.7	6.8	7.6
Reduction Potential (eH)			279	58	-44	275	-197	262	-150	-87
Temperature (°C)			22.4	23.7	19.5	24.1	19.4	25.3	20.3	23.7
Ammonia as N (mg/L)	2.3	0.01	0.02	0.2	0.5	50.4	<0.01	228	43.4	120

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

Perched water within the Landfill generally tended to contain low salt content, low dissolved oxygen (DO), and acidic to slightly alkaline pH.

In general, groundwater in the weathered sandstone was generally acidic and saline, as observed in samples from the cross-gradient, and down-gradient monitoring wells.

Elevated concentrations of ammonia which exceed the Environmental and Human Health Assessment Criteria were found in groundwater samples from down-gradient monitoring wells which targeted perched water within the Landfill (MW05 and MW07), and groundwater monitoring wells in the weathered sandstone (MW06). The results show that the Landfill is producing elevated concentrations of ammonia in leachate, which is impacting on both the perched groundwater and the underlying aquifer.

Table 7-4 provides a summary of the physico-chemical parameters and ammonia analytical results for the off-site monitoring wells and the surface water drain.



■ **Table 7-4 Physico-Chemical Parameters and Ammonia, Off-site Locations**

Analyte	Environmental Assessment Criteria	Human Health Assessment Criteria	Off-site Wells						Drain	
			Up-gradient (CR14, MW01)		Cross-gradient (CR15)		Down-gradient (CR13)			
			Min	Max	Min	Max	Min	Max	Min	Max
Dissolved Oxygen (mg/L)			1.9	5.9	2.4	4.6	2.9	4.0	4.0	6.6
Total Dissolved Solids (ppK)			0.2	7.3	0.1	0.9	0.2	0.4	0.2	0.3
pH			3.8	4.3	5.0	6.0	5.0	5.7	7.0	7.5
Reduction Potential (eH)			148	407	18	100	2	111	-16	68
Temperature (°C)			21.2	22.6	19.7	21.2	21.6	22.4	19.4	25.7
Ammonia as N (mg/L)	2.3	0.01	0.14	0.06			9.79	9.79	4.21	4.21

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

Table 7-4 shows that the physico-chemical parameters for the up-gradient and cross-gradient off-site monitoring wells were similar to the results from groundwater samples taken from up-gradient and cross-gradient monitoring wells beneath the Landfill in the weathered sandstone.

Elevated concentrations of ammonia which exceeded the Environmental and Human Health Assessment Criteria were found in the monitoring well down-gradient of the Landfill (CR13) and the drain. The maximum concentration of ammonia detected in CR13 (9.79 mg/L) was lower than the maximum concentrations detected in the perched water within the Landfill (228 mg/L). This may be partly attributed to the dilution of ammonia as the perched groundwater within the Landfill mixes with the groundwater within the weathered sandstone, and further attenuation in the aquifer as groundwater moves beneath the site to CR13.

Perched groundwater within the Landfill potentially seeps into the drain on the eastern boundary of the site on the basis that the elevation of the drain is below perched water levels within the Landfill. The elevated concentration of ammonia found in the drain is likely to be attributed to seepage of perched groundwater from the Landfill and possibly other off-site commercial/industrial sources (refer to **Section 2.4**).

7.2.2. Metals

The analytical results for metals are summarised in **Table 7-5** for the on-site monitoring wells, and **Table 7-6** for the off-site monitoring wells.

■ **Table 7-5 Metals, On-site Locations**

Analyte (mg/L)	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill				Perched Water Within Former Landfill			
			Cross-gradient (MW02)		Down-gradient (MW06, MW09)		Cross-gradient (MW03, MW04, MW08)		Down-gradient (MW05, MW07)	
			Min	Max	Min	Max	Min	Max	Min	Max
Arsenic	0.36	0.05	<0.001	0.001	<0.001	0.025	<0.001	0.018	0.002	0.008
Cadmium	0.0008	0.005	0.0003	0.0006	<0.0001	0.0002	<0.0001	0.0007	<0.0001	0.0006
Chromium	0.04	0.05	0.001	0.009	<0.001	0.001	<0.001	0.012	<0.001	0.019
Copper	0.0025	1	0.003	0.018	<0.001	0.006	<0.001	0.02	<0.001	0.009
Lead	0.0094	0.05	0.001	0.043	<0.001	0.003	<0.001	0.048	<0.001	0.002
Nickel	0.017	0.1	0.002	0.1	<0.001	0.019	0.003	0.124	0.012	0.122
Zinc	0.031	5	0.06	0.359	0.021	0.042	0.005	0.463	<0.005	0.043
Mercury	0.0054		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

■ **Table 7-6 Metals, Off-site Locations**

Analyte (mg/l)	Environment al Assessment Criteria	Human Health Assessment Criteria	Off-site Wells						Drain	
			Up-gradient (CR14, MW01)		Cross-gradient (CR15)		Down-gradient (CR13)			
			Min	Max	Min	Max	Min	Max	Min	Max
Arsenic	0.36	0.05	<0.001	0.002	<0.001	0.002	0.016	0.022	<0.001	0.001
Cadmium	0.0008	0.005	<0.0001	0.0003	<0.0001	0.0003	<0.0001	0.0004	<0.0001	0.0011
Chromium	0.04	0.05	0.01	0.021	<0.001	<0.001	<0.001	<0.001	<0.001	0.007
Copper	0.0025	1	0.014	0.028	<0.001	0.002	<0.001	0.007	0.002	0.02
Lead	0.0094	0.05	0.026	0.115	<0.001	0.002	<0.001	<0.001	<0.001	0.013
Nickel	0.017	0.1	0.028	0.038	<0.001	0.003	0.001	0.001	0.001	0.005
Zinc	0.031	5	0.072	0.154	0.014	0.07	0.016	0.042	0.09	0.173
Mercury	0.0054		<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.001	<0.0001	<0.0001

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

Elevated concentrations of copper, lead, nickel and zinc with concentrations above the Environmental Assessment Criteria were found in MW01 (refer to **Table 7-6**) which is a monitoring well located up-gradient of the Landfill in the weathered sandstone.

Elevated concentrations of copper and zinc with concentrations which exceed the Environmental Assessment Criteria were also found in CR14 which is an off-site monitoring well located up-gradient of the Landfill. Lead was found with concentrations which exceeded the Human Health Assessment Criteria in groundwater samples from off-site well MW01.

MW01 and CR14 are considered to be up-gradient of the Landfill on the basis that: these monitoring wells are located on the western boundary on the known extent of the Landfill (refer to **Section 2.8**); elevated concentrations of ammonia (which is an indicator of the presence of landfill



leachate) have not been detected in groundwater samples from these wells (refer to **Table 7-4**); and the absence of waste materials encountered when drilling the monitoring well in MW01¹⁹ (refer to **Appendix B**).

Table 7-5 shows that the majority of samples from the on-site monitoring wells had concentrations of copper, lead, nickel and zinc with concentrations above the Environmental Assessment Criteria. The maximum concentrations detected, however, were lower than those found in MW01. The findings indicate that elevated concentrations of metals occur in the vicinity (and up-gradient) of the site. The sources of these metals are unknown, and are potentially derived from industrial sources in the vicinity of the site, or naturally occurring within groundwater. Notwithstanding this, leachate from the Landfill is unlikely to be having a deleterious effect on groundwater with respect to metals.

An elevated concentration of cadmium which exceeded the Environmental Assessment Criteria was detected in the drain on the eastern boundary of the site in one of the sampling rounds. All other samples from the drain and groundwater had concentrations of cadmium which were below the Environmental Assessment Criteria.

7.2.3. Hydrocarbons

The analytical results for Total Petroleum Hydrocarbons (TPH) are summarised in **Table 7-7** for the on-site monitoring wells, and **Table 7-8** for the off-site monitoring wells.

■ **Table 7-7 Total Petroleum Hydrocarbons, On-site Locations**

Analyte (µg/L)	Environmental Assessment Criteria	Groundwater Beneath Former Landfill				Perched Water Within Former Landfill			
		Cross-gradient (MW02)		Down-gradient (MW06, MW09)		Cross-gradient (MW03, MW04, MW08)		Down-gradient (MW05, MW07)	
		Min	Max	Min	Max	Min	Max	Min	Max
C6 - C9		<20	<20	<20	50	<20	50	30	60
C10 - C14		<50	<50	<50	840	<50	580	90	800
C15 - C28		<100	<100	<100	2500	<100	1700	300	1900
C29 - C36		<50	<50	<50	710	<50	710	<50	680
C10 - C36		<50	<50	<50	4050	<50	2990	440	3170

¹⁹ Note LCC has been unable to provide the exploratory logs and well construction records for CR13, CR14, and CR15.



■ Table 7-8 Total Petroleum Hydrocarbons, Off-site Locations

Analyte (µg/L)	Environmental Assessment Criteria	Off-site Wells						Drain	
		Up-gradient (CR14, MW01)		Cross-gradient (CR15)		Down-gradient (CR13)			
		Min	Max	Min	Max	Min	Max	Min	Max
C6 - C9		<20	<20	<20	<20	<20	<20	<20	<20
C10 - C14		<50	60	<50	<50	<50	110	<50	80
C15 - C28		<100	400	<100	160	200	500	<100	350
C29 - C36		<50	240	<50	100	<50	530	<50	130
C10 - C36		<50	690	<50	260	200	1100	<50	560

Concentrations of TPH were generally higher in samples from down-gradient groundwater monitoring wells when compared to samples of perched water from monitoring wells located around the boundary of the Landfill. Whilst not directly sampled in this investigation, elevated concentrations of TPH would also be expected to be found in perched water within the central parts of the Landfill.

Due to the presence of elevated concentrations of TPH in the first monitoring round, aliphatic/aromatic hydrocarbons were included the laboratory analysis in addition to TPH in the second and third monitoring rounds for selected samples. The analytical results for aliphatic/aromatic hydrocarbons are summarised in Table 7-9.

■ Table 7-9 Aromatic/Aliphatic Hydrocarbons, On-site Locations

Analyte (µg/L)	Human Health/ Environmental Assessment Criteria	Groundwater Beneath Former Landfill				Perched Water Within Former Landfill			
		Cross-gradient (MW02)		Down-gradient (MW06, MW09)		Cross-gradient (MW03, MW04, MW08)		Down-gradient (MW05, MW07)	
		Min	Max	Min	Max	Min	Max	Min	Max
Aliphatic C10-C14		-	-	<50	<50	<50	<50	<50	<50
Aliphatic C15-C28		-	-	<100	<100	<100	<100	<100	400
Aliphatic C29-C36		-	-	<50	<50	<50	<50	<50	150
Aliphatic C10 - C36		-	-	<50	<50	<50	<50	<50	550
Aromatic C10-C14		-	-	<50	<50	60	70	60	180
Aromatic C15-C28		-	-	<100	<100	<100	<100	<100	<100
Aromatic C29-C36		-	-	<50	<50	<50	<50	<50	<50
Aromatic C10 - C36		-	-	<50	<50	60	70	60	180



Analyte (µg/L)	Human Health/ Environmental Assessment Criteria	Groundwater Beneath Former Landfill				Perched Water Within Former Landfill			
		Cross-gradient (MW02)		Down-gradient (MW06, MW09)		Cross-gradient (MW03, MW04, MW08)		Down-gradient (MW05, MW07)	
		Min	Max	Min	Max	Min	Max	Min	Max
Aliphatic/Aromatic C10 - C36	600			<50	<50	60	70	60	730

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

An elevated concentration of aliphatic/aromatic hydrocarbons which exceeded the Environmental and Human Health Assessment Criteria was detected in the sample from MW05 (730 µg/L C₁₀-C₃₆) in the second monitoring round. All other samples tested however had concentrations of aliphatic/aromatic hydrocarbons (C₁₀-C₃₆) which were below the Environmental Assessment Criteria.

With the exception of the sample from MW05 in the second monitoring round, the concentrations of aliphatic/aromatic hydrocarbons (C₁₀-C₃₆) were lower than concentrations of TPH (C₁₀-C₃₆) in the samples analysed (refer to **Appendix D.2.2**). For example, in the third monitoring round, the sample from MW04 had a TPH (C₁₀-C₃₆) concentration of 1420 µg/L, and an aliphatic/aromatic hydrocarbon (C₁₀-C₃₆) concentration of 60 µg/L. The difference between these results is attributed to the removal of polar based organics²⁰ via silica gel clean up which is a standard procedure for the analysis of aliphatic/aromatic hydrocarbons. The aliphatic/aromatic hydrocarbons remaining in the sample following silica gel clean up are largely petroleum derived non-polar hydrocarbons. Conversely it should be noted that TPH analysis includes all recoverable hydrocarbons (polar and non-polar) and includes non-petroleum based hydrocarbons.

In the fourth monitoring round samples were analysed for TPH, and TPH 'with silica gel clean up'. The analytical results for the on-site monitoring wells are shown in **Table 7-10**, and the off-site monitoring wells in **Table 7-11**.

■ **Table 7-10 Total Petroleum Hydrocarbons, 7 October 2009, On-site Locations**

Analyte (µg/L)	Human Health/ Environmental Assessment Criteria	Groundwater Beneath Former Landfill			Perched Water Within Former Landfill				
		Cross-gradient	Down-gradient		Cross-gradient			Down-gradient	
			MW02	MW06	MW09	MW03	MW04	MW08	MW05
Total Petroleum Hydrocarbons									
C6 - C9		<20	30	<20	<20	50	50	50	50
C10 - C14		<50	350	60	70	410		370	590
C15 - C28		<100	960	180	120	880		1190	1300

²⁰ Such as fatty acids, lipids, proteins, sugars etc.

Analyte (µg/L)	Human Health/ Environmental Assessment Criteria	Groundwater Beneath Former Landfill			Perched Water Within Former Landfill				
		Cross- gradient	Down-gradient		Cross-gradient			Down-gradient	
		MW02	MW06	MW09	MW03	MW04	MW08	MW05	MW07
C29 - C36		<50	220	60	60	290		410	270
C10 - C36		<50	1530	310	250	1580		1970	2160
Total Petroleum Hydrocarbons (Silica Gel Clean Up)									
C10 - C14		<50	<50	<50	<50	<50		<50	<50
C15 - C28		<100	<100	<100	<100	<100		<100	<100
C29 - C36		<50	<50	<50	<50	<50		<50	<50
C10 - C36	600	<50	<50	<50	<50	<50		<50	<50

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

■ **Table 7-11 Total Petroleum Hydrocarbons, 7 October 2009, Off-site Locations**

Analyte (µg/L)	Human Health/ Environmental Assessment Criteria	Off-site Wells				Drain
		Up-gradient	Up-gradient	Cross-gradient	Down-gradient	Down-gradient
		MW01	CR14	CR15	CR13	
Total Petroleum Hydrocarbons						
C6 - C9		<20	<20	<20	<20	
C10 - C14		60	<50	<50	110	80
C15 - C28		130	<100	160	330	350
C29 - C36		60	<50	100	80	130
C10 - C36		250	<50	260	520	560
Total Petroleum Hydrocarbons (Silica Gel Clean Up)						
C10 - C14		<50	<50	<50	<50	<50
C15 - C28		<100	<100	<100	<100	<100
C29 - C36		<50	<50	<50	<50	<50
C10 - C36	600	<50	<50	<50	<50	<50

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

Table 7-10 and Table 7-11 show that whilst elevated concentrations of TPH were detected, the concentrations of TPH with silica-gel clean up were below laboratory detection limits in the majority of samples analysed. In regard to the TPH detected in the fourth monitoring round, the laboratory advised that the main source of hydrocarbons found were not petroleum based, however the source of the hydrocarbons could not be confirmed.

These findings, and those for the analysis of aliphatic/aromatic hydrocarbons (with the exception of the aliphatic/aromatic sample result from MW05 in the second monitoring round) show that the elevated concentrations of TPH detected in groundwater, are likely to be comprised of mainly non-polar and non-petroleum based organic substances present in landfill leachate which are being generated through the decomposition of putrescible materials.



7.2.4. Volatile Organic Compounds

The analytical results for the volatile organic compounds (VOC) found in samples with concentrations above laboratory detection limits are summarised in **Table 7-12** for the on-site monitoring wells, and **Table 7-13** for the off-site monitoring wells.

■ **Table 7-12 Volatile Organic Compounds, On-site Locations**

Analyte (µg/L)	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill				Perched Water Within Former Landfill			
			Cross-gradient (MW02)		Down-gradient (MW06, MW09)		Cross-gradient (MW03, MW04, MW08)		Down-gradient (MW05, MW07)	
			Min	Max	Min	Max	Min	Max	Min	Max
Monocyclic Aromatic Hydrocarbons										
Benzene	2000	10	<1	<1	<1	2	<1	6	3	5
Toluene	180	1000	<2	<2	-	10	<2	<2	<2	10
Ethylbenzene	80	150	<2	<2	<2	2	<2	11	<2	5
meta- & para-Xylene	340	200	<2	<2	<2	2	<2	10	<2	9
ortho-Xylene	640	1400	-	-	<2	<2	<2	4	<2	3
Isopropylbenzene	30	150	-	-	<5	<5	<5	5	<5	<5
n-Propylbenzene	128		-	-	<5	<5	<5	8	<5	<5
1,2,4-Trimethylbenzene	33		-	-	<5	<5	<5	24	<5	14
p-Isopropyltoluene	85		-	-	<5	<5	<5	29	<5	18
Halogenated Aliphatic Compounds										
Dichlorodifluoromethane	390	390	-	-	<50	<50	<50	60	<50	<50
Halogenated Aromatic Compounds										
Chlorobenzene	55	300	-	-	<5	7	<5	8	7	26
1,4-Dichlorobenzene	60	40	-	-	<5	11	<5	6	<5	47
1,2-Dichlorobenzene	160	1500	-	-	<5	<5	<5	<5	<5	8
Polycyclic Aromatic Hydrocarbons										
Naphthalene	85	70	-	-	<7	20	<7	20	10	24

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.



■ Table 7-13 Volatile Organic Compounds, Off-site Locations

Analyte (µg/L)	Environmental Assessment Criteria	Environmental Assessment Criteria	Off-site Wells						Drain	
			Up-gradient (CR14, MW01)		Cross-gradient (CR15)		Down-gradient (CR13)			
			Min	Max	Min	Max	Min	Max	Min	Max
Monocyclic Aromatic Hydrocarbons										
Benzene	2000	10	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	180	1000	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	80	150	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	340	200	<2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	640	1400	<2	<2	<2	<2	<2	<2	<2	<2
Isopropylbenzene	30	150	<5	<5	<5	<5	<5	<5	<5	<5
n-Propylbenzene	128		<5	<5	<5	<5	<5	<5	<5	<5
1,2,4-Trimethylbenzene	33		<5	<5	<5	<5	<5	<5	<5	<5
p-Isopropyltoluene	85		<5	<5	<5	<5	<5	<5	<5	<5
Halogenated Aliphatic Compounds										
Dichlorodifluoromethane	390	390	<50	<50	<50	<50	<50	<50	<50	<50
Halogenated Aromatic Compounds										
Chlorobenzene	55	300	<5	<5	<5	<5	<5	<5	<5	<5
1,4-Dichlorobenzene	60	40	<5	<5	<5	<5	<5	<5	<5	<5
1,2-Dichlorobenzene	160	1500	<5	<5	<5	<5	<5	<5	<5	<5
Polycyclic Aromatic Hydrocarbons										
Naphthalene	85	70	<1	<1	<1	<1	<1	<1	<1	<1

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

VOCs were detected in samples from the perched water within the Landfill, and from groundwater samples from down-gradient monitoring wells within the Landfill. The concentrations of VOCs detected did not exceed the Environmental Assessment Criteria.

1,4-Dichlorobenzene was detected in a sample of perched water from MW05 in the second monitoring round with a concentration which exceeded the Human Health Assessment Criteria. All other samples of perched water from MW05, the other groundwater monitoring wells and the drain, had concentrations of 1,4-Dichlorobenzene which were below the Human Health Assessment Criteria.

VOCs were not detected in any off-site groundwater samples, or in water samples from the drain.



7.2.5. Semi-Volatile Organic Compounds

The analytical results for semi-volatile organic compounds (SVOC) found in samples with concentrations above laboratory detection limits are summarised in **Table 7-14** for the on-site monitoring wells, and **Table 7-15** for the off-site monitoring wells.

■ **Table 7-14 Semi-Volatile Organic Hydrocarbons, On-site Locations**

Analyte (µg/L)	Environm ental Assesse ment Criteria	Human Health Assesse ment Criteria	Groundwater Beneath Former Landfill						Perched Water Within Former Landfill					
			Up-gradient (MW01)		Cross-gradient (MW02)		Down-gradient (MW06, MW09)		Cross-gradient (MW03, MW04, MW08)		Down-gradient (MW05, MW07)			
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Polycyclic Aromatic Hydrocarbons														
Phenanthrene	2	-						<1	1.8	<1	1.1	<1	<1	
Phenolic Compounds														
2-Methylphenol	13	200	-	-	-	-	-	<1	2	<1	<3.8	<1	225	
3- & 4-Methylphenol	543		-	-	-	-	-	<2	<2	<2	<7.7	<2	49	
2,4-Dimethylphenol	2		730	-	-	-	-	-	<1	1.2	<1	<3.8	<1	4.6
2,4-Dichlorophenol	120		200	-	-	-	-	-	<1	<1	<1	<3.8	<1	1.3
4-Chloro-3-methylphenol	350		350	-	-	-	-	-	<1	<1	<1	<3.8	<1	36.4
2,4,5-Trichlorophenol	0.5	1	-	-	-	-	-	-	<1	<1	<1	<3.8	<1	1

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

■ **Table 7-15 Semi-Volatile Organic Compounds, Off-site Locations**

Analyte (µg/L)	Environmental Assessment Criteria	Human Health Assessment Criteria	Off-site Wells						Drain	
			Up-gradient (CR14, MW01)		Cross-gradient (CR15)		Down-gradient (CR13)			
			Min	Max	Min	Max	Min	Max	Min	Max
Polycyclic Aromatic Hydrocarbons										
Phenanthrene	2	-	<1	<1	-	-	<1	<1	<1	<1
Phenolic Compounds										
2-Methylphenol	13	200	<1	<1	-	-	<1	<1	<1	<1
3- & 4-Methylphenol	543		<2	<2	-	-	<2	<2	<2	<2
2,4-Dimethylphenol	2	730	<1	<1	-	-	<1	<1	<1	<1
2,4-Dichlorophenol	120	200	<1	<1	-	-	<1	<1	<1	<1
4-Chloro-3-methylphenol	350	350	<1	<1	-	-	<1	<1	<1	<1
2,4,5-Trichlorophenol	0.5	1	<1	<1	-	-	<1	<1	<1	<1

Note: The Environmental and Human Health Assessment Criteria are defined in Section 4.3.

As shown **Appendix D.2.2**, elevated concentrations of phenolic compounds which exceeded the Environmental and Human Health Assessment Criteria were found in a sample of perched water from MW05 in the second monitoring round. All other samples of perched water from MW05, the



other groundwater monitoring wells and the drain, had concentrations of phenolic compounds which were below the Environmental and Human Health Assessment Criteria.

All other SVOC analytes were below the Environmental Assessment Criteria in the samples analysed. Organo-pesticides, oxygenated compounds, fumigants, and PCB were not detected in any of the groundwater samples tested. SVOCs were not detected in groundwater sampled from off-site wells, or in water sampled from the drain.

7.3. Landfill Gas Monitoring

Historical Monitoring

LCC has undertaken an ongoing landfill gas monitoring program (2000 to 2008) from monitoring wells fitted with free-venting gas well caps installed around the boundary of the site. The monitoring program has detected low levels of methane gas over this time period with concentrations which were well below the LEL for methane (5%). These findings indicate that gas from the Landfill is unlikely to pose an unacceptable risk to off-site receptors (refer to **Section 2.9.4**).

Concentrations of methane ranged between 0% and 1.7% along the eastern boundary of the site, 0% and 0.3% along the northern, southern and western boundaries.

Concentrations of CO₂ ranged between 0% and 11.2% along the eastern boundary of the site, 0% to 6.3% along the northern boundary, 0% and 7.3% along the western boundary and 0% to 10.1% along the southern boundary.

Full copies of the gas monitoring data have been included in **Appendix D.3.1**.

Landfill Gas Monitoring

As part of the Investigation landfill gas monitoring wells were installed within the Landfill, as described in **Section 5.2**. Five rounds of landfill gas monitoring have been undertaken, the results of which are summarised in **Appendix D.3.2**. Six rounds of landfill gas monitoring were undertaken by SKM for the Investigation. The methodology used for landfill gas monitoring is summarised in **Section 5.4**.

Elevated concentrations of methane which exceeded the LEL were detected in monitoring wells MW04, MW05, MW08 and MW09 in the majority of monitoring rounds undertaken during the Investigation. Maximum concentrations found ranged between 49.7% (MW07) and 99.3% (MW08).

Elevated concentrations of carbon dioxide have also been detected in these wells. Maximum concentrations found ranged between 9.5% (MW07) and 15.5% (MW04).

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It should be noted that portable landfill gas analysers report hydrocarbon vapours in addition to methane. Consequently a methane reading from the analyser can be comprised of methane and other hydrocarbon vapours.

Gas samples from the monitoring wells MW03, MW04, MW05, MW07, and MW08 were collected by Simtars on the 29 October 2009 and analysed for 73 volatile organic compounds (VOC). A copy of the report prepared by Simtars on the gas analysis is provided in **Appendix F**. The analytical results from the VOC gas analysis are summarised in **Table 7-16**. It should be noted that the VOC analytical methodology used by Simtars does not include methane. Simtars advised that there were unable to test for methane in the VOC gas analysis.

■ **Table 7-16 Volatile Organic Compound Gas Analysis**

Analyte	NOHSC Guideline		MW03	MW04	MW05	MW07	MW08
	TWA (mg/m ³)	STEL (mg/m ³)					
Rate of Flow (L/min)			<0.005	<0.3	<0.03	<0.03	<0.05
Aliphatic Hydrocarbons							
2-methylbutane			<0.2	1.1	0.2	0.6	2.1
n-pentane	1770	2210	<0.2	1.5	<0.2	0.6	1.3
2-methylpentane			<0.2	0.9	<0.2	0.5	1.9
3-methylpentane			<0.2	0.7	<0.2	0.3	1.3
methylcyclopentane			<0.2	0.3	<0.2	0.3	1
n-hexane	176	-	<0.2	1.1	0.3	0.6	2.3
3-methylhexane			<0.2	0.9	<0.2	0.4	1.6
cyclohexane	1055	-	<0.2	0.6	<0.2	0.4	1.6
methylcyclohexane	1610	-	<0.2	2.7	0.6	0.7	4.1
2,2,4-trimethylpentane			<0.2	0.6	<0.2	0.3	1.8
n-heptane	1640	2050	<0.2	0.7	<0.2	0.4	1.7
n-octane	1400	1750	<0.2	0.2		0.4	1.5
n-nonane	1050	-	<0.2	<0.2	2	2.5	7.7
n-decane			<0.2	<0.2	5.1	1.7	14.7
n-undecane			<0.2	<0.2	1.8	<0.2	7.8
n-dodecane			<0.2	<0.2	<0.2	<0.2	0.3
alpha-pinene			<0.2	<0.2	<0.2	<0.2	2.4
D-limonene			<0.2	<0.2	<0.2	<0.2	1.2
Chlorinated Hydrocarbons							
chlorobenzene	46	-	<0.2	0.8	0.7	<0.2	<0.2
1,4-dichlorobenzene			<0.2	0.8	2.1	1.1	<0.2
Aromatic Hydrocarbons							
benzene	16	-	<0.2	0.6	0.3	0.7	0.7
ethylbenzene	434	543	<0.2	0.1	1.1	0.2	6.6
isopropylbenzene			<0.2	2.1	1.5	1.5	1.9
1,2,3-trimethylbenzene			<0.1	0.2	<0.1	0.4	<0.1
1,2,4-trimethylbenzene	123	-	<0.2	0.5	3.5	0.6	6.2
1,3,5-trimethylbenzene			<0.2	<0.1	1.7	0.2	1.8
p/m-xylene			<0.2	<0.1	2.7	0.8	5.2
o-xylene	350	655	<0.2	0.1	0.7	<0.1	0.7
Ketones							
acetone	1185	2375	<0.2	<0.2	0.6	<0.2	<0.2
Alcohols							
2-ethyl hexanol			<1.0	<1.0	3.8	4.9	<1.0



Analyte	NOHSC Guideline		MW03	MW04	MW05	MW07	MW08
	TWA (mg/m ³)	STEL (mg/m ³)					
Total VOC			<2.0	374	342	481	666

Note: The NOHSC Guidelines are described further in Section 4.3.

Table 7-16 shows that a range of VOCs were detected in the gas samples collected with concentrations which were below the NOHSC Guideline. Simtars interpretation of the results indicated the profile of gases in the four perched wells was consistent with a mineral turpentine solvent mixture.

The rate of flow was measured using a portable flow meter by Simtars prior to sampling at each location. The rate of flow varied within each perched well, and ranged between <0.005 L/min and 0.3 L/min.

Landfill Vent Monitoring

In the majority of monitoring rounds, low or non-detectable concentrations of methane and carbon dioxide were detected from the monitoring ports attached to the landfill vents (refer to **Appendix D.3.2**). This may be attributed to atmospheric dilution in the vents, as evident from measured oxygen concentrations at approximately 21%. In the monitoring round on 4 November 2009, an elevated detection of methane which exceeded the LEL was found in Vent 2; all other vents however had concentrations of methane which were below the LEL or below detection limits.



8. Qualitative Risk Assessment

8.1. Risk to Human Health

8.1.1. Capping Materials

For the majority of the Landfill (approximately 93% of the landfill surface), the surface material was found to be comprised of an approximately 1m thick capping layer comprised of silty sand (0-0.1 m thickness) and an underlying clay based material comprised of sandy clay to clayey sand (0.2-0.8 m thickness). The capping layer of the eastern embankment of the Landfill (approximately 7% of the landfill surface) was found to be comprised of poorly structured clayey sand (0.2-0.5 m thickness).

The findings of the soil sampling of the capping material indicate that potential contaminants are at concentrations which would not pose an unacceptable risk to future site users.

The capping layer of the eastern embankment of the Landfill was found to be comprised of poorly structured clayey sand (0.2-0.5 m thickness). The thickness of the surface material at this location does not provide an adequate barrier between the surface and the waste material below. It is recommended that the capping layer of the eastern embankment be built up to provide a minimum thickness of 0.5 m for reasons outlined in Section 9.1.

8.1.2. Landfill Gases

Monitoring of landfill gases from the perched wells indicates that the waste materials are generating methane at concentrations well above the LEL. Landfill gas which includes methane, is considered to pose a risk to future site users as an asphyxiant and flammable gas (refer to Section 4.2.2). The primary risk to future site users will be the migration of gases along pathways created by foundations (including piles) and underground services or service trenches into buildings located on the site, or other confined spaces (e.g. service pits). Controls will need to be put in place to mitigate potential risks to future site users; these are summarised in Section 9.

Ambient odours from the landfill were not observed during the undertaking of the investigation. Accordingly with the capping layer in place, landfill odours are not expected to be nuisance or concern post development.

A range of volatile organic compounds have been detected in landfill gases at concentrations which were below the NOHSC Guidelines, and accordingly are unlikely to pose an unacceptable risk to future uses of the site.



8.2. Risk to the Environment

Two groundwater systems have been observed on the site. These include:

- groundwater within the weathered sandstone beneath the Landfill; and
- perched groundwater within the Landfill.

It is considered highly likely that the perched water is in connection with the groundwater in the weathered sandstone, and these systems combine down-gradient of the Landfill for reasons outlined **Section 6.2**. These groundwater systems flow in a north-easterly direction towards Slacks Creek. Slacks Creek is located approximately 320 m east of the site, and is considered to be the main environmental receptor of groundwater from the site. Accordingly, the potential risks to ecosystems in the creek are assessed by comparison of contaminant concentrations in site groundwater to ecosystem-based Environmental Assessment Criteria, and Human Health Assessment Criteria associated with recreational contact.

Metals

Elevated concentrations of copper, lead, nickel and zinc with concentrations above the Environmental Assessment Criteria have been found in groundwater samples from monitoring wells up-gradient of the Landfill, and within the Landfill. Lead was found in a monitoring well up-gradient of the Landfill with a concentration which exceeded the Human Health Assessment Criteria. The highest concentrations detected were from the up-gradient monitoring well (MW01). An increase in the concentration of metals was not observed in the monitoring wells down-gradient of the Landfill. These findings indicate that elevated concentrations of metals occur in the vicinity (and up-gradient) of the site, however it is unknown whether the elevated concentrations are associated with surrounding industrial land use, naturally occurring background conditions, or a combination of both these factors. Leachate from the Landfill is unlikely to be having a deleterious effect on groundwater with respect to metals.

Ammonia

Ammonia was detected at concentrations which exceed the Environmental and Human Health Assessment Criteria in groundwater samples from monitoring wells within and down-gradient of the Landfill. Ammonia is widely recognised as one of the most prevalent and continuous contaminants sourced from former landfills (Kjeldsen et al 2002). The site investigation data for CR13 which is a monitoring well located down-gradient of the Landfill shows that the concentrations of ammonia have attenuated from 39.9 mg/L in 2000 (refer to **Section 2.9.2**) to approximately 10 mg/L in 2008-09. Notwithstanding this, elevated concentrations of ammonia were detected in other monitoring wells along the eastern boundary of the Landfill.



A review of the Australian Drinking Water Guidelines (2004) and the World Health Organisation Guidelines for Drinking-water Quality²¹ was undertaken to determine the human health implications of high concentrations of ammonia in water. Conclusions from these guidelines indicate that ammonia is not of direct importance for health (via ingestion) in concentrations to be expected in drinking water. The Australian Drinking Water Guideline value derived is instead based on other considerations such as attacking copper pipes and fittings, or nuisance growths of micro-organisms which may lead to skin irritation. Accordingly the risk to human health through ingestion from ammonia in groundwater is considered to be low. It is noted, however, that ammonia can have a toxic effect on humans only if the intake becomes higher than the detoxification capacity of the body. In studies with animals, high doses of ammonia (over 100 mg/kg body weight per day) have generally not produced any significant toxic effects.

Ammonia is a known toxicant to fish and can have a deleterious effect on aquatic ecosystem health. However factors such as dilution would lower the concentration of ammonia prior to discharge to the nearest receiving watercourse (Slacks Creek, 320 m east of the site).

Nitrate

Nitrate concentrations in samples from CR13 which is a monitoring well located down-gradient of the Landfill consistently exceeded the Environmental Assessment Criteria between November 2004 and May 2006. However since July 2006, the concentrations of nitrate in samples from CR13 have been below the Environmental Assessment Criteria (refer to **Section 2.9.2**).

Total Phosphorus and Phosphate

Total phosphorus was found in groundwater samples with concentrations which exceeded the Environmental Assessment Criteria in 2002. Total phosphorus has not been monitored since 2002, however phosphate was included in the monitoring program from 2004-2008 and was found to be below laboratory detection limits (refer to **Section 2.9.2**).

Hydrocarbons

Elevated concentrations of hydrocarbons have been consistently detected in groundwater. The analytical results and interpretation of the source hydrocarbons by the laboratory indicate that the elevated concentrations of hydrocarbons found in groundwater samples are predominately organic substances being produced by the Landfill through the decomposition of putrescible materials rather than petroleum based hydrocarbons (e.g. oils).

An elevated concentration of petroleum based aliphatic hydrocarbons was detected in one groundwater sample in the second monitoring round with a concentration which exceeded the Environmental and Human Health Assessment Criteria. However, no other exceedances of the

²¹ WHO, 1996, Ammonia in Drinking-water. World Health Organisation, Geneva.



Environmental and Human Health Assessment Criteria for petroleum based hydrocarbons was found.

Volatile Organic Compounds

A range of VOCs were detected in groundwater samples with concentrations which were below the Environmental Assessment Criteria.

An elevated concentration of 1,4-Dichlorobenzene which exceeded the Human Health Assessment Criteria was found in a perched water sample from one of the monitoring wells (MW05) in the second monitoring round. On the basis that elevated concentrations of 1,4-Dichlorobenzene which exceed the Human Health Assessment Criteria were not consistently found and dilution factors in the receiving environment, the risk to human health from 1,4-Dichlorobenzene is considered to be low. All other samples from MW05 and samples from the other groundwater monitoring wells had concentrations of phenolic compounds which were below detection limits or below the Human Health Assessment Criteria.

Semi-Volatile Organic Compounds

The majority of SVOCs including PAH (with the exception phenanthrene), pesticides, oxygenated compounds, fumigants, and PCB were not detected in any of the groundwater samples tested. Phenanthrene was detected in some of the samples analysed with concentrations below the Environmental Assessment Criteria.

An elevated concentration of phenolic compounds which exceeded the Environmental Assessment Criteria was found in a perched water sample from one of the monitoring wells (MW05) in the second monitoring round. All other samples from MW05 and samples from the other groundwater monitoring wells had concentrations of phenolic compounds which were below detection limits or below the Environmental Assessment Criteria. On the basis that elevated concentrations of phenolic compounds which exceed the Environmental Assessment Criteria were not consistently found, the risk to the receiving environment from phenolic compounds is considered to be low.

Summary of Findings

Slacks Creek is a highly disturbed system which has been heavily modified from its natural state.

It is considered likely that landfill leachate from the site which contains elevated concentrations of ammonia and organics is potentially having some deleterious impact on Slacks Creek. It should be noted that the site is located within a large urban catchment with residential and commercial/industrial areas which would also be contributing to the degradation of Slacks Creek.

Landfill leachate is discharged from the site via seepages into the drain, and groundwater migration. Leachate discharged from the site will be diluted via other sources of surface water



discharged to the drain, groundwater occurring in the vicinity of the site, and water present in Slacks Creek.

As the Landfill has not been constructed with an engineered liner or leachate collection system it is not considered feasible to modify the Landfill to effectively capture and treat landfill leachate. The concentration of contaminants in leachate from the Landfill will decrease with time, as the putrescible material in the Landfill degrades. This is evident from the decrease in ammonia concentrations in monitoring well CR13 from 2000 to 2008-09. Accordingly the most appropriate approach for the ongoing management of the site is considered to be the continuation of the monitoring program currently being undertaken to confirm that attenuation of contaminants is occurring over time. The proposed development will also need to be constructed in a way which minimises percolation of rainfall into the landfill (by contouring and surface drainage design) and which does not exacerbate potential pathways (e.g. through uncontrolled breaches in the capping layer) on the site. Construction methods for the proposed development are discussed further in **Section 9**.

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9. Remediation Strategy

This section provides a summary of the remediation strategy proposed for the development of the site. The key remedial measures required for the redevelopment of the site include:

- the building up of the capping layer in the eastern embankment of the site;
- the inclusion of gas protection measures in buildings;
- the re-construction of gas vents closed during the construction phase for the proposed development;
- the location of services above the capping material where practicable;
- the use of sensitive construction and piling measures to minimise disturbance to the capping material;
- the use of low permeability materials or membranes for proposed water storage areas on the site;
- the undertaking of an ongoing monitoring program during and post development of the site; and
- the confirmation that former underground tank on the site has been removed.

These measures are summarised as follows and described in further detail in the Remediation Plan prepared for the Project.

9.1. Capping Layer

The capping layer of the eastern embankment of the Landfill was found to vary from 0.2-0.5 m in thickness. The capping layer of the eastern embankment will be built up to provide a minimum thickness of 0.5 m using uncontaminated fill material. This has been recommended for the following reasons:

- As the embankment may be acting as a pathway for the venting of landfill gases, it is not recommended that a low permeability material be used to build up the embankment, or the thickness of the capping material be significantly increased (e.g. to 1 m). Such a material could potentially change the landfill gas migration and venting regime along the embankment.
- The primary function of the capping layer along the embankment is considered to be a barrier to prevent the accidental uncovering of underlying fill material. A 0.5 m thickness capping layer is considered sufficient for this purpose. It should be noted that this area of the site will not be actively used post development (i.e. it will remain as a grass embankment).



- The building up of the capping layer to 1 m within the eastern embankment would not significantly reduce the quantity or quality of leachate generated, or mitigate the discharge of leachate from the site.

9.2. Gas Protection

Three buildings have been proposed on the site including:

- main facilities building with an open air viewing stand;
- kennel block; and
- maintenance shed.

The proposed location of these buildings is shown in Figure 2, Appendix A.

Main Facilities Building

The boreholes drilled for the Preliminary Geotechnical Investigation shows that eastern half of the Main Facilities Building is likely to be located over soil/waste materials, and the western half over soil materials. Further ground characterisation during the detailed design phase will confirm the ground conditions beneath this building.

It is proposed that the Main Facilities Building will be founded on piles and a slab suspended off-the-ground. An open void will be located between the slab and the ground to allow for the free venting of air beneath the building.

Kennel Block and Maintenance Shed

The boreholes drilled for the Preliminary Geotechnical Investigation show that ground beneath the Kennel Block and Maintenance Shed is unlikely to contain waste materials. Further ground characterisation during the detailed design phase will confirm this. Slab-on-ground foundations are proposed for these buildings. Gas protection measures proposed for these buildings include:

- well-constructed ground slab located above the capping layer;
- low-permeability gas/vapour membrane;
- the location of services above the capping layer and entering buildings from the side (rather than through floor slabs); and
- passive in-ground venting, with the venting system being located above the capping layer and beneath the floor slab to allow for the venting of landfill gases.

During the detailed design phase of the Project, monitoring may be undertaken at the location of these proposed buildings to characterise the Landfill gas regime at these locations. Should the findings of landfill gas monitoring indicate that the gas regime at these locations is of low risk, the protection measures proposed may be amended in consultation with DERM.

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9.3. Landfill Gas Vents

The proposed development will involve the removal of two of the existing landfill gas vents. It is proposed that two additional vents will be constructed in the vicinity of the vents being removed during the construction process.

The height of the vents will be reduced to allow for improved viewing and the functioning of the site as a greyhound racing facility. A reduction in the height of the vents is not expected to impair their functionality.

9.4. Services

All services will either run above or within the capping material. Where services are located within the capping material, they will be exposed to the atmosphere to vent potential landfill gases prior to a worker entering any confined spaces. Services will not be located beneath the capping layer.

9.5. Construction Methods

Piling Methods

Piling will be required for the construction of the Main Facilities Building. The piles will be founded on the sandstone strata beneath the site. Piling will require disturbance to the capping material. The capping material surrounding the piles will be resealed through packing a low permeability clay based material around the pile.

It is noted that groundwater within the sandstone is already affected by leachate generated from the landfill. The absence of an engineered clay liner over the site, and waste materials directly overlying the sandstone in parts of the site has resulted in connectivity between the landfill leachate and the groundwater in the sandstone. Therefore pathways already exist between the landfill leachate and the sandstone. Accordingly techniques involving the advancement of piles through bentonite slurry casing are considered unnecessary.

Racing Track

Preloading will be undertaken over the racing area to accelerate the settlement process and stabilise the surrounding ground. Groundwater mounding may occur as a result of preloading however it is not expected to result in any further risk to human health or the environment. Pad foundations are to be used for the running rail around the racing track and lighting following preloading. This will negate the need to pile through the Landfill cap for the running rail.



9.6. Stormwater and Surface Drainage

Surface drainage and stormwater management features of the proposed development are described in the *Infrastructure Servicing and Site Based Stormwater Management Plan* (SKM, 2009). The main features of the proposed stormwater management system are shown in **Appendix B**.

Stormwater collected from the surface of the site will be diverted to vegetated swales to capture litter, suspended solids and other matter prior to discharging into the drainage system. The installation of swales minimises the need to excavate through the surface material and into the waste material below.

During periods of heavy rainfall, surface water is to be captured and temporarily held within retention basins on-site. The retention basin will be lined high density poly-ethylene (HDPE) liners or equivalent to prevent vertical seepage into the Landfill.

The drain skirting the south and east of the site is to be managed by LCC as an easement. It is proposed that some restoration of this drain be undertaken by LCC as part of the redevelopment. The level of restoration to be undertaken will be confirmed during the detailed design phase. It is not anticipated that the restoration work will involve disturbance to the Landfill.

9.7. Monitoring

Monitoring of groundwater quality and landfill gases will be undertaken during the construction of the Project.

Post development the site will be managed under a Site Management Plan (SMP). The SMP will be prepared during the detailed design phase and held on record with DERM.

The SMP will provide a framework for ongoing environmental monitoring as well as stipulate any ongoing operational controls for the site.



10. Conclusions and Recommendations

10.1. Project Overview

Greyhounds Queensland Limited (GQL) is planning the development of the Logan Greyhound Facility ("the Project") at Cronulla Park, Slacks Creek ("the site"). Cronulla Park was formerly used a landfill ("the Landfill") between the 1970s and 1980s.

GQL engaged Sinclair Knight Merz (SKM) to undertake a Stage 1 and Stage 2 Contaminated Site Investigation ("the Investigation") of the site. The aims of the Investigation were to establish:

- whether the site in its current condition poses an unacceptable risk to human health and/or the receiving environment; and
- whether remediation will be required to enable the site to be used for a commercial land use (greyhound racing facility), and if so, the required remedial measures.

10.2. Site Conditions

Surface Material

For the majority of the Landfill, the surface material was found to be comprised of a layer of silty sand (0-0.1 m thickness) and an underlying clay based material comprised of sandy clay to clayey sand (0.2-0.8 m thickness).

The surface layer of the eastern embankment of the Landfill was found to be comprised of poorly structured clayey sand (0.2-0.5 m thickness).

Waste Material

Where encountered, waste materials varied in thickness from 1.2 to 10.5 metres in thickness. An engineered liner was not found beneath the Waste Material.

Natural Material

The natural material was generally a sandy or silty clay of weathered sandstone. This was underlain by the coarse grained sandstone.

Groundwater

Two groundwater systems have been observed on the site. These include:

- groundwater within the weathered sandstone beneath the Landfill; and
- perched water within the Landfill.

The perched water is likely to be in connection with the groundwater in the weathered sandstone beneath the Landfill. These two systems also combine together down-gradient of the Landfill.

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These groundwater systems flow in a north-easterly direction to Slacks Creek which is located approximately 320 m east of the site.

Slacks Creek is the main environmental receptor of both groundwater and surface water from the site.

10.3. Analytical Results

Capping Material

Shallow soils in the capping material at the site were found to contain contaminant concentrations which were below the Human Health Assessment Criteria. Shallow soils at the site would subsequently not pose an unacceptable risk to human health.

Landfill Gases

Monitoring of landfill gases from the perched wells indicates that the waste materials are generating methane at concentrations well above the LEL. Landfill gas which is primarily methane, is considered to pose a risk to future site users as an asphyxiant and flammable gas. Volatile organic compounds have been detected in landfill gases at concentrations which were below the NOHSC Guidelines, and accordingly are unlikely to pose an unacceptable risk to future uses of the site.

Groundwater

Slacks Creek is a highly disturbed system which has been heavily modified from its natural state. It is considered likely that landfill leachate from the site which contains elevated concentrations of ammonia and organics is potentially having some deleterious impact on water quality in Slacks Creek. Residential and commercial/industrial areas located within the catchment will also contributing to the degradation of Slacks Creek.

On the basis that the Landfill has not been constructed with an engineered liner or leachate collection system it is not considered feasible to modify the Landfill to effectively capture and treat landfill leachate. The concentration of contaminants in leachate from the Landfill will decrease with time as the putrescible material in the Landfill degrades. This process is occurring as evident from the decrease in ammonia concentrations in groundwater from 2000 to 2008-09. The most appropriate approach for the ongoing management of the site in regard to groundwater is considered to be the continuation of the monitoring program currently being undertaken to confirm that attenuation of contaminants is occurring over time.

10.4. Suitability of Site for Proposed Development

Based on the findings of the Investigation the site is considered to be suitable for the proposed development and use provided that potential risks relating to landfill gas and contaminated groundwater are addressed in the design, construction, and future management stages of the site. It

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is intended the site will be constructed in accordance with a Remediation Plan (RP), and managed post-construction under a Site Management Plan (SMP). The SMP will provide a framework for ongoing environmental monitoring as well as stipulate any ongoing operational controls for the site, and will be administered by LCC. The SMP will include groundwater and landfill gas monitoring at the site.

The key remedial measures required for the redevelopment of the site include:

- the building up of the capping layer in the eastern embankment of the site;
- the inclusion of gas protection measures in buildings;
- the re-construction of gas vents closed for the proposed development;
- the location of services above the capping material where practicable;
- the use of sensitive construction and piling measures to minimise disturbance to the capping material;
- the use of low permeability materials or membranes for proposed water storage areas on the site;
- the undertaking of an ongoing monitoring program during and post development of the site; and
- the confirmation that former underground tank on the site has been removed.

Further detail regarding the proposed remediation strategy are to be provided in the Remediation Plan which is being prepared for the redevelopment of the site.



11. References

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Appendix A Figures

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Logan Greyhound Facility Supplementary Site Investigation

Legend



Site Boundary

Notes:

1. Aerial Photograph - Google Earth Pro, 2008
2. Scale and features shown are approximate locations only

Figure 1
Site Location Plan





LEGEND

- BOREHOLES**
- Landfill Vent
 - 2009 Shallow Monitoring Bore
 - 2009 Deep Monitoring Bore
 - 2009 Shallow Soil Sampling Location
 - Geotechnical Borehole
 - Historical Gas Sampling Well
 - Historical Soil Bore
 - Historical Groundwater Well
- LANDFILL**
- Municipal and Light Industrial Waste
 - Municipal Waste-Domestic
 - Animal and Sanitary Waste
 - Tyre and Steel Waste
 - No Waste Disposal (Tread Area)
 - Workshop Washdown Area
 - General Waste



CAD DRAWING		AMENDMENTS		Scale		Project No.		Project Name		Client		Drawn		Checked		Approved		Date		Project No.		Project Name		Client		Drawn		Checked		Approved		Date	
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CAD DRAWING DO NOT MANUALLY AMEND AMENDMENTS		SKM Sinclair Knight Merz Pty Ltd ACN 001 024 085 32 Cordella Street South Brisbane QLD 4101 Telephone (07) 3026 7100 Facsimile (07) 3026 7300		SCALE 1:250 DESIGNED DRAWN CHECKED APPROVED DATE PROJECT NO.	LOCALITY: SLACKS CREEK LOGAN GREYHOUND FACILITY GROUND SITE INVESTIGATION Figure 3 Existing Topography & Drainage Patterns	DRAWING NO. QE09537/01 SHEET 1 OF 1 SIZE A3
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W →



Logan Greyhound Facility

Legend

- 2009 Shallow Monitoring Bore
- 2002 Shallow Monitoring Bore
- 2009 Deep Monitoring Bore
- 22.24 Average Groundwater Level over monitoring period (m AHD)
- Approximate Groundwater Flow Direction

Notes:
1. Aerial Photograph - Google Earth Pro, 2008
2. Scale and features shown are approximate locations only

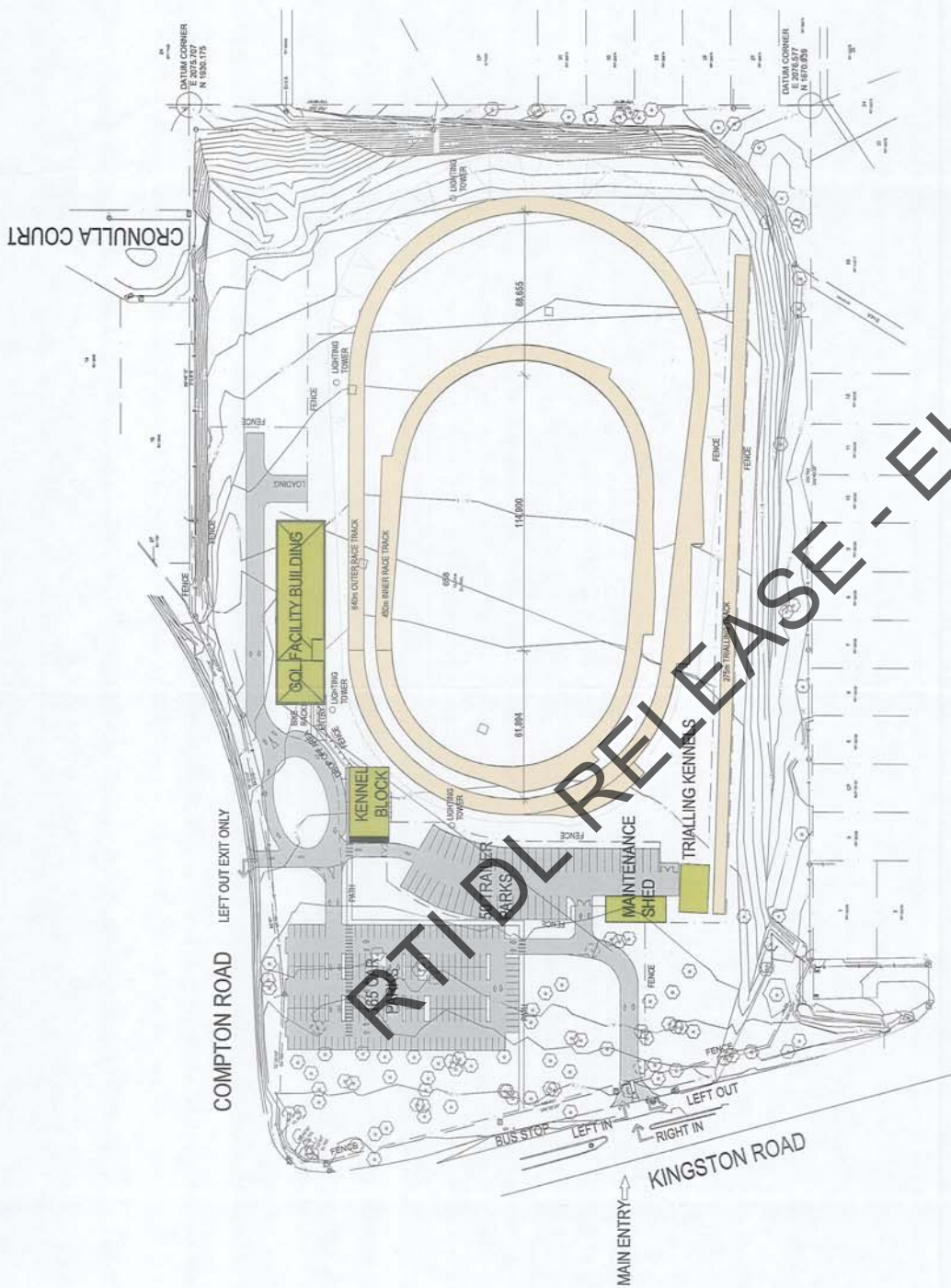
Figure 6
Average Groundwater Levels

0 100 m



Appendix B Development Application Plans

RTI DL RELEASE - EHP



1 Site Plan 1:2000

FACILITY BUILDING GFA: 2400m²
 KENNEL BLOCK GFA: 363m²
 TRIALLING KENNELS GFA: 170m²
 MAINTENANCE SHED GFA: 270m²
 TOTAL SITE GFA: 3203m²

PRELIMINARY
 NOT FOR CONSTRUCTION

LOGAN GREYHOUND FACILITY
 GREYHOUNDS QUEENSLAND



30/11/2009 © SK-101 -E JOB NO: GREY0001

APPROVED FOR ISSUE: _____

SCALE: 1:2000 @ A3



SITE PLAN -

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PRELIMINARY
NOT FOR CONSTRUCTION

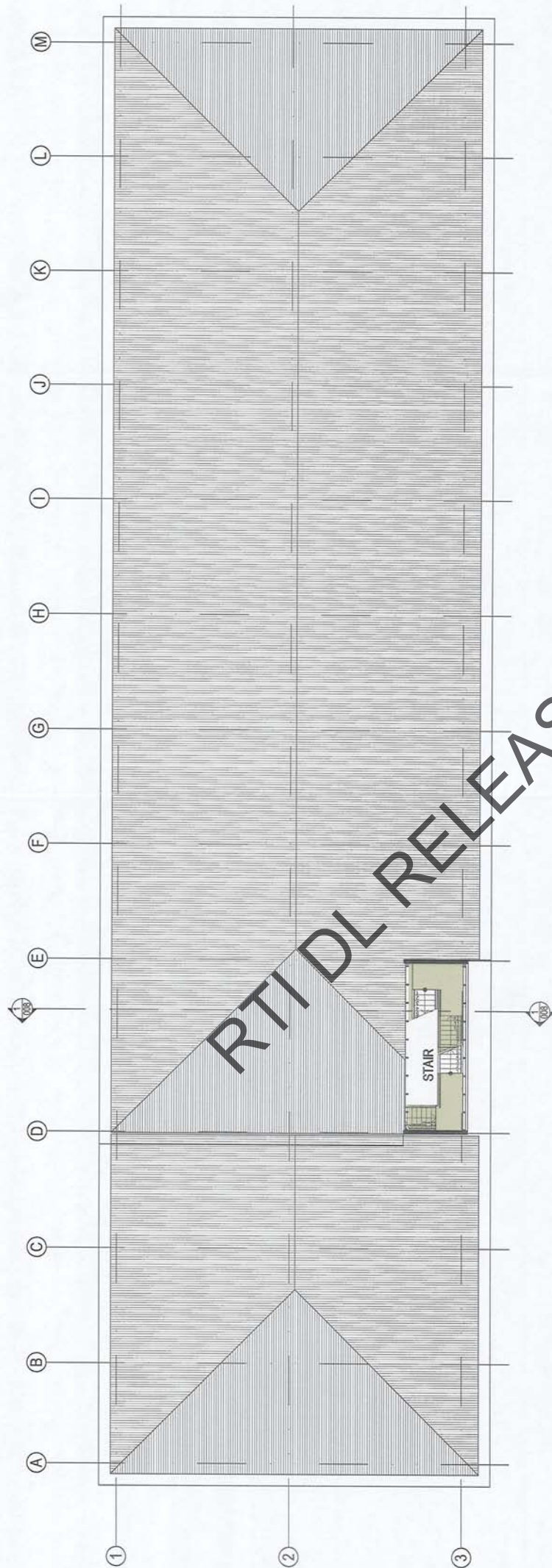
Zone	Perimeter	Room Name	Room Number	Measured Area
Administration	9.00	ADMINISTRATION	9.00	4.85
Amenities	9.22	AMENITIES	9.22	5.32
Back of House	21.00	BACK OF HOUSE	21.00	15.36
Cash	31.29	CASH	31.29	55.38
Concourse	68.81	CONCOURSE	68.81	232.12
Deck	44.60	DECK	44.60	60.80
Kitchen	35.39	KITCHEN	35.39	65.14
Plant	13.21	PLANT	13.21	10.65
Staff WC	110.23	STAFF WC	110.23	503.78
Switch Room	25.39	SWITCH ROOM	25.39	124.60
Tote Admin	27.13	TOTE ADMIN	27.13	39.57
Tote Admin	15.20	TOTE ADMIN	15.20	45.65
Tote Admin	16.33	TOTE ADMIN	16.33	13.49
Tote Admin	20.61	TOTE ADMIN	20.61	19.51
Tote Admin	18.40	TOTE ADMIN	18.40	19.72
Restaurant / Function	13.10	RESTAURANT / FUNCTION	13.10	6.52
Amenities	123.41	AMENITIES	123.41	192.50
Back of House	113.48	BACK OF HOUSE	113.48	418.81
Bar	44.60	BAR	44.60	60.80
Deck	29.60	DECK	29.60	53.85
Kitchen	20.87	KITCHEN	20.87	28.14
Lounge	39.95	LOUNGE	39.95	89.85
Tote	35.50	TOTE	35.50	82.68
Tote	24.60	TOTE	24.60	37.70
Tote	16.40	TOTE	16.40	14.25
Stair	23.11	STAIR	23.11	24.62
Stair	21.20	STAIR	21.20	19.09
Stair	22.60	STAIR	22.60	22.05
Stair	1.042.43 m	STAIR	1.042.43 m	2.283.53 m²

1 GROUND FLOOR PLAN 1:200

LOGAN GREYHOUND FACILITY

FLOOR PLANS - GQL FACILITY BUILDING

GREYHOUNDS QUEENSLAND



1 LEVEL 2 PLAN 1:200

LOGAN GREYHOUND FACILITY

GREYHOUNDS QUEENSLAND



SK-004 - B JOB NO: GREY0001

FLOOR PLANS - GQL FACILITY BUILDING

SCALE: 1:200 @ A3



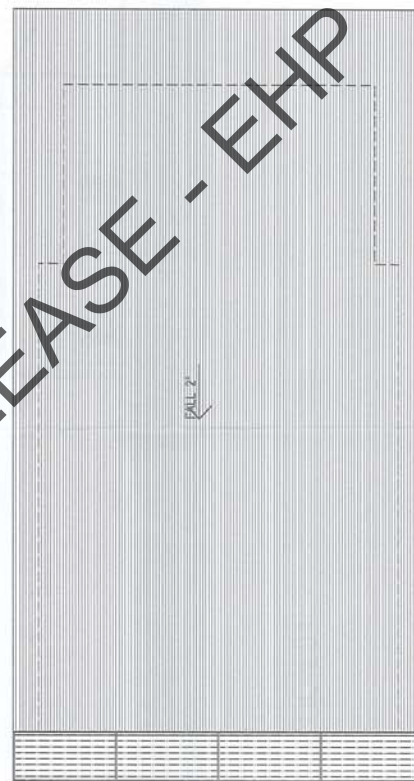
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1 GROUND FLOOR PLAN 1:200



2 ROOF PLAN 1:200

Zone / Room / Floor (Story)	Room Name	Perimeter	Measured Area
Ground	KENNELS	65.05	259.79
	STEWARDS	16.60	16.80
	VET	15.60	14.40
	WEIGHT ROOM	38.68	52.92
		135.93 m	343.91 m²

LOGAN GREYHOUND FACILITY

GREYHOUNDS QUEENSLAND

FLOOR PLANS - KENNEL BLOCK

SCALE: 1:200 @ A3

APPROVED FOR ISSUE: _____

02/12/2019 ©

SK-007 -A JOB NO: GREY0001



PRELIMINARY
NOT FOR CONSTRUCTION

NOT FOR CONSTRUCTION



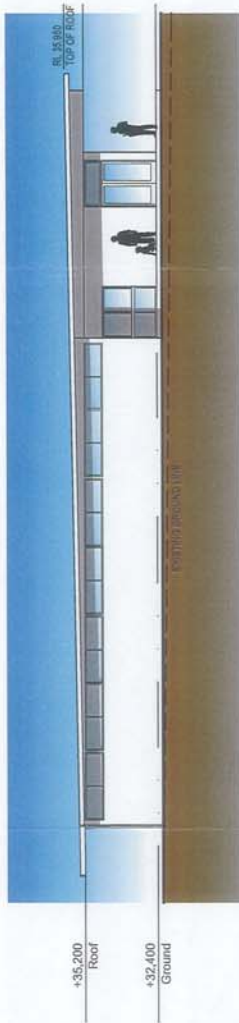
GREYHOUNDS QUEENSLAND

SCALE- 1:200 @A3

APPROVED FOR ISSUE: _____



ML Design
architecture | master planning | urban design | interior design



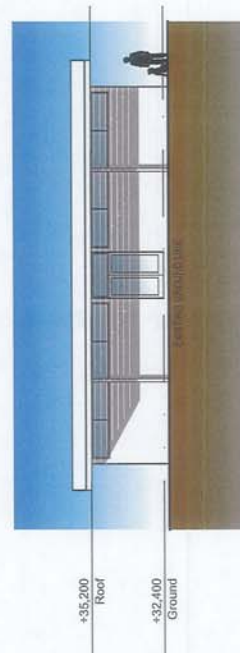
B SOUTH ELEVATION 1:200



D NORTH ELEVATION
1:200



A EAST ELEVATION 1:200



C WEST ELEVATION
1:200

ELEVATIONS - KENNEL BLOCK





13-054

DL Documents

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RTI DL RELEASE - EHP

PRELIMINARY
NOT FOR CONSTRUCTION

LOGAN GREYHOUND FACILITY

GREYHOUNDS QUEENSLAND



architecture | master planning | urban design | interior design

02/12/2009 © SK-012 -A JOB NO: GREY0001

APPROVED FOR ISSUE: _____

PERSPECTIVES -

M. Design Pty Ltd
AO 11 10 00 00 00
11/11/2009
File Name: P:\00000001_ML Design Road - State Govt - Documentation\B1_Productions\B1_Design\Arch\02\Main\GREY0001_Layer1.dwg



Appendix C Exploratory Logs

RTI DL RELEASE - EHP

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
Location: Cronulla Park
Job No: QE09537

Start - Finish Date: 11/05 - 13/05/09
Bore dia: 150mm

Driller: Numac Drilling
Rig: Geoprobe
Surface Conditions: Grass

Northings: mN
Easting: mE
RL: 33.96m AHD
Logged: OK
Checked: OK

					SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests	ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations
1	A0, 0.0 A0, 0.0 A0, 0.0	○ ○ ○				FILL: Clayey SAND light brown, fine to coarse grained with trace quartz gravels no gravels	MD	D	
2	A0, 0.0	○				Sandy CLAY (CL-Cl) red to brown, low to moderate plasticity red to brown, coarse grained, angular	F	M	
3	A0					CLAY (CL) white, friable	VSt	D	
4	A0					CLAY red to brown, with coarse, angular sands Silty CLAY (CL) white, low plasticity, with increasing silt content with depth, highly weathered sandstone	VSt	M	
5	A0					Sandy CLAY (CH) red, with some angular gravel lenses, highly weathered sandstone white, with trace fine sands, moderate to high plasticity	St	M-W	
6	A0					Sandy CLAY (Cl) red, moderate plasticity, highly weathered rock	St	W	
7						Borehole terminated at 7.5m			
8									
9									
10									

SKM ENV 1 QE09537 (REV 2).GPJ INTRO.GDT 17/3/10

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
 Location: Cronulla Park Start - Finish Date: 11/05 - 13/05/09
 Job No: QE09537 Bore dia: 150mm

Driller: Numac Drilling
 Rig: Geoprobe
 Surface Conditions: Grass

Northings: mN
 Eastings: mE
 RL: 31.75m AHD
 Logged: OK
 Checked: OK

					SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
depth (m)	Visual/Oddour, PID (ppm)	sample type	field tests ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations	
0	A0, 0.0	○			FILL: Sandy GRAVEL yellow-brown, with some low plasticity fines				
0.5	A0, 0.0	○			increased clay content with depth	MD	M		
1	A0, 0.0	○			FILL: SAND yellow-brown, grey, fine grained, well rounded with trace clay	MD	M		
2	A0								
2.5					FILL: CLAY (CH) yellow, with red and grey lenses	F	M		
3	A0				Sandy CLAY (Cl) white, with red, coarse grained angular sands, some weathered rock fragments	St	M		
4	A0				Sandy CLAY (Cl) red, with coarse angular sands of weathered material in a red-brown clay matrix	St	W		
5	A0								
6	A0								
7									
8					Borehole terminated at 7.5m				
9									
10									

SKM ENV 1 QE09537 (REV 2).GPJ INTRO.GDT 17/3/10

VISUAL RANKING	
0	No visible evidence of contamination
1	Slight visible contamination
2	Visible contamination
3	Significant visible contamination
ODOUR RANKING	
A	No Non-Natural odours
B	Slight Non-Natural odours
C	Moderate Non-Natural odours
D	Strong Non-Natural odours

FIELD DATA ABBREVIATIONS	
S _{uv}	= Uncorrected vane shear (kPa)
S _p	= Pocket penetrometer (kPa)
N	= SPT blows per 300mm
FPM	= Field permeability
PID	= Photoionisation detector reading (ppm, V/V)
GROUNDWATER SYMBOLS	
▽	= Water level (static)
▽	= Water level (during drilling)
↔	= Outflow / Inflow

FIELD DATA SYMBOLS	
×	= Geoprobe Sample
⊥	= Pocket Penetrometer test
▽	= Standard Penetration Test (SPT top = start of N blowcount)
▽	= SPT Spoon Sample (Pushed)
■	= Undisturbed Tube Sample
●	= Disturbed Sample
■	= Bulk Sample

DENSITY (N-value)	
VL (very loose)	<10
L (loose)	10 - 20
MD (medium dense)	20 - 30
D (dense)	30 - 50
VD (very dense)	>50
CO (compact)	>50/150mm
MOISTURE CONDITION	
D	= Dry
M	= Moist
W	= Wet

CONSISTENCY (S _u)	
VS (very soft)	< 12 kPa
S (soft)	12 - 25
F (firm)	25 - 50
St (stiff)	50 - 100
VSt (very stiff)	100 - 200
H (hard)	> 200 kPa

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd

Driller: Numac Drilling

Northings: mN

Location: Cronulla Park

Start - Finish Date:11/05 - 13/05/09

Rig: Geoprobe

Easting: mE

Logged: OK

Job No: QE09537

Bore dia: 150mm

Surface Conditions: Grass

RL: 31.77m AHD

Checked: OK

				SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations
0	A0				FILL: Sandy CLAY grey, low plasticity, friable		D	
1	A0				grey-brown, low to moderate plasticity			
2	A0				yellow to brown, low plasticity			
2	A0				FILL: CLAY Borehole terminated at 2.0m			
3								
4								
5								
6								
7								
8								
9								
10								

VISUAL RANKING

0 No visible evidence of contamination

1 Slight visible contamination

2 Visible contamination

3 Significant visible contamination

ODOUR RANKING

A No Non-Natural odours

B Slight Non-Natural odours

C Moderate Non-Natural odours

D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS

Suv = Uncorrected vane shear (kPa)

Sup = Pocket penetrometer (kPa)

N = SPT blows per 300mm

FPM = Field permeability

PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS

▽ = Water level (static)

▽ = Water level (during drilling)

↕ = Outflow / Inflow

FIELD DATA SYMBOLS

× = Geoprobe Sample

⊥ = Pocket Penetrometer test

▽ = Standard Penetration Test (SPT top = start of N blowcount)

▽ = SPT Spoon Sample (Pushed)

■ = Undisturbed Tube Sample

● = Disturbed Sample

□ = Bulk Sample

DENSITY (N-value)

VL (very loose) <10

L (loose) 10 - 20

MD (medium dense) 20 - 30

D (dense) 30 - 50

VD (very dense) >50

CO (compact) >50/150mm

MOISTURE CONDITION

D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS (very soft) < 12 kPa

S (soft) 12 - 25

F (firm) 25 - 50

St (stiff) 50 - 100

VSt (very stiff) 100 - 200

H (hard) > 200 kPa

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
Location: Cronulla Park Start - Finish Date: 11/05 - 13/05/09
Job No: QE09537 Bore dia: 150mm

Driller: Numac Drilling
Rig: Geoprobe
Surface Conditions: Grass

Northings: mN
Eastings: mE
RL: 29.73m AHD
Logged: OK
Checked: OK

					SOIL DESCRIPTION		SOIL CONDITION	COMMENTS
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations
0	A0, 0.0	○			FILL: Sandy CLAY	F	D	
0	A0, 0.0	○			brown, with trace rocks, boulders, rubble angular coarse sands			
1	A2	○			FILL: Clayey SAND	MD	M	
					dark brown with mottled grey, red, low to moderate plasticity, some domestic waste (plastic wrap, glass, etc)			
2	B3	○	▽		FILL: Refuse	S		
					domestic wastes, silt matrix			
3	B3							
4	B3		▽		grey	S	W	
5	B3				Borehole terminated at 5m			
6								
7								
8								
9								
10								

SKM ENV 1 QE09537 (REV 2), GPJ INTRO.GDT 17/3/10

VISUAL RANKING		FIELD DATA ABBREVIATIONS		FIELD DATA SYMBOLS		DENSITY (N-value)		CONSISTENCY (Su)	
0	No visible evidence of contamination	Suv	= Uncorrected vane shear (kPa)	×	= Geoprobe Sample	VL (very loose)	<10	VS (very soft)	< 12 kPa
1	Slight visible contamination	Sup	= Pocket penetrometer (kPa)	⊥	= Pocket Penetrometer test	L (loose)	10 - 20	S (soft)	12 - 25
2	Visible contamination	N	= SPT blows per 300mm	▽	= Standard Penetration Test	MD (medium dense)	20 - 30	F (firm)	25 - 50
3	Significant visible contamination	FPM	= Field permeability	▽	= SPT Spoon Sample (Pushed)	D (dense)	30 - 50	St (stiff)	50 - 100
	ODOUR RANKING	PID	= Photoionisation detector reading (ppm, V/m)	▽	= SPT Spoon Sample (Pushed)	VD (very dense)	>50	VSt (very stiff)	100 - 200
A	No Non-Natural odours			■	= Undisturbed Tube Sample	CO (compact)	>50/150mm	H (hard)	> 200 kPa
B	Slight Non-Natural odours			●	= Disturbed Sample				
C	Moderate Non-Natural odours			□	= Bulk Sample				
D	Strong Non-Natural odours								

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
Location: Cronulla Park
Job No: QE09537

Start - Finish Date: 11/05 - 13/05/09
Bore dia: 150mm

Driller: Numac Drilling
Rig: Geoprobe
Surface Conditions: Grass

Northings: mN
Eastings: mE
RL: 27.58m AHD
Logged: OK
Checked: OK

					SOIL DESCRIPTION	SOIL CONDITION		COMMENTS
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations
1	A0 A2 A2	○ ○ ○			FILL: Sandy CLAY brown, very poor structure, trace rocks, rubble traces of domestic rubble, darker lenses of sandy soil	S S	D D	
2	A2				FILL: Refuse traces of red SANDSTONE through domestic refuse. Includes plastics, glass, metal objects, within grey SILT matrix	S	M-W	
3	B3							
4	B3							
5	B3							
6	B3				Borehole terminated at 6.0m			
7								
8								
9								
10								

RT/DL RELEASE - EHP

VISUAL RANKING 0 No visible evidence of contamination 1 Slight visible contamination 2 Visible contamination 3 Significant visible contamination ODOUR RANKING A No Non-Natural odours B Slight Non-Natural odours C Moderate Non-Natural odours D Strong Non-Natural odours	FIELD DATA ABBREVIATIONS Su _v = Uncorrected vane shear (kPa) Su _p = Pocket penetrometer (kPa) N = SPT blows per 300mm FPM = Field permeability PID = Photoionisation detector reading (ppm, V/V) GROUNDWATER SYMBOLS = Water level (static) = Water level (during drilling) = Outflow / Inflow	FIELD DATA SYMBOLS × = Geoprobe Sample ⊥ = Pocket Penetrometer test ▽ = Standard Penetration Test (SPT top = start of N blowcount) ▽ = SPT Spoon Sample (Pushed) ■ = Undisturbed Tube Sample ● = Disturbed Sample ▮ = Bulk Sample	DENSITY (N-value) VL (very loose) <10 L (loose) 10 - 20 MD (medium dense) 20 - 30 D (dense) 30 - 50 VD (very dense) >50 CO (compact) >50/150mm MOISTURE CONDITION D = Dry M = Moist W = Wet	CONSISTENCY (Su) VS (very soft) < 12 kPa S (soft) 12 - 25 F (firm) 25 - 50 St (stiff) 50 - 100 VSt (very stiff) 100 - 200 H (hard) > 200 kPa
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Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
Location: Cronulla Park Start - Finish Date: 11/05 - 13/05/09
Job No: QE09537 Bore dia: 150mm

Driller: Numac Drilling
Rig: Geoprobe
Surface Conditions: Grass

Northings: mN
Eastings: mE
RL: 27.81m AHD
Logged: OK
Checked: OK

				SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations
0.0	A0, 0.0	○			FILL: Sandy CLAY brown to red, trace quartz gravels, loose materials	S	D	
0.0	A0, 0.0	○				L	M	
0.0	A0, 0.0	○			FILL: Clayey SAND red, yellow, coarse grained angular sands, moderate structure	L	W	
1.0	B3				FILL: Refuse some domestic waste, includes plastics, glass, metal cannisters, wire, etc	L	W	
2.0	B3							
3.0	B3							
4.0	B3							
5.0	B3							
6.0	B3							
7.0	B3							
8.0	A0				FILL: Clay red-brown, very-stiff	VSt	D	
8.0	A0				Sandy CLAY red to white, highly weathered sandstone	F	W	
9.0	A0				Borehole terminated at 9.0m			
10.0								

SKM ENV 1 QE09537 (REV 2).GPJ INTRO.GDT 17/3/10

VISUAL RANKING	
0	No visible evidence of contamination
1	Slight visible contamination
2	Visible contamination
3	Significant visible contamination
ODOUR RANKING	
A	No Non-Natural odours
B	Slight Non-Natural odours
C	Moderate Non-Natural odours
D	Strong Non-Natural odours

FIELD DATA ABBREVIATIONS	
Suv	= Uncorrected vane shear (kPa)
Sup	= Pocket penetrometer (kPa)
N	= SPT blows per 300mm
FPM	= Field permeability
PID	= Photoionisation detector reading (ppm, V/V)
GROUNDWATER SYMBOLS	
▽	= Water level (static)
▽	= Water level (during drilling)
→	= Outflow / Inflow

FIELD DATA SYMBOLS	
×	= Geoprobe Sample
⊥	= Pocket Penetrometer test
▽	= Standard Penetration Test (SPT top = start of N blowcount)
▽	= SPT Spoon Sample (Pushed)
■	= Undisturbed Tube Sample
●	= Disturbed Sample
■	= Bulk Sample

DENSITY (N-value)	
VL (very loose)	<10
L (loose)	10 - 20
MD (medium dense)	20 - 30
D (dense)	30 - 50
VD (very dense)	>50
CO (compact)	>50/150mm
MOISTURE CONDITION	
D	= Dry
M	= Moist
W	= Wet

CONSISTENCY (Su)	
VS (very soft)	< 12 kPa
S (soft)	12 - 25
F (firm)	25 - 50
St (stiff)	50 - 100
VSt (very stiff)	100 - 200
H (hard)	> 200 kPa

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
Location: Cronulla Park Start - Finish Date: 11/05 - 13/05/09
Job No: QE09537 Bore dia: 150mm

Driller: Numac Drilling Rig: Geoprobe
Surface Conditions: Grass Northings: mN Eastings: mE Logged: OK
RL: 28.48m AHD Checked: OK

					SOIL DESCRIPTION		SOIL CONDITION		COMMENTS	
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests	ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations	
0	A0	○				FILL: Sandy CLAY brown to red, with coarse grained, angular sands, no structure FILL: Refuse domestic refuse including plastics, glass, metals, within grey, Silty CLAY matrix	F S	D M		
1	B3									
2	B3									
3	B3									
4	B3									
5	A0					FILL: CLAY (CH) brown, very stiff Borehole terminated at 6.0m	VSt	W		
6										
7										
8										
9										
10										

SKM ENV 1 QE09537 (REV 2).GPJ INTRO.GDT 17/3/10

VISUAL RANKING 0 No visible evidence of contamination 1 Slight visible contamination 2 Visible contamination 3 Significant visible contamination ODOUR RANKING A No Non-Natural odours B Slight Non-Natural odours C Moderate Non-Natural odours D Strong Non-Natural odours		FIELD DATA ABBREVIATIONS Suv = Uncorrected vane shear (kPa) Sup = Pocket penetrometer (kPa) N = SPT blows per 300mm FPM = Field permeability PID = Photoionisation detector reading (ppm, VV) GROUNDWATER SYMBOLS = Water level (static) = Water level (during drilling) = Outflow / Inflow		FIELD DATA SYMBOLS X = Geoprobe Sample ⊥ = Pocket Penetrometer test ∇ = Standard Penetration Test (SPT top = start of N blowcount) ▽ = SPT Spoon Sample (Pushed) ■ = Undisturbed Tube Sample ● = Disturbed Sample ▨ = Bulk Sample		DENSITY (N-value) VL (very loose) <10 L (loose) 10 - 20 MD (medium dense) 20 - 30 D (dense) 30 - 50 VD (very dense) >50 CO (compact) >50/150mm MOISTURE CONDITION D = Dry M = Moist W = Wet		CONSISTENCY (Su) VS (very soft) < 12 kPa S (soft) 12 - 25 F (firm) 25 - 50 St (stiff) 50 - 100 VSt (very stiff) 100 - 200 H (hard) > 200 kPa	
---	--	--	--	---	--	---	--	---	--

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
Location: Cronulla Park Start - Finish Date: 11/05 - 13/05/09
Job No: QE09537 Bore dia: 150mm

Driller: Numac Drilling
Rig: Geoprobe
Surface Conditions: Grass

Northings: mN
Eastings: mE
RL: 30.65m AHD
Logged: OK
Checked: OK

					SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations	
	A0	○			FILL: Sandy CLAY	F	D		
	A0	○			brown, coarse grained, angular sands				
	A1	○			FILL: Refuse	S	M-W		
					domestic refuse including plastics, metals, within Silty CLAY matrix				
1	B3								
			▽						
2	B3								
3	B3				FILL: Sandy CLAY	VSt	D		
			▽		yellow-brown, very stiff				
					Borehole terminated at 3.0m				
4									
5									
6									
7									
8									
9									
10									

RTI DL RELEASE - EHP

FIELD DATA ABBREVIATIONS

Suv = Uncorrected vane shear (kPa)

Sup = Pocket penetrometer (kPa)

N = SPT blows per 300mm

FPM = Field permeability

PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS

▽ = Water level (static)

▽ = Water level (during drilling)

▽ = Outflow/Inflow

FIELD DATA SYMBOLS

× = Geoprobe Sample

⊥ = Pocket Penetrometer test

▽ = Standard Penetration Test (SPT top = start of N blowcount)

▽ = SPT Spoon Sample (Pushed)

■ = Undisturbed Tube Sample

● = Disturbed Sample

□ = Bulk Sample

DENSITY (N-value)

VL (very loose) <10

L (loose) 10 - 20

MD (medium dense) 20 - 30

D (dense) 30 - 50

VD (very dense) >50

CO (compact) >50/150mm

MOISTURE CONDITION

D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS (very soft) < 12 kPa

S (soft) 12 - 25

F (firm) 25 - 50

St (stiff) 50 - 100

VSt (very stiff) 100 - 200

H (hard) > 200 kPa

SKM ENV 1 QE09537 (REV 2) GPJ INTRO.GDT 17/3/10

VISUAL RANKING	
0	No visible evidence of contamination
1	Slight visible contamination
2	Visible contamination
3	Significant visible contamination
ODOUR RANKING	
A	No Non-Natural odours
B	Slight Non-Natural odours
C	Moderate Non-Natural odours
D	Strong Non-Natural odours

FIELD DATA ABBREVIATIONS	
Suv	= Uncorrected vane shear (kPa)
Sup	= Pocket penetrometer (kPa)
N	= SPT blows per 300mm
FPM	= Field permeability
PID	= Photoionisation detector reading (ppm, V/V)
GROUNDWATER SYMBOLS	
▽	= Water level (static)
▽	= Water level (during drilling)
→	= Outflow / Inflow

FIELD DATA SYMBOLS	
×	= Geoprobe Sample
⊥	= Pocket Penetrometer test
▽	= Standard Penetration Test (SPT top = start of N blowcount)
▽	= SPT Spoon Sample (Pushed)
■	= Undisturbed Tube Sample
●	= Disturbed Sample
■	= Bulk Sample

DENSITY (N-value)	
VL (very loose)	<10
L (loose)	10 - 20
MD (medium dense)	20 - 30
D (dense)	30 - 50
VD (very dense)	>50
CO (compact)	>50/150mm
MOISTURE CONDITION	
D	= Dry
M	= Moist
W	= Wet

CONSISTENCY (Su)	
VS (very soft)	< 12 kPa
S (soft)	12 - 25
F (firm)	25 - 50
St (stiff)	50 - 100
VSt (very stiff)	100 - 200
H (hard)	> 200 kPa

Project: Cronulla Park Site Investigation Client: Greyhounds QLD Ltd
Location: Cronulla Park Start - Finish Date: 11/05 - 13/05/09
Job No: QE09537 Bore dia: 150mm

Driller: Numac Drilling Rlg: Geoprobe Northing: mN
Surface Conditions: Grass Eastings: mE Logged: OK
RL: 28.99m AHD Checked: OK

					SOIL DESCRIPTION	SOIL CONDITION		COMMENTS
depth (m)	Visual/Odour, PID (ppm)	sample type	field tests ground water	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/density	moisture condition	drilling method, well construction, water and additional observations
1	A0 A0 A3	○ ○			FILL: Clayey SAND red to orange, coarse grained angular sand FILL: Sandy CLAY black, brown, loose FILL: Refuse domestic refuse including plastics and metal, within grey silty clay matrix			
2	A3							
3	A3							
4	A3				FILL: CLAY (CH) red to brown, very stiff			
5	A3				Sandy CLAY (CI) white, red, with lenses of weathered rock			
6	A3				Clayey SAND white, coarse grained sand and fine gravels			
7	A3							
8	A3				Borehole terminated at 8.0m			

SKM ENW 1 QE09537 (REV 2) GPJ INTRO.GDT 17/3/10

VISUAL RANKING 0 No visible evidence of contamination 1 Slight visible contamination 2 Visible contamination 3 Significant visible contamination ODOUR RANKING A No Non-Natural odours B Slight Non-Natural odours C Moderate Non-Natural odours D Strong Non-Natural odours		FIELD DATA ABBREVIATIONS Suv = Uncorrected vane shear (kPa) Sup = Pocket penetrometer (kPa) N = SPT blows per 300mm FPM = Field permeability PID = Photoionisation detector reading (ppm, V/V) GROUNDWATER SYMBOLS = Water level (static) = Water level (during drilling) = Outflow / Inflow		FIELD DATA SYMBOLS X = Geoprobe Sample ⊥ = Pocket Penetrometer test ▽ = Standard Penetration Test (SPT top = start of N blowcount) = SPT Spoon Sample (Pushed) = Undisturbed Tube Sample = Disturbed Sample = Bulk Sample		DENSITY (N-value) VL (very loose) <10 L (loose) 10 - 20 MD (medium dense) 20 - 30 D (dense) 30 - 50 VD (very dense) >50 CO (compact) >50/150mm MOISTURE CONDITION D = Dry M = Moist W = Wet		CONSISTENCY (Su) VS (very soft) < 12 kPa S (soft) 12 - 25 F (firm) 25 - 50 St (stiff) 50 - 100 VSt (very stiff) 100 - 200 H (hard) > 200 kPa	
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REPORT OF TEST PIT: TP1

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 1.30 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0				SM	Silty SAND Fine grained, pale grey to pale brown, some coarse to cobble sized, angular gravel present (approx. 20% volume), some burnt wood fragments and one plastic bag present, dry to moist, loose to medium dense.	D-M L-MD	Fill
			0.2							
			0.35							
			0.4				SP/ SW	SAND Medium to coarse grained, angular, yellow brown to orange brown, trace of clay present, moist, loose to medium dense.	M L-MD	Fill?
			0.6							
			0.8	0.80			CI- CH/ SC	Sandy CLAY/Clayey SAND Medium to high plasticity, yellow brown, coarse grained sand, trace of medium sized gravel present (less than 10%), moist, soft to firm, clay content increasing with depth.	M-W S-F	Residual Possible weathered rock.
			1.0	1.00			CI	Sandy CLAY Medium plasticity, brown orange with some red brown and grey mottling, some coarse grained sand, some gravel present (less than 10%), moist to wet, soft to firm, firmness increasing with depth.	M-W S-F	Residual Possible weathered rock.
			1.2							
			1.30							
			1.4					TEST PIT DISCONTINUED @ 1.30 m SWL 0.8m below ground surface. Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exporatory hole progressed by hand auger.		
			1.6							
			1.8							
			2.0							

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP10

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.70 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY	DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0					SM	Silty SAND Fine grained, pale grey, dry, loose.	D	L		Fill
			0.10					CI-CH/SC	Sandy CLAY/Clayey SAND Medium to high plasticity, red brown to orange brown, dry to moist, very stiff to hard.				Fill
			0.2										
			0.4							D-M	VSL-H		
			0.6										
			0.70										
			0.8						TEST PIT DISCONTINUED @ 0.70 m Refusal to hand auger GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exploratory hole progressed by hand auger.				
			1.0										
			1.2										
			1.4										
			1.6										
			1.8										
			2.0										

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP1A

SHEET: 1 OF 1

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.60 m
BUCKET TYPE: Ripper

MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0		TP1A 0.1-0.3 DS 0.10-0.30m			SM	Silty SAND Fine grained, pale grey, dry, loose.	D	L	Fill
			0.10					CI-CH	Sandy CLAY Medium to high plasticity, dark grey and red brown, coarse grained sand present, trace wood fragments present, moist, firm to stiff.	M	LL	Fill
			0.2					SC	Clayey SAND Coarse grained, brown and orange brown, moist, loose to medium dense.	M	L-MD	Fill
HA			0.4	0.40								
			0.6	0.60					TEST PIT DISCONTINUED @ 0.60 m GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exporatory hole progressed by hand auger.			
			0.8									
			1.0									
			1.2									
			1.4									
			1.6									
			1.8									
			2.0									

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP2

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.70 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
EX			0.0		TP0.1-0.4 DS 0.20-0.40m		SM	Silty SAND Fine to medium grained, pale brown to pale grey, low plasticity fines (less than 20% volume), dry to moist, loose to medium dense.	D-M	L-MD	Fill
			0.2	0.20			SC	Clayey SAND Coarse grained, orange brown to yellow brown, low to medium plasticity fines present (approx. 20% volume), loose to medium dense.	M	MD	Fill
			0.6	0.60			SM	Silty SAND Medium grained, dark grey to black, trace angular coarse gravel, trace of wood fragments, moist, loose to medium dense, high organic content, organic odour.	M	L-MD	Fill
HA			0.70					TEST PIT DISCONTINUED @ 0.70 m GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Explosion hole progressed by hand auger.			
			0.8								
			1.0								
			1.2								
			1.4								
			1.6								
			1.8								
			2.0								

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GAP gINT FN. F01e
RL2

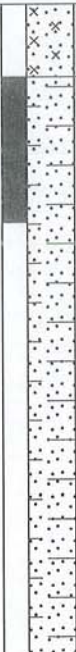


REPORT OF TEST PIT: TP3

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 1.10 m
BUCKET TYPE: Batter

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0		TP3 0.1-0.3 DS 0.10-0.30m			SM	Silty SAND Fine grained, pale grey, dry, loose.	D	L	Fill
			0.10	SC				Clayey SAND Fine to coarse grained, brown orange, clay fines (35%) medium plasticity, moist, firm to stiff, clay fines 35%, moisture increasing with depth.			Fill	
HA			0.2							M	F-SI	
			0.4									
			0.6									
			0.8									
			0.90									
			1.0	CL- CI								
			1.10									
			1.2									
			1.4									
			1.6									
			1.8									
			2.0									
									TEST PIT DISCONTINUED @ 1.10 m GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exporatory hole progressed by hand auger.			

RTI DL RELEASE - EHP

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP4

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.70 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0				SM	Silty SAND Fine grained, grey to pale brown, dry, loose.	D	L	
			0.10				CI-CH	Sandy CLAY Medium to high plasticity, brown orange, sand coarse grained (approx. 40%), red brown gravel present (less than 10% volume), moist, firm to stiff.			
HA			0.2								
			0.4								
			0.6	0.60			SM	Silty SAND Coarse grained, pale brown to pale grey, some medium sized, dark grey angular gravel present, moist, loose to medium dense.	M	L-MD	
			0.70					TEST PIT DISCONTINUED @ 0.70 m GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exploratory hole progressed by hand auger.			
			0.8								
			1.0								
			1.2								
			1.4								
			1.6								
			1.8								
			2.0								

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP5

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.70 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0		TP5 0.1-0.3 DS 0.10m			SM	Silty SAND Fine grained, pale grey, dry, loose.	D	L	Fill
			0.10	SC				Clayey SAND Fine to coarse grained, orange brown with medium to high plasticity clay fines (40%), moist, firm to stiff.			Fill	
			0.2									
			0.4									
HA			0.6	0.60				CL- CI	Sandy CLAY Low to medium plasticity, grey, moist, soft, root hairs present.	M	L-MD	Fill
			0.70									
			0.8									
			1.0									
			1.2									
			1.4									
			1.6									
			1.8									
			2.0									

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP6

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 1.20 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0		TP6 0.1-0.4 DS 0.10-0.40m		SM	Silty SAND Fine grained, pale grey, dry, loose.	L	Fill
			0.10	SC			Clayey SAND Fine to coarse grained, orange brown, high plasticity clay 32%, angular, pale brown gravel present, moist, firm to stiff, moisture increasing with depth.		Fill	
			0.2	CL- CI			Sandy CLAY Low to medium plasticity, dark grey and orange brown, some coarse sized, angular gravel present (less than 10%), moist, soft to firm, slight organic odour.		Fill	
0.4	0.40									
HA			0.6						SF	
			0.8							
			1.0							
			1.2	1.20						
			1.4							
			1.6							
			1.8							
			2.0							
			2.2							
			2.4							
TEST PIT DISCONTINUED @ 1.20 m GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exporatory hole progressed by hand auger.										

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP7

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.80 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description							
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	
EX			0.0		TP7 0.2-0.4 DS 0.20-0.40m			SM	Silty SAND Fine grained, pale grey, dry, loose.	D	L	Fill	
			0.10	CH				Sandy CLAY High plasticity, orange brown and pale grey, sand 33% fine to coarse grained moist, firm to stiff.			Fill		
			0.2										
HA			0.4							M	F-St		
			0.6										
			0.65	CL- CI	Sandy CLAY Low to medium plasticity, dark grey to brown, sand coarse grained, trace fine gravel present (less than 10%), some wood fragments present, moist, soft to firm.	M	S-F	Fill					
			0.8	0.80					TEST PIT DISCONTINUED @ 0.80 m GROUNDWATER NOT ENCOUNTERED				
			1.0										
			1.2										
			1.4										
			1.6										
			1.8										
			2.0										

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP8

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.80 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description				
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0				SM	Silty SAND Fine grained, pale grey, dry, loose.	D L	Fill
			0.10		DS 0.10-0.30m		CI-CH/SC	Sandy CLAY/Clayey SAND Medium to high plasticity, orange brown and white, sand coarse grained, moist, firm to stiff.	M F-St	Fill
			0.2							
HA			0.4							
			0.6							
			0.70				CL-CI/SC	Sandy CLAY/Clayey SAND Low to medium plasticity, brown orange to pale brown, moist, soft.	M S	Fill
			0.80					TEST PIT DISCONTINUED @ 0.80 m GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exploratory hole progressed by hand auger.		
			1.0							
			1.2							
			1.4							
			1.6							
			1.8							
			2.0							

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GAP gINT FN. F01e
RL2



REPORT OF TEST PIT: TP9

CLIENT: SKM
PROJECT: Compton Road Landfill
LOCATION: Compton Road
JOB NO: 097633033

POSITION: As per SKM supplied site plan.
SURFACE RL: m DATUM: AHD
PIT DEPTH: 0.50 m
BUCKET TYPE: Ripper

SHEET: 1 OF 1
MACHINE: 1.5 tonne excavator
CONTRACTOR: Andreas Butter
LOGGED: SDB DATE: 15/5/09
CHECKED: MJP DATE: 26/5/09

Excavation				Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX			0.0		TP9 0.2-0.4 DS 0.20-0.40m			SM	Silty SAND Fine grained, pale grey, dry, loose.	D	L	Fill
			0.2	0.20				SC	Clayey SAND Fine to coarse grained, pale brown and brown orange, high plasticity fines 38%, some angular, trace of fine to medium sized, gravel present (less than 10%), moist, firm to stiff.	M	St	Fill
			0.4	0.40				SM	Silty SAND Coarse grained, dark brown, low plasticity fines present, some organic matter consisting of root hairs and stems present, moist, loose.	M	L	Fill
			0.50						TEST PIT DISCONTINUED @ 0.50 m GROUNDWATER NOT ENCOUNTERED Backfilled with bentonite grout. Superficial soil cover excavated by machine. Exporatory hole progressed by hand auger.			
HA			0.6									
			0.8									
			1.0									
			1.2									
			1.4									
			1.6									
			1.8									
			2.0									

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GAP gINT FN. F01e
RL2

BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.4m
EASTING: 511529.114
NORTHING: 6944765.275
DIP/AZIMUTH: 90°/-

BORE No: 1
PROJECT No: 74122
DATE: 12/10/09
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ext Low	Very Low	Low	Medium			High	Very High	Ext High	B - Bedding S - Shear	J - Joint D - Drill Break	Type
		FILLING CLAYEY SAND - medium dense pale brown clayey sand filling																			
	0.5	FILLING SAND - medium dense red brown coarse grained sand																			
	1.9	SILTY CLAY - very stiff pale grey high plasticity, moist																S			13,13,11 N = 24
	2.7	SANDY CLAY - dense red brown medium to coarse grained, medium plasticity, moist																S			15, 15, 30/80mm
	3.4	CLAYEY SAND - very dense pale grey white fine to coarse grained																S			21, 30/90mm
		- showing characteristics of being extremely low strength, extremely weathered sandstone																S			

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED

Initials:

Date:



Douglas Partners
Geotechnics • Environment • Groundwater

BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.4m
EASTING: 511529.114
NORTHING: 6944765.275
DIP/AZIMUTH: 90°/---

BORE No: 1
PROJECT No: 74122
DATE: 12/10/09
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	FW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding	J - Joint	Type
		CLAYEY SAND - very dense pale grey white fine to coarse grained (continued)																S			30/130mm
		- becoming pale red-brown																			
	6																	S			30/100mm
	7																				
	7.2	CORE LOSS																			7.2m: CORE LOSS: 700mm
	7.9	SANDSTONE - medium strength, moderately weathered to slightly weathered fractured light grey and red-brown mottled medium to coarse sand bedding at 0 - 10° - 50mm clay seam - becoming extremely low strength to very low strength, highly weathered to moderately weathered red-brown and light grey - 150mm low strength to medium strength band																			PL(A) = 0.02MPa PL(D) = 0.34MPa
	8																				
	9.0	CORE LOSS																			9m: CORE LOSS: 450mm
	9.45	- becoming high strength, slightly weathered slightly fractured light grey and red-brown mottled - becoming moderately weathered - 50mm fine to medium conglomerate interbed																			PL(A) = 0.79MPa PL(D) = 1.96MPa

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND									
A	Auger sample	pp	Pocket penetrometer (kPa)						
D	Disturbed sample	PID	Photo ionisation detector						
B	Bulk sample	S	Standard penetration test						
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa						
W	Water sample	V	Shear Vane (kPa)						
C	Core drilling	Δ	Water seep	≠	Water level				

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.4m
EASTING: 511529.114
NORTHING: 6944765.275
DIP/AZIMUTH: 90°/---

BORE No: 1
PROJECT No: 74122
DATE: 12/10/09
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding	J - Joint	Type
		- 220mm extremely low strength, extremely weathered grey siltstone interbed - becoming very low strength to low strength															9.95m: B: 20°, pl, sm				
	10.4	SILTSTONE - extremely low strength, extremely weathered slightly fractured grey siltstone bedding at 10°																			
	10.8	- 5mm coal seam																			PL(A) = 0.03MPa PL(D) = 0.05MPa
-11		SANDSTONE - extremely low strength, extremely weathered slightly fractured orange-brown fine to medium sandstone bedding at 0° - becoming very low strength, slightly weathered grey and yellow-brown mottled bedding at 20° - 30mm extremely low strength siltstone interbed																C	100	100	PL(A) = 0.06MPa PL(D) = 0.09MPa
		- becoming low strength, slightly weathered grey															11.65m: J: 60°, pl, sm, cf 5mm 11.7m: B: 10°, pl, sm				
-12																	12.1m: B: 10°, pl, sm 12.25m: J: 60°, pl, sm, cf 10mm 12.45m: B: 10°, pl, sm				PL(A) = 0.52MPa PL(D) = 0.09MPa
		- becoming medium strength to high strength, fresh																			
-13		- coal laminae to 1mm bedding																			
		- becoming high strength, medium to coarse sandstone																			
-14		- 5 - 20 siltstone laminae at 20 - 30mm spacing to 14.10mm - becoming fine to medium sandstone																C	100	100	PL(A) = 1.24MPa PL(D) = 0.83MPa
		- 250mm medium strength, dark grey siltstone interbed																			
																	14.6m: B: 10°, pll sm 14.85m: B: 10°, pl, sm				PL(A) = 0.33MPa PL(D) = 0.52MPa
																					PL(A) = 0.96MPa PL(D) = 0.87MPa

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		≡	Water level

CHECKED	
Initials:	
Date:	



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.4m
EASTING: 511529.114
NORTHING: 6944765.275
DIP/AZIMUTH: 90°/—

BORE No: 1
PROJECT No: 74122
DATE: 12/10/09
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		Ex Low	Very Low	Low	Medium	High			Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %
	15.5	SANDSTONE - extremely low strength, extremely weathered slightly fractured orange-brown fine to medium sandstone bedding at 0° (continued)																				
		Bore discontinued at 15.5m																				
	16																					
	17																					
	18																					
	19																					

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED

Initials:

Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.55m
EASTING: 511557.648
NORTHING: 6944723.559
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 74122
DATE: 15/10/09
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)			Discontinuities		Sampling & In Situ Testing				Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
			EW	HW	NW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00		B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		FILLING - loamy sand (Topsoil)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		⊗	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.55m
EASTING: 511557.648
NORTHING: 6944723.559
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 74122
DATE: 15/10/09
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Rock Strength	Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS				B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
		SILTY CLAY - very stiff pale grey band of red and orange sand clay mottling (<i>continued</i>)											S			5,12,20 N = 32
	6												S			6,7,14 N = 21
	7.5	SAND - very dense red fine to medium grained sand resembles extremely low strength to very low strength sandstone											S			10/0mm (no sample)
	8.0	SANDSTONE - low strength to medium strength, highly weathered slightly fractured unbroken red brown medium to coarse sandstone bedding @ 10° - 50mm extremely low strength pale grey clay interbed									8.26m: B: 10°, un, ro					PL(A) = 0.31MPa PL(D) = 0.35MPa
	9	- 20mm extremely low strength pale grey clay interbed - 50mm extremely low strength pale grey clay interbed - 20mm extremely low strength pale grey clay interbed - 50mm extremely low strength pale grey and brown clay interbed - 350mm extremely low strength extremely weathered grey siltstone - becoming extremely low strength to very low strength, highly weathered sandstone - 150mm extremely low strength, extremely weathered grey siltstone									8.74m: B: 10°, pl, sm, 20mm cf 8.85m: B: 10°, pl, sm, 50mm cf		C	100	100	PL(A) = 0.06MPa PL(D) = 0MPa
											9.4m: B: 15°, pl, sm 9.56m: B: 15°, pl, sm					

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED	
Initials:	
Date:	



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.55m
EASTING: 511557.648
NORTHING: 6944723.559
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 74122
DATE: 15/10/09
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW		FS	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type
		SANDSTONE - low strength to medium strength, highly weathered slightly fractured unbroken red brown medium to coarse sandstone bedding @ 10° (continued) = 20mm extremely low strength, extremely weathered grey siltstone															C	100	100	PL(A) = 0.05MPa PL(D) = 0MPa
	11.0	CORE LOSS													11m: CORE LOSS: 200mm					
	11.2	SILTSTONE - low strength, slightly weathered slightly fractured dark grey siltstone bedding 0° - 10°													11.2m: B: 10°, un, ro					PL(A) = 0.05MPa PL(D) = 0.09MPa
	12														12.1m: B: 0°, pl, ro 12.23m: B: 10°, pl, sm					PL(A) = 0.1MPa PL(D) = 0.09MPa
		- fractured													12.65m: J: 45°, pl, sm		C	97	97	
	13	- becoming fractured - fractured													13.1m: J: 45°, pl, ko 13.15m: B: 0°, un, sm					
		- fractured													13.45m: J: 45°, pl, sm					PL(A) = 0.68MPa PL(D) = 0.03MPa
	14	Bore discontinued at 14.0m													13.85m: J					

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		⊗	Water level

CHECKED

Initials:

Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.53m
EASTING: 511552.315
NORTHING: 6944649.729
DIP/AZIMUTH: 90°/-

BORE No: 3
PROJECT No: 74122
DATE: 16/10/09
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing						
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %
	0.1	FILLING - pale brown sand filling																									
		FILLING SANDY CLAY - soft brown orange red and brown medium plasticity fine to medium grained																									
-1	1.2	FILLING CLAYEY SAND - loose orange brown fine grained																									
	1.4	FILLING SANDY CLAY - very soft dark grey organic material																									
-2	2.0	SANDY CLAY - very stiff red brown medium plasticity fine to medium grained with bands of pale grey clay																									
	2.8	SANDY CLAY - very stiff pale grey orange and red mottling low plasticity fine grained																									
-3	3.5	CLAYEY SAND - dense pale grey white																									
		- contains some extremely low strength, extremely weathered sandstone																									
-4	4.5	SAND - dense red medium grained sand																									
	4.7	CLAYEY SAND - dense pale grey orange red mottling																									

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore

WATER OBSERVATIONS: Groundwater encountered at 2m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		‡	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.53m
EASTING: 511552.315
NORTHING: 6944649.729
DIP/AZIMUTH: 90°/-

BORE No: 3
PROJECT No: 74122
DATE: 16/10/09
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Rock Strength	Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS	FR				B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
	5.2	CLAYEY SAND - dense pale grey orange red mottling (continued)												S			6,14,19 N = 33
		SILTY CLAY - hard pale grey high plasticity															
	6	- showing characteristics of being extremely low strength, extremely weathered siltstone												S			9,18,23 N = 41
	7																
														S			11,22,29 N = 51
	8																
	8.8	SILT - dark brown resembling extremely low strength, extremely weathered siltstone with occasional thin bands of coal												S			12, 21, 30/120mm
	9																

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore

WATER OBSERVATIONS: Groundwater encountered at 2m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		⊥	Water level

CHECKED

Initials:

Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.53m
EASTING: 511552.315
NORTHING: 6944649.729
DIP/AZIMUTH: 90°/-

BORE No: 3
PROJECT No: 74122
DATE: 16/10/09
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low			Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type
	10.0	SILTY CLAY - black																			
																		S			22, 30/50mm
	11																				
	12	- becoming very low strength siltstone																S			30/70mm
	13																				
	13.5	- becoming low to medium strength siltstone Bore discontinued at 13.5m																S			10/0mm
	14																				

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW

TYPE OF BORING: 100mm Auger/Washbore

WATER OBSERVATIONS: Groundwater encountered at 2m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED

Initials:

Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.14m
EASTING: 511662.329
NORTHING: 6944602.941
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 74122
DATE: 15/10/09
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength						Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS	PR		Ext Low	Very Low	Low	Medium	High	Very High			Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %
	0.2	FILLING - pale grey clayey sand filling (Topsoil)																					
		FILLING SANDY CLAY - firm orange-brown sandy clay filling																					
	0.8	FILLING - refuse waste																					
	1	- containing fibrous organic material, pale and dark grey, firm, wet																S				3,4,2 N = 6	
	2																						
	3																						
	4																						
	4.3	SANDSTONE - extremely low strength, extremely weathered pale grey and orange-brown coarse grained sandstone																					

RIG: 13 tonne truck mounted

DRILLER: Geodrill

LOGGED: SP

CASING:

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ✕ Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.14m
EASTING: 511662.329
NORTHING: 6944602.941
DIP/AZIMUTH: 90°/---

BORE No: 4
PROJECT No: 74122
DATE: 15/10/09
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing				Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint D - Drill Break		Type	Core Rec. %	RQD %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		SANDSTONE - extremely low strength, extremely weathered pale grey and orange-brown coarse grained sandstone (continued)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													</

RIG: 13 tonne truck mounted
TYPE OF BORING: 100mm Auger/Washbore/NMLC
WATER OBSERVATIONS: No free groundwater was encountered
REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

DRILLER: Geodrill

LOGGED: SP

CASING:

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		W	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.14m
EASTING: 511662.329
NORTHING: 6944602.941
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 74122
DATE: 15/10/09
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
								B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE - extremely low strength, extremely weathered pale grey and orange-brown coarse grained sandstone (continued)								S			22,12,16 N = 28
	10.8	SILTSTONE - extremely low strength to very low strength, dark grey siltstone											
	11.5	SANDSTONE - very low strength, orange-brown sandstone								S			30/75mm
	11.7	SANDSTONE - medium strength, moderately weathered to slightly weathered slightly fractured grey and orange-brown stained fine to medium sandstone bedding at 10°											
	12							11.75m: J: sv, un, ro, lim					PL(A) = 0.66MPa PL(D) = 0.39MPa
	12.58	- 50mm extremely low strength, dark grey siltstone interbed - intermittent coal laminae to 3mm on bedding CORE LOSS						12.15m: B: 10°, pl, ro 12.3m: B: 10°, pl, sm 12.5m: 10°, pl, sm 12.58m: CORE LOSS: 220mm		C	100	100	
	12.8							12.85m: J: 65°, pl, sm 13m: B: 10°, pl, sm					PL(A) = 0.12MPa PL(D) = 0.16MPa
	12.84	SILTSTONE - very low strength to low strength, fresh stained fractured dark grey siltstone						13.2m: B: 10°, pl, sm 13.25m: B: 10°, un, sm					
	13							13.75m: B: 10°, pl, ro		C	83	78	
	13.25	SANDSTONE - medium strength to high strength, slightly weathered slightly fractured green-grey medium to coarse sandstone bedding 0° - 10°						14.18m: 10°, un, sm 14.35m: B: 10°, pl, sm 14.6m: B: 20°, pl, ro					PL(A) = 1.65MPa PL(D) = 1.49MPa
	14	- becoming fresh bedding at 10° - 20° - intermittent coal laminae to 5mm on bedding - 50 - 150mm medium strength to high strength, conglomerate interbeds at 200 - 500mm intervals to 16.00m								C	100	95	

RIG: 13 tonne truck mounted

DRILLER: Geodrill

LOGGED: SP

CASING:

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength ls(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.14m
EASTING: 511662.329
NORTHING: 6944602.941
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 74122
DATE: 15/10/09
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low			Medium	High	Very High	Ex High	B - Bedding S - Shear		J - Joint D - Drill Break	Type	Core Rec. %	RQD %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		SANDSTONE - medium strength to high strength, slightly weathered slightly fractured green-grey medium to coarse sandstone bedding 0° - 10° (continued)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

RIG: 13 tonne truck mounted

DRILLER: Geodrill

LOGGED: SP

CASING:

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength ls(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED	
Initials:	
Date:	



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 98.59m
EASTING: 511784.775
NORTHING: 6944726.4
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 74122
DATE: 14/10/09
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Rock Strength	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS			B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	LOAMY SAND - (Topsoil) black													
		FILLING SANDY CLAY - stiff red brown sandy clay filling medium plasticity													
	0.75	FILLING CLAYEY SAND - medium dense orange brown													
	1.0	FILLING SANDY CLAY - dark grey landfill combined with sandy clay													
	2														
	3														
	4														

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 6.4m (HW)

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: Groundwater encountered at 5m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED

Initials:

Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 98.59m
EASTING: 511784.775
NORTHING: 6944726.4
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 74122
DATE: 14/10/09
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	FW	MW	SW		FS	FR	Ex Low	Very Low	Low			Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type
	5.0	FILLING SANDY CLAY - orange brown containing landfill																			

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 6.4m (HW)

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: Groundwater encountered at 5m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	>	Water seep
		g	Water level

CHECKED

Initials:

Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 98.59m
EASTING: 511784.775
NORTHING: 6944726.4
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 74122
DATE: 14/10/09
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing							
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding	J - Joint	S - Shear	D - Drill Break	Type	Core Rec. %
	10.5	FILLING SANDY CLAY - orange brown containing landfill (continued)																										
	11	SILTY CLAY - hard pale grey slightly sandy patches of sand																						S				9,15,23 N = 38
	11.9	SAND - dense to very dense red coarse grained																										
	12.1	SANDSTONE - high strength, slightly weathered slightly fractured unbroken light grey medium to coarse sandstone bedding at 10° - 100mm low strength to medium strength band - becoming moderately weathered to slightly weathered light grey and orange-brown mottled - 30mm very low strength band - coal laminae to 2mm at 100mm spacing to 13.50m - becoming fresh grey conglomerate interbeds to 100mm at 300 - 500mm intervals until 14.90m																										PL(A) = 0.59MPa PL(D) = 0.79MPa
	13																											
	14																											

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 6.4m (HW)

TYPE OF BORING: 100mm Auger/Washbore/NMLC

WATER OBSERVATIONS: Groundwater encountered at 5m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PI	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		≡	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 98.59m
EASTING: 511784.775
NORTHING: 6944726.4
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 74122
DATE: 14/10/09
SHEET 4 OF 4

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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.24m
EASTING: 511719.906
NORTHING: 6944764.492
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 74122
DATE: 13/10/09
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low			Medium	High	Very High	Ex High	B - Bedding	J - Joint	Type
		FILLING - pale grey/brown clayey sand filling (Topsoil)																			
	0.3	FILLING SANDY CLAY - stiff to very stiff red brown medium plasticity																			
	0.9	FILLING CLAYEY SAND - medium dense dark grey fine to coarse grained																			
	1.3	FILLING CLAYEY SAND - medium dense dark grey containing refuse waste																			
	2.6	FILLING CLAY - dark grey medium plasticity contains traces of landfill refuse waste																			
	3.9	FILLING SANDY CLAY - very stiff orange brown medium plasticity fine to medium grained sand, traces of blue paint																			

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW = 6m

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		☼	Water level

CHECKED	
Initials:	
Date:	



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.24m
EASTING: 511719.906
NORTHING: 6944764.492
DIP/AZIMUTH: 90°/-

BORE No: 6
PROJECT No: 74122
DATE: 13/10/09
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				Test Results & Comments
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	
		FILLING SANDY CLAY - very stiff orange brown medium plasticity fine to medium grained sand, traces of blue paint (<i>continued</i>)																				
	5.5	SILTY CLAY - very stiff pale grey medium plasticity some red brown and yellow brown mottling																				
	-6																	S				5,9,12 N = 21
	-7																					
	7.2	SANDY CLAY - very stiff pale brown high plasticity medium grained																	S			10,10,17 N = 27
	-8																					
	8.2	SILTY CLAY - very stiff white pale grey streaks of coarse red sand																	S			9,11,12 N = 23
	-9																					
	8.8	SAND - very dense pale red grey medium grained showing characteristics of being extremely low strength, extremely weathered sandstone																	S			30/70mm
		- becoming coarse grained																				

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW = 6m

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		W	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.24m
EASTING: 511719.906
NORTHING: 6944764.492
DIP/AZIMUTH: 90°/-

BORE No: 6
PROJECT No: 74122
DATE: 13/10/09
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Rock Strength	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS			B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
	10.3	SANDSTONE - high strength, slightly weathered fractured to slightly fractured purple grey and orange-brown stained medium to coarse sandstone bedding sub-horizontal													10/0mm refusal
	10.8	CORE LOSS													
	11.1	SANDSTONE - extremely low strength, extremely weathered to highly weathered fractured grey and orange-brown stained fine sandstone bedding at 0 - 10% siltstone laminae to 20mm at 50 - 100mm intervals													
	11.4	SILTSTONE - extremely low strength to very low strength, extremely weathered to highly weathered fractured grey siltstone bedding at 10° fine sandstone laminae to 10mm													
	12.2	SANDSTONE - extremely low strength, extremely weathered to highly weathered fractured to slightly fractured dark grey and orange-brown mottled fine sandstone bedding at 0 - 10° siltstone laminae to 20 at 20 - 100mm intervals													
	13.35	SILTSTONE - extremely low strength to very low strength, moderately weathered to slightly weathered fractured to slightly fractured grey siltstone bedding at 10°													
	13.85	SANDSTONE - low strength, fresh slightly fractured unbroken grey fine to medium sandstone bedding at 10° siltstone laminae to 10mm at 20 - 100 mm intervals until 14.70m													
	14.55	- becoming medium strength light grey coarse sandstone													

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW = 6m

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		≡	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.24m
EASTING: 511719.906
NORTHING: 6944764.492
DIP/AZIMUTH: 90°/-

BORE No: 6
PROJECT No: 74122
DATE: 13/10/09
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength						Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High	Very High			Ex High	B - Bedding	J - Joint	Type	Core Rec. %		RQD %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		SANDSTONE - low strength, fresh slightly fractured unbroken grey fine to medium sandstone bedding at 10° siltstone laminae to 10mm at 20 - 100 mm intervals until 14.70m (continued) becoming high strength, medium to coarse sandstone																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																</

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: HW = 6m

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED	
Initials:	
Date:	



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.35m
EASTING: 511653.554
NORTHING: 6944798.592
DIP/AZIMUTH: 90°/-

BORE No: 8
PROJECT No: 74122
DATE: 09/10/09
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %
	0.05	LOAMY SAND (Topsoil)																				
		FILLING SANDY CLAY - stiff red brown sandy clay medium plasticity, dry																				
	0.7	FILLING CLAYEY SAND - medium dense to dense pale brown clayey sand, dry																				
1	1.0	FILLING CLAYEY SAND - medium dense dark grey clayey sand traces of gravel																				
	1.7	FILLING SILTY SAND - medium dense pale brown silty sand																S				2.9,14 N = 23
2	2.0	FILLING SILTY SAND - medium dense yellow orange silty sand fine grained																				
	2.3	FILLING SANDY CLAY - stiff to very stiff red sandy clay medium to high plasticity fine grained																				
	2.6	CLAYEY SAND - dense white fine grained																				
3																						
																		S				8,15,21 N = 36
4	4.0	SILTY SAND - dense to very dense bands of red and white sand getting denser with depth showing characteristics of being extremely low strength, extremely weathered sandstone																S				29, 30/50mm

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		☼	Water level

CHECKED

Initials:

Date:



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Geotechnics • Environment • Groundwater

BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.35m
EASTING: 511653.554
NORTHING: 6944798.592
DIP/AZIMUTH: 90°/-

BORE No: 8
PROJECT No: 74122
DATE: 09/10/09
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %
		SILTY SAND - dense to very dense bands of red and white sand getting denser with depth showing characteristics of being extremely low strength, extremely weathered sandstone (continued)																				27, 30/100mm
	-6																	S				30/130mm
	-7																					30/110mm
	-8																					
	-8.5	CLAY - hard pale grey medium plasticity occasional band of sand																				
	-9																					9,14,20 N = 34
	-9.8	CLAY - hard dark grey medium plasticity																				

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	>	Water seep
		W	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.35m
EASTING: 511653.554
NORTHING: 6944798.592
DIP/AZIMUTH: 90°/-

BORE No: 8
PROJECT No: 74122
DATE: 09/10/09
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Rock Strength	Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS	FR			B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
	10.2	CLAY - hard dark grey medium plasticity (continued)														
		CLAYEY SAND - very dense red brown medium plasticity, dry showing characteristics of being extremely low strength to very low strength sandstone											S			30/50mm
	11.9	SANDY CLAY - very dense pale grey red brown sand bands											S			30/70mm
	12.4	CLAY - hard dark grey medium plasticity														
	12.9	SANDSTONE - very low strength to low strength, slightly weathered grey fine to medium sandstone											S			30/5mm
	13.5	SANDSTONE - medium strength, slightly weathered to fresh grey slightly fractured unbroken fine to medium sandstone bedding at 20°														PL(A) = 0.58MPa PL(D) = 0.73MPa
	14	- bedding at 10° - coal laminae to 2mm on bedding to 14.20m - becoming coarse sandstone intermittent siltstone laminae to 10mm to 16.10m - becoming fine sandstone									14.15m: J: 20°, un, ro 14.35m: B: 10°, pl, sm		C	97	94	PL(A) = 0.33MPa

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength ls(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		≡	Water level

CHECKED

Initials:

Date:



Douglas Partners
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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.35m
EASTING: 511653.554
NORTHING: 6944798.592
DIP/AZIMUTH: 90°/-

BORE No: 8
PROJECT No: 74122
DATE: 09/10/09
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities			Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ext Low	Very Low	Low	Medium			High	Very High	Ext High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %
		SANDSTONE - medium strength, slightly weathered to fresh grey slightly fractured unbroken fine to medium sandstone bedding at 20° (continued) - becoming fine to medium sandstone - becoming low strength to medium strength - becoming medium to coarse sandstone - becoming moderately weathered to slightly weathered - 20mm extremely weathered siltstone laminae - becoming fresh - 30mm low strength to medium strength siltstone interbed - becoming medium strength to high strength CORE LOSS SANDSTONE - medium strength, slightly weathered to fresh grey slightly fractured unbroken fine to medium sandstone bedding at 20° CORE LOSS SILTSTONE - medium strength, fresh dark grey slightly fractured unbroken siltstone bedding sub-horizontal - becoming medium strength to high strength - becoming medium strength														14.95m: J: 60°, pl, sm 15m: J: 45°, pl, sm 15.85m: J: 30°, pl, sm 16.11m: B: 10°, un, sm, cc 16.15m: B: 45°, pl, sm, cc 16.25m: B: 10°, pl, sm, cf 20mm 16.4m: CORE LOSS: 100mm 16.7m: CORE LOSS: 250mm 16.73m: B: 10°, pl, sm						PL(D) = 0MPa PL(A) = 0.38MPa PL(D) = 0.28MPa PL(A) = 1.08MPa PL(D) = 1.4MPa PL(A) = 1.08MPa PL(D) = 0.44MPa
	16																C	97	94			
	16.4																					
	16.5																					
	16.7																					
	16.95																					
	17																					
	18																C	91	90			
	19																					
	19.1																					
	19.5																					
														</								

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A Auger sample	pp Pocket penetrometer (kPa)		
D Disturbed sample	PID Photo ionisation detector		
B Bulk sample	S Standard penetration test		
U Tube sample (x mm dia.)	PL Point load strength Is(50) MPa		
W Water sample	V Shear Vane (kPa)		
C Core drilling	▷ Water seep	Water level	

CHECKED	
Initials:	
Date:	



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.995m
EASTING: 511634.031
NORTHING: 6944775.474
DIP/AZIMUTH: 90°/-

BORE No: 9
PROJECT No: 74122
DATE: 08/10/09
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type
	0.2	FILLING SILTY SAND - silty sand filling with some fine gravel (Topsoil)																			
	0.8	FILLING SANDY CLAY - very stiff, pale brown, high plasticity, medium grained sandy clay filling, sand fraction medium grained, dry																			
	1	FILLING SANDY CLAY - firm to stiff, dark brown, high plasticity sandy clay filling, sand fraction medium grained, dry																			
	2																				
	3																				
	3.4	FILLING SANDY CLAY - stiff, dark grey, medium plasticity sandy clay, sand fraction fine to coarse grained, moist																			
	4																				

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	D	Water seep
			Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.995m
EASTING: 511634.031
NORTHING: 6944775.474
DIP/AZIMUTH: 90°/-

BORE No: 9
PROJECT No: 74122
DATE: 08/10/09
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength						Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
			EW	FW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High	Very High			Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	5.2	FILLING SANDY CLAY - very stiff, pale red brown, medium plasticity sandy clay filling, sand fraction medium to coarse grained, wet																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
			Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.995m
EASTING: 511634.031
NORTHING: 6944775.474
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 74122
DATE: 08/10/09
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength						Water	Fracture Spacing (m)			Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW		FS	FR	Ex	Low	Very Low	Low		Medium	High	Very High	Ex	High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
	10.0	SANDY CLAY (as before)																		S			16, 30/60mm		
	10.2	SANDY CLAY - hard, red brown, medium plasticity sandy clay, sand fraction medium grained																							
	10.7	CLAYEY SAND - dense to very dense, pale red and orange brown, fine grained clayey sand (showing characteristics of being weathered sandstone)																							
11		- fine to medium grained																		S			30/50mm		
	11.7	SANDY CLAY - black sandy clay layer																							
12	11.9	CLAYEY SAND - very dense, red brown, medium grained clayey sand (showing characteristics of being weathered sandstone)																		S			30/120mm		
		- dense to very dense, pale grey																					'S' refusal		
13	13.0	SANDSTONE - high strength, slightly weathered, slightly fractured to unbroken, grey, medium to coarse grained sandstone, bedding at 10°																		S					
			</																						

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		W	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 99.995m
EASTING: 511634.031
NORTHING: 6944775.474
DIP/AZIMUTH: 90°/-

BORE No: 9
PROJECT No: 74122
DATE: 08/10/09
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)			Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
			EW	FW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	15.0	SANDSTONE (as before)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

RIG: Hydrapower Scout

DRILLER: Groundtest

LOGGED: MB

CASING: 9m

TYPE OF BORING: 100mm Auger

WATER OBSERVATIONS: Groundwater encountered at 3m depth

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
D Disturbed sample	PID Photo ionisation detector
B Bulk sample	S Standard penetration test
U Tube sample (x mm dia.)	PL Point load strength Is(50) MPa
W Water sample	V Shear Vane (kPa)
C Core drilling	> Water seep
	W Water level

CHECKED

Initials:

Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.09m
EASTING: 511625.599
NORTHING: 6944745.908
DIP/AZIMUTH: 90°/-

BORE No: 10
PROJECT No: 74122
DATE: 14/10/09
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		Ex Low	Very Low	Low	Medium	High			Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %
	0.2	FILLING CLAYEY SAND - pale grey/yellow clayey sand filling (Topsoil)																			
		FILLING SANDY CLAY - stiff red-brown sandy clay filling																			
	0.9	FILLING SILTY CLAY - stiff grey sandy silty clay filling																			
	1.5	FILLING CLAYEY SAND - loose pale grey clayey sand filling																			
	2.6	FILLING - refuse waste																			
	3.2	SANDY CLAY - very stiff pale grey and orange mottled showing characteristics of being extremely low strength, extremely weathered sandstone																			

RIG: 13t Truck mounted

DRILLER: Geodrill

LOGGED: SP

CASING:

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		≡	Water level

CHECKED	
Initials:	
Date:	



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.09m
EASTING: 511625.599
NORTHING: 6944745.908
DIP/AZIMUTH: 90°/-

BORE No: 10
PROJECT No: 74122
DATE: 14/10/09
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		SANDY CLAY - very stiff pale grey and orange mottled showing characteristics of being extremely low strength, extremely weathered sandstone (continued)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

RIG: 13t Truck mounted

DRILLER: Geodrill

LOGGED: SP

CASING:

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	Δ	Water seep
		≡	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.09m
EASTING: 511625.599
NORTHING: 6944745.908
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 74122
DATE: 14/10/09
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW		FS	FR	Ex Low	Low	Medium			High	Very High	Ex High	B - Bedding	J - Joint	Type
		SILTSTONE - extremely low strength, extremely weathered dark grey (continued)															S			30/110mm
	11.5	SANDSTONE - medium strength to low strength, slightly weathered slightly fractured pink grey medium to coarse sandstone bedding at 10° - becoming low strength to medium strength, coarse sandstone bedding at 10 - 20°													11.5m: J: 30°, un, ro		C	100	80	PL(A) = 0.8MPa PL(D) = 0.46MPa
	12.45	- clay band - becoming fresh fine to medium sandstone													12.05m: J: 45°, un, sm 12.35m: J: 20°, un, sm 12.4m: J: 70°, pl, ro					
	12.55	SILTSTONE - low strength, fresh fractured to slightly fractured dark grey siltstone bedding at 0 - 10° CORE LOSS													12.55m: CORE LOSS: 350mm					
	12.9	- becoming very low strength													13m: B: 10°, pl, sm					PL(A) = 0.02MPa PL(D) = 0.07MPa
	13	- becoming extremely low strength to very low strength, brown and grey - becoming very low strength to low strength, slightly weathered orange-brown and grey mottled													13.3m: B: 10°, pl, sm, 13.35m: J: 30°, pl, sm 13.5m: J: 45°, pl, ti 13.6m: B: 10°, un, sm 13.65m: J: 35°, un, sm 13.75m: B: 10°, un, sm 13.85m: J: 40°, pl, sm 13.95m: J: 45°, un, sm 14.05m: J: 50°, un, sm 14.1m: J: 40°, un, sm 14.15m: J: 50°, un, sm 14.2m: J: 25°, pl, sm		C	80	65	
	14	- becoming low strength, fresh stained - becoming medium strength, fresh bedding at 0° fine sandstone laminae to 0 mm at 10 - 100 mm intervals													14.4m: J: 45°, pl, ti 14.75m: J: 30°, sv, pl, lim to 15.10m		C	100	100	PL(A) = 0.75MPa PL(D) = 0.01MPa

RIG: 13t Truck mounted

DRILLER: Geodrill

LOGGED: SP

CASING:

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND	
A	Auger sample
D	Disturbed sample
B	Bulk sample
U	Tube sample (x mm dia.)
W	Water sample
C	Core drilling
pp	Pocket penetrometer (kPa)
PD	Photo ionisation detector
S	Standard penetration test
PL	Point load strength Is(50) MPa
V	Shear Vane (kPa)
Δ	Water seep
W	Water level

CHECKED
Initials:
Date:



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BOREHOLE LOG

CLIENT: SKM Pty Ltd
PROJECT: Proposed Redevelopment
LOCATION: Cnr Compton & Kingston Roads, Slacks Creek

SURFACE LEVEL: 100.09m
EASTING: 511625.599
NORTHING: 6944745.908
DIP/AZIMUTH: 90°/-

BORE No: 10
PROJECT No: 74122
DATE: 14/10/09
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Rock Strength	Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS				B - Bedding S - Shear	J - Joint D - Drill Break	Type	Core Rec. %	RQD %	Test Results & Comments
		- becoming very low strength (continued) - becoming extremely low strength to very low strength, highly weathered											C	100	100	
	15.6	- becoming medium strength, fresh SANDSTONE - medium strength to high strength, fresh slightly fractured grey fine to medium sandstone bedding at 0 - 10° siltstone laminae to 10m at 10 - 100mm									15.15m: J: 45°, pl, sm 15.2m: B: 10°, pl, sm 15.35m: J: 35°, pl, sm 15.55m: B: 0°, pl, sm		C	100	50	PL(A) = 0.89MPa PL(D) = 0.53MPa
	16												C	100	100	PL(A) = 1.57MPa PL(D) = 0.57MPa
	16.7	Bore discontinued at 16.7m														
	17															
	18															
	19															

RIG: 13t Truck mounted

DRILLER: Geodrill

LOGGED: SP

CASING:

TYPE OF BORING: 100mm Auger/Washbore/NMLC coring

WATER OBSERVATIONS: No free groundwater was encountered

REMARKS: TBM (RL100m) - Top of concrete pad at monitoring well (MW03)

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		⊗	Water level

CHECKED
Initials:
Date:



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Appendix D Analytical Data

D.1 Soil Data

RTI DL RELEASE - EHP

Cronulla Park: Soil Results

Analyte (mg/kg)	Human Health Assessment Criteria	MW07 0.0-0.1m	MW08 0.2-0.3m	MW09 0.0-0.1m	MW04 0.2-0.3m	MW05 0.2-0.3m	MW06 0.2-0.3m	MW01 0.2-0.3m	MW02 0.2-0.3m	TP10 0.2-0.3m	TP2 0.2-0.3m	TP3 0.2-0.3m	TP4 0.2-0.3m	TP5 0.2-0.3m	TP6 0.2-0.3m	TP7 0.2-0.3m	TP8 0-0.1m	TP9 0.2-0.3m
Metals																		
Arsenic	500	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cadmium	100	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chromium	500	13	11	12	16	21	14	9	28	3	5	5	8	6	8	4	3	2
Copper	5000	5	5	5	6	16	5	5	5	5	5	5	5	5	5	5	5	5
Lead	1500	7	5	5	11	8	5	8	18	6	5	5	5	5	5	6	5	5
Nickel	3000	4	5	5	4	10	3	5	3	5	5	5	5	5	5	5	5	5
Zinc	35000	31	5	5	1	1	6	5	18	5	5	5	5	5	5	5	5	5
Mercury	75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

RTI DL RELEASE - EHP

Cronulla Park: Soil Results

Analyte (mg/kg)	Human Health Assessment Criteria	MW07 0.0-0.1m	MW08 0.2-0.3m	MW09 0.0-0.1m	MW04 0.2-0.3m	MW05 0.2-0.3m	MW06 0.2-0.3m	MW01 0.2-0.3m	MW02 0.2-0.3m	TP10 0.2-0.3m	TP2 0.2-0.3m	TP3 0.2-0.3m	TP4 0.2-0.3m	TP5 0.2-0.3m	TP6 0.2-0.3m	TP7 0.2-0.3m	TP8 0.0-0.1m	TP9 0.2-0.3m
OC Pesticides																		
alpha-BHC										<0.05			<0.05	<0.05		<0.05		<0.05
Hexachlorobenzene (HCB)										<0.05			<0.05	<0.05		<0.05		<0.05
beta-BHC										<0.05			<0.05	<0.05		<0.05		<0.05
gamma-BHC										<0.05			<0.05	<0.05		<0.05		<0.05
delta-BHC										<0.05			<0.05	<0.05		<0.05		<0.05
Heptachlor										<0.05			<0.05	<0.05		<0.05		<0.05
Aldrin										<0.05			<0.05	<0.05		<0.05		<0.05
Heptachlor epoxide										<0.05			<0.05	<0.05		<0.05		<0.05
trans-Chlordane										<0.05			<0.05	<0.05		<0.05		<0.05
alpha-Endosulfan										<0.05			<0.05	<0.05		<0.05		<0.05
cis-Chlordane										<0.05			<0.05	<0.05		<0.05		<0.05
Dieldrin										<0.05			<0.05	<0.05		<0.05		<0.05
4,4'-DDE										<0.05			<0.05	<0.05		<0.05		<0.05
Endrin										<0.05			<0.05	<0.05		<0.05		<0.05
beta-Endosulfan										<0.05			<0.05	<0.05		<0.05		<0.05
4,4'-DDD										<0.05			<0.05	<0.05		<0.05		<0.05
Endrin aldehyde										<0.05			<0.05	<0.05		<0.05		<0.05
Endosulfan sulphate										<0.05			<0.05	<0.05		<0.05		<0.05
4,4'-DDT										<0.05			<0.05	<0.05		<0.05		<0.05
Endrin ketone										<0.05			<0.05	<0.05		<0.05		<0.05
Methoxychlor										<0.05			<0.05	<0.05		<0.05		<0.05
Total OC Pesticides										<0.05			<0.05	<0.05		<0.05		<0.05
OP Pesticides																		
Dichlorvos										<0.05			<0.05	<0.05		<0.05		<0.05
Dementon-S-methyl										<0.05			<0.05	<0.05		<0.05		<0.05
Monocrotophos										<0.05			<0.05	<0.05		<0.05		<0.05
Dimethoate										<0.05			<0.05	<0.05		<0.05		<0.05
Diazinon										<0.05			<0.05	<0.05		<0.05		<0.05
Chlorpyrifos-methyl										<0.05			<0.05	<0.05		<0.05		<0.05
Parathion-methyl										<0.05			<0.05	<0.05		<0.05		<0.05
Malathion										<0.05			<0.05	<0.05		<0.05		<0.05
Fenitrothion										<0.05			<0.05	<0.05		<0.05		<0.05
Chlorpyrifos										<0.05			<0.05	<0.05		<0.05		<0.05
Parathion										<0.05			<0.05	<0.05		<0.05		<0.05
Pirimphos-ethyl										<0.05			<0.05	<0.05		<0.05		<0.05
Chlorfenvinphos										<0.05			<0.05	<0.05		<0.05		<0.05
Bromophos-ethyl										<0.05			<0.05	<0.05		<0.05		<0.05
Fenamiphos										<0.05			<0.05	<0.05		<0.05		<0.05
Prothiofos										<0.05			<0.05	<0.05		<0.05		<0.05
Ethion										<0.05			<0.05	<0.05		<0.05		<0.05
Carbophenothion										<0.05			<0.05	<0.05		<0.05		<0.05
Azinphos Methyl										<0.05			<0.05	<0.05		<0.05		<0.05
Total OP Pesticides										<0.05			<0.05	<0.05		<0.05		<0.05

RT/DL RELEASE - EHP

Cronulla Park: Soil Results

Analyte (mg/kg)	Human Health Assessment Criteria	MW07 0.0-0.1m	MW08 0.2-0.3m	MW09 0.0-0.1m	MW04 0.2-0.3m	MW05 0.2-0.3m	MW06 0.2-0.3m	MW01 0.2-0.3m	MW02 0.2-0.3m	TP10 0.2-0.3m	TP2 0.2-0.3m	TP3 0.2-0.3m	TP4 0.2-0.3m	TP5 0.2-0.3m	TP6 0.2-0.3m	TP7 0.2-0.3m	TP8 0.0-0.1m	TP9 0.2-0.3m
TPH																		
C6 - C9 Fraction		<10			<10	<10			<10	<10	<10	<10	<10	<10				<10
C10 - C14 Fraction		<50			<50	<50			<50	<50	<50	<50	<50	<50				<50
C15 - C28 Fraction		<100			<100	<100			<100	<100	<100	<100	<100	<100				<100
C29 - C36 Fraction		<100			<100	<100			<100	<100	<100	<100	<100	<100				<100
Total C10 - C36 Fraction		<250			<250	<250			<250	<250	<250	<250	<250	<250				<250
BTEX																		
Benzene		<0.2			<0.2	<0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				<0.2
Toluene		<0.5			<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5
Ethylbenzene		<0.5			<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5
m,p- & para-Xylene		<0.5			<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5
ortho-Xylene		<0.5			<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5
Total BTEX		<0.5			<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5
PAHs																		
Naphthalene										<0.5			<0.5	<0.5				<0.5
Acenaphthylene										<0.5			<0.5	<0.5				<0.5
Acenaphthene										<0.5			<0.5	<0.5				<0.5
Fluorene										<0.5			<0.5	<0.5				<0.5
Phenanthrene										<0.5			<0.5	<0.5				<0.5
Anthracene										<0.5			<0.5	<0.5				<0.5
Fluoranthene										<0.5			<0.5	<0.5				<0.5
Pyrene										<0.5			<0.5	<0.5				<0.5
Benz(a)anthracene										<0.5			<0.5	<0.5				<0.5
Chrysene										<0.5			<0.5	<0.5				<0.5
Benz(b)fluoranthene										<0.5			<0.5	<0.5				<0.5
Benz(k)fluoranthene										<0.5			<0.5	<0.5				<0.5
Benz(a)pyrene										<0.5			<0.5	<0.5				<0.5
Indeno(1,2,3-cd)pyrene										<0.5			<0.5	<0.5				<0.5
Dibenzo(a,h)anthracene										<0.5			<0.5	<0.5				<0.5
Benz(g,h,i)perylene										<0.5			<0.5	<0.5				<0.5
Sum of PAHs										<0.5			<0.5	<0.5				<0.5
Phenols																		
Phenol										<0.5			<0.5	<0.5				<0.5
2-Chlorophenol										<0.5			<0.5	<0.5				<0.5
2-Methylphenol										<0.5			<0.5	<0.5				<0.5
3- & 4-Methylphenol										<1			<1	<1				<1
2-Nitrophenol										<0.5			<0.5	<0.5				<0.5
2,4-Dimethylphenol										<0.5			<0.5	<0.5				<0.5
2,4-Dichlorophenol										<0.5			<0.5	<0.5				<0.5
2,6-Dichlorophenol										<0.5			<0.5	<0.5				<0.5
4-Chloro-3-methylphenol										<0.5			<0.5	<0.5				<0.5
2,4,6-Trichlorophenol										<0.5			<0.5	<0.5				<0.5
2,4,5-Trichlorophenol										<0.5			<0.5	<0.5				<0.5
Pentachlorophenol										<2			<2	<2				<2
PCBs																		
Total Polychlorinated biphenyls										<0.10			<0.10	<0.10				<0.10

RTI DL RELEASE - EHP



D.2 Groundwater Data

D.2.1 Historical Data

RTI DL RELEASE - EHP

Cronulla Park CR13 Monitoring Results

Zionville Park: CR13 Monitoring Results			Environmental Assessment Criteria																Human Health Assessment Criteria															
Analyte	EC (µS/cm)	Inorganic (mg/l)	Calcium	Sodium	Potassium	Magnesium	Bicarbonate	Sulphate	Chloride	Fluoride	Aluminium	Iron	Copper	Manganese	Nickel	Lead	Zinc	Ammonia	Nitrate	Phosphate	Total Organic Carbon	Total Phosphorus	Chemical Oxygen Demand	Biological Oxygen Demand	Organics (µg/l)	TPH (C6-C9)	TPH (C10-C14)	TPH (C15-C28)	TPH (C29-C36)	TPH (C10-C36)				
6.5-8.0	2200		5.44	5.94	5.12	5.51	6.21	5.21	5.52	5.88	5.78	5.63	5.56	5.5	5.61	5.65	5.34	5.11	4.82	5.56	5.33	5.22	5.44	5.65	5.4	5.45	5.03	5.36	684	669				
								829	713	822	786	737	771	763	610	684	716	610	644	760	592	593	720	701	616	651	780	778	720	684	669			
								2	2	2	2	1	2	1	2	2.2	1.8	7.4	3.2	4.3	3.1	4	3.1	2.4	3.6	3.8	4	1.3	0.9	1.2	1.4	6.1		
								94	77	53	91	60	84	60	85	68	61	90	82	84	105	90	73	92	85	93	72	84	88	75	80	80		
								10	19	13	10	9	7	6	7	7.6	7.3	5.5	4.6	5.7	5.8	5	3	4.7	3.9	4.5	4.2	5.1	6.6	5.6	6.3	6.5		
																15	19	12	0.05	11	12	11	9.6	12	12	13	12	13	12	17	15	14		
																56	61	54	42	26.3	35.3	44	54	44.3	28.7	50	55	41	39.4	47.6	49.2	48	22	44
								9	8	9	8	9	8	9	8	13	10	9	8	9	8	9	7	8	9	8	10	10	8	8	13	13		
								189	220	160	195	225	195	193	182	217	263	164	161	70	170	170	210	160	150	170	160	160	170	175	170	165	170	
																																0.12		
																																</		

Cronulla Park: CR14 Monitoring Results

Analyte	Environmental Assessment Criteria	Human Health Assessment Criteria	00-Jul-00	07-Oct-00	22-Jan-01	16-Jul-01	17-Apr-02	22-Jan-02	18-Oct-02	24-Jan-03	16-Apr-03	29-Jul-03	03-Oct-03	23-Jan-04	16-Apr-04	29-Jul-04	03-Nov-04	14-Feb-05	27-Oct-05	13-Feb-06	13-May-06	26-Jul-06	14-Oct-06	30-Jan-07	24-Apr-07	24-Jul-07	23-Oct-07	11-Feb-08	11-May-08	01-Aug-08	
pH (pH units)	6.5-8.0		4.7	5.1	4.7	3.98	4.95	4.99	4.17	4.56	6.86	4.83	4.59	4.38	4.4	3.35	3.48	5.16	5.42	4.41	4.62	4.15	4.6	4.47	4.28	4.11	4.29	4.39	3.89	4.4	
EC (µS/cm)	2200								286	224	274	231	269	289	245	211	252	239	310	236	253	290	377	392	296	291	364	475	291	403	
Inorganic (mg/l)																															
Calcium																															
Sodium																															
Potassium																															
Magnesium																															
Bicarbonate																															
Sulphate																															
Chloride																															
Fluoride																															
Aluminium																															
Iron																															
Copper	0.0025	1	0.66	0.01	0.06	0.13	0.26	0.14	0.13	0.04	0.01	0.01	0.04	0.63	0.01	0.08	0.64	0.07	0.16	0.07	0.16	0.032	0.072	0.085	0.12	0.072	0.12	0.072	0.12	0.05	
Manganese	3.6	0.5	0.034	0.026	0.025	0.034	0.029	0.029	0.022	0.019	0.019	0.021	0.022	0.024	0.02	0.02	0.035	0.21	0.03	0.04	0.024	0.026	0.027	0.022	0.029	0.038	0.057	0.025	0.025	0.03	
Nickel	0.017	0.1	0.004	0.003	0.003	0.002	0.027	0.003																							
Lead	0.0094	0.05	0.017	0.009	0.003	0.003	0.002	0.003																							
Zinc	0.031	5	0.02	0.023	0.02	0.024	0.018	0.017	0.011	0.011	0.009	0.01	0.012	0.011	0.006	0.006	0.011	0.009	0.009	0.009	0.01	0.031	0.026	0.014	0.007	0.011	0.011	0.026	0.0096	0.0096	
Ammonia	2.3	0.5	0.04	0.06	0.12	0.03	0.08	0.04	0.02	0.05	0.04	0.04	0.01	0.02	0.01	0.04	0.01	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Nitrate	17	10000	0.02	0.04	0.05	0.02	0.06	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.04	0.01	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Phosphate																															
Total Organic Carbon																															
Chemical Oxygen Demand	0.05		0.89	0.65	0.54	1.02	0.28	0.36	7																						
Biological Oxygen Demand			58	4	36	84	144	39																							
Organics (µg/l)			6	8	4	11																									
TPH (C8-C9)																															
TPH (C10-C14)																															
TPH (C15-C28)																															
TPH (C29-C36)																															
TPH (C10-C36)																															

Cronulla Park- CR1 Monitoring Results																															
Analyte	Environmental Assessment Criteria	Human Health Assessment Criteria																													
			22-Jan-01	06-Jul-01	17-Apr-02	22-Jan-02	18-Oct-02	24-Jan-03	06-Apr-03	28-Jul-03	24-Oct-03	23-Jan-04	16-Apr-04	29-Jul-04	03-Nov-04	04-Feb-05	28-Apr-05	28-Jul-05	27-Oct-05	03-Feb-06	03-May-06	26-Jul-06	24-Oct-06	30-Jan-07	24-Apr-07	24-Jul-07	23-Oct-07	11-Feb-08	01-May-08	01-Aug-08	
pH (pH units)	6.5-8.0		5.78	5.31	5.86	6.25	5.83	6.11	6.77	6.43	6.57	6.07	6.33	343	276	337	342	305	350	386	274	285	358	376	315	357	385	378	315	261	320
EC (µS/cm)	2200																														
Inorganic (mg/l)																															
Calcium								4	4	5	6	5	5	5	6.9	2.9	5.4	2	3.5	2.9	2.6	4.5	5.1	5.1	4.4	6.3	4.1	4.6	2.6	4.2	
Sodium			35	39	34	34	32	33	38	36	35	26	24	34	34	34	34	32	51	43	37	41	50	39	45	39	38	36	37	35	
Potassium												1			0.62	1.6	0.5	0.6	0.1	0.4	0.3	0.8	0.7	0.3	1	0.2	0.8	0.5	0.3	1.1	
Magnesium															9.7	16	6.1	10	5.3	6.5	6.3	7.5	9.4	10	9	11	11	9.5	8.4	8.7	
Bicarbonate			78	42	56	57	74	48	46	34	61	65	53	48	29	16.4	56.6	21	51	40.2	37.7	52	90	65.6	82.03	66.4	53.3	50	40	27	
Sulphate			15	17	17	17	12	15	14	13	15	16	14	17	14	12	13	13	13	9	13	13	15	13	12	15	12	14	10	13	
Chloride			50	55	77	43	45	49	49	93	50	43	54	53	49	59	46	51	62	55	53	52	50	52	48	50	62	49	55	58	
Fluoride																															
Aluminium			19.8	1.55	12	11.2	14.5	14	2.42	8.39	6.77	2.69	4.94	78	13	0.03	14	14	0.03	8.6	0.91		8.6	18	12	0.12	17	15	10	0.08	
Iron																															
Copper	0.0025	1	0.001																												
Manganese	3.6		0.049	0.039	0.046	0.039	0.043	0.042	0.05	0.039	0.038	0.038	0.042	0.03	0.047	0.03	0.05	0.03	0.04	0.03	0.03	0.022	0.045	0.045	0.045	0.047	0.034	0.029	0.025	0.08	
Nickel	0.017		0.002		0.008	0.001																									
Lead	0.0094	0.05	0.002	0.002	0.007	0.009	0.007	0.013	0.003	0.003	0.004	0.003	0.004	0.017	0.011	0.004	0.004	0.004	0.004	0.004	0.009	0.013	0.0097	0.013	0.025	0.003	0.004	0.008	0.006		
Zinc	0.031	5	0.007	0.002	0.007	0.009	0.007	0.013	0.003	0.003	0.004	0.003	0.004	0.017	0.011	0.004	0.004	0.004	0.004	0.004	0.009	0.013	0.0097	0.013	0.025	0.003	0.004	0.008	0.006		
Ammonia	2.3	0.5	0.48	0.06	0.72	0.57	0.59	0.61	0.53	0.53	0.53	0.53	0.53	0.7	0.5	0.5	0.8	0.6	0.8	0.6	0.4	0.5	0.7	0.8	0.8	0.7	0.6	0.6	0.4	0.3	
Nitrate	17	10000	0.01																0.04	0.027	0.05										
Phosphate																															
Total Organic Carbon							4	1	9	9	9	9	9	10	11	0.5	2	14	23	6	9	18	3	3	7	3	3	5	1	3	
Total Phosphorus			0.18	0.7	0.07																										
Chemical Oxygen Demand	0.05		104	193	104	31																									
Biological Oxygen Demand			4	8																											
Organics (µg/l)																															
TPH (C6-C9)																															
TPH (C10-C14)			89																												
TPH (C15-C28)			165																												
TPH (C29-C36)			99																												
TPH (C10-C36)			353																												
	800	600				55																									



D.2.2 2009 Investigation Data

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Cronulla Park round water Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill													
			Cross-gradient MW02							Downgradient						
			18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	
R																
Groundwater Level (m AHD)			29.05	28.03	29.00	29.08	21.55		21.84	21.34	21.37	25.09	25.09	24.89	24.87	
IC																
Pesticide Chemical Parameters (In situ)																
Dissolved Oxygen (mg/L)			5.5	3.96	1.13	5.79	1.27		3.52	1.09	2.34	4.97	4.11	1.42	3.79	
Total Dissolved Solids (ppK)			4.87	4.04	2.92	4.34	2.22		1.86	1.36	1.83	0.332	0.332	2.42	0.492	
pH			4.09	3.65	3.41	3.86	6.27		6	5.87	6.41	5.12	4.44	3.75	4.29	
Reduction Potential (eH)			279	380	416	458	-44		-20	-9	-30	124	242	267	275	
Temperature (°C)			23.7	22.4	23.2	22.4	19.5		20.9	24.1	22.7	20.2	20.7	20.4	22.1	
Ammonia (mg/)																
Ammonia as N	2.3	0.5	0.12	0.02			13.8		50.4			0.58	0.5			
Dissolved Metals (mg/)																
Arsenic	0.36	0.05	<0.001	0.001	<0.001		0.008	0.009	0.025	0.013		<0.001	0.001	<0.001		
Cadmium	0.0008	0.005	0.0006	0.0006	0.0003		0.001	0.001	<0.001	0.0002		<0.001	0.0001	0.0002		
Chromium ^A	0.04	0.05	0.009	0.004	0.001		0.004		<0.001	0.001		<0.001	<0.001	0.001		
Copper	0.0025	1	0.018	0.017	0.003		<0.001		<0.001	0.003		0.001	0.001	0.006		
Lead	0.0094	0.05	0.032	0.043	0.001		<0.001		<0.001	<0.001		0.001	0.001	0.003		
Nickel	0.017	0.1	0.1	0.098	0.002		0.016	0.013	0.013	0.008		0.003	0.002	<0.001		
Zinc	0.031	5	0.359	0.349	0.06		0.029	0.028	0.039	0.026		0.038	0.042	0.021		
Mercury	0.0054		<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001		

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Within Former Landfill															
			Cross-gradient						Downgradient									
			MW03			MW04			MW08			MW05			MW07			
			18/5/09	26/09	17/9/09	7/10/09	18/5/09	26/09	17/9/09	7/10/09	19/5/09	26/09	17/9/09	7/10/09	18/5/09	26/09	17/9/09	7/10/09
R																		
Groundwater Level (m AHD)			29.79	29.94	29.71	29.68	25.28	25.46	25.27	25.27	27.31	27.41	27.30	27.27	22.15	22.90	22.01	21.92
IC																		
Pesticide Chemical Parameters (In situ)																		
Dissolved Oxygen (mg/L)			7.06	6.27	3.16	5.8			0.84			3.82	1.21	0.13		1.25	0.81	0.06
Total Dissolved Solids (ppK)			0.46	0.46	0.385	0.385			1.51			1.92	2.23	2.2		1.1	1.77	3.12
pH			5.43	5.46	5.13	4.39			7.12			6.99	6.73	7.73		6.8	6.85	7.38
Reduction Potential (eH)			179	262	143	62			-144			-58	-59	-197		-103	-126	-150
Temperature (°C)			22.5	20.5	21.6	21.8			25.3			19.4	22	22		21.8	23.5	22.6
Ammonia (mg/L)																		
Ammonia as N	2.3	0.5	0.52	<0.01			228	37.9			27	92.6			120	87.2		43.4
Iron (mg/L)																		
Arsenic	0.36	0.05	<0.001	<0.001	0.001		0.003	0.005	0.007		<0.001	0.018	0.012		0.003	0.005	0.003	0.006
Cadmium	0.0008	0.005	<0.0001	0.0001	0.0007		<0.0001	0.0001	0.0004		<0.0001	<0.0001	0.0003		<0.0001	0.0003	<0.0001	<0.0001
Chromium*	0.04	0.05	<0.001	<0.001	0.012		<0.001	0.003	0.003		<0.001	0.004	0.009		0.003	0.006	0.019	0.006
Copper	0.0025	1	<0.001	<0.001	0.02		<0.001	0.004	0.004		0.003	<0.001	0.011		<0.001	0.001	0.004	<0.001
Lead	0.0094	0.05	<0.001	<0.001	0.048		<0.001	0.001	0.001		<0.001	<0.001	<0.001		<0.001	0.002	0.001	<0.001
Nickel	0.017	0.1	0.004	0.004	0.124		0.013	0.003	0.009		0.003	0.017	0.023		0.013	0.122	0.012	0.039
Zinc	0.031	5	0.33	0.035	0.463		<0.001	0.009	0.004		<0.001	0.012	0.034		<0.001	0.043	0.018	<0.001
Mercury	0.0054		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001

Cronulla Park Groundwater Monitoring Results

Cronulla Park round water Monitoring Results																							
Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Offsite Wells																				
			Upgradient						Cross-gradient						Downgradient								
			MW01						CR14						CR15						CR13		
			18/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09		
R			30.99	31.00	31.02	31.06		31.34	31.33	31.59	31.36		27.76	27.92	27.68	27.59		20.72	20.89	20.60	20.61		
Groundwater Level (m AHD)																							
IC																							
Pesticide Chemical Parameters (In situ)																							
	Dissolved Oxygen (mg/L)		4.63	5.94	1.89	4.38		3.8	2.79	1.93	3.37		3.45	2.69	2.4	4.51		3.75	3.51	2.85	4.04		
	Total Dissolved Solids (ppK)		3.9	4.38	1.75	5.46		4.9	0.158	0.156	0.164		0.944	0.113	0.13	0.143		0.436	0.381	0.237	0.379		
	pH		3.9	3.62	3.29	3.7			3.75	4.26	4.16			5	5.56	6.02		4.99	5.24	5.74	5.74		
	Reduction Potential (eH)		369	184	345	407		269	148	215	214		100	79	51	18		2	111	88	90		
Temperature (°C)			22.6	21.2	21.5	20.8		21.2	21.4	23.3	21.4		19.7	19.8	21.2	20.6		22.1	21.6	22.4	21.6		
Ammonia (mg/)																							
Ammonia as N	2.3	0.5	0.08	0.03				0.14											9.79				
Iron & Metals (mg/)																							
Arsenic	0.36	0.05	<0.001	0.002	<0.001	<0.001	0.002	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002		0.016	0.019	0.022	0.022		
Cadmium	0.0008	0.005	<0.0001	0.0003	0.0002	0.0002	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0003	0.0002		<0.0001	<0.0001	<0.0001	0.0004		
Chromium*	0.04	0.05	0.01	0.018	0.021	0.021	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
Copper	0.0025	1	0.021	0.028	0.014	0.014	0.005	0.006	0.002	0.006		<0.001	0.002	0.001	0.002	0.002		<0.001	<0.001	<0.001	0.007		
Lead	0.0094	0.05	0.026	0.064	0.115	0.115	0.001	0.006	0.002	0.002	<0.001	<0.001	0.002	0.002	0.002	0.002		<0.001	<0.001	<0.001	<0.001		
Nickel	0.017	0.1	0.032	0.038	0.028	0.028	0.004	0.009	0.002	0.002		<0.001	0.002	0.003	0.002	0.002		0.001	0.001	0.001	0.001		
Zinc	0.031	5	0.1	0.154	0.072	0.072	0.105	0.079	0.015	0.015		0.046	0.014	0.07	0.057	0.057		0.042	0.025	0.016	0.025		
Mercury	0.0054		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Drain			
			25/2/09	9/6/09	17/9/09	7/10/09
R						
Groundwater Level (m AHD)						
LIORIC						
Pesticide Chemical Parameters (In situ)						
Dissolved Oxygen (mg/L)				6.11	3.95	6.58
Total Dissolved Solids (ppK)				0.24	0.306	0.208
pH				7.25	7.03	7.5
Reduction Potential (eH)				68	-16	54
Temperature (°C)				19.4	23.9	25.7
Ammonia (mg/l)						
Ammonia as N	2.3	0.5		4.21		
Dissolved Metals (mg/l)						
Arsenic	0.36	0.05	<0.001	0.001	<0.001	
Cadmium	0.0008	0.005	<0.0001	0.0003	0.0011	
Chromium ^a	0.04	0.05	<0.001	0.007	0.002	
Copper	0.0025	1	0.002	0.003	0.002	
Lead	0.0094	0.05	<0.001	<0.001	0.013	
Nickel	0.017	0.1	0.001	0.001	0.005	
Zinc	0.031	5	0.038	0.173	0.097	
Mercury	0.0054		<0.0001	<0.0001	<0.0001	

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill													
			Cross-gradient MW02						Downgradient							
			MW02						MW06				MW09			
			18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09		
OR IC																
P (µg /)																
C6 - C9 Fraction			<20	<20	<20	50	40	40.0	30	30	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction			<50	<50	<50	840	500		50	350	<50	<50	<50	60	60	60
C15 - C28 Fraction			<100	<100	<100	2500	1200		180	960	100	<100	<100	100	180	180
C29 - C36 Fraction			<50	<50	<50	710	210		<50	220	<50	<50	<50	60	60	60
Total C10 - C36 Fraction			<50	<50	<50	4050	1910		230	1530	100	<50	<50	160	300	300
Pesticide Clean (µg /)																
C10 - C14 Fraction										<50						<50
C15 - C28 Fraction										<100						<100
C29 - C36 Fraction										<50						<50
Total C10 - C36 Fraction (sum)	600	600								<50						<50
Pesticide Aromatic (µg /)																
Aliphatic C10-C14										<50						
Aliphatic C15-C28										<100						
Aliphatic C29-C36										<50						
Total C10 - C36 Aliphatic										<50						
Aromatic C10-C14										<100						
Aromatic C15-C28										<50						
Aromatic C29-C36										<50						
Total C10 - C36 Aromatic										<100						
Total C10 - C36 Aliphatic/Aromatic	600	600														
(µg /)																
Benzene	2000	10	<1	<1	<1	2	2			1.0	<1			<1	<1	<1
Toluene	180	1000	<2	<2	<2	10	8			3.0	<2			<2	<2	<2
Ethylbenzene	80	150	<2	<2	<2	<2	<2				<2			<2	<2	<2
meta- & para-Xylene	340	200	<2	<2	<2	2	2				<2			<2	<2	<2
ortho-Xylene	640	1400	<2	<2	<2	<2	<2				<2			<2	<2	<2

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Within Former Landfill															
			Cross-gradient						Downgradient									
			MW03			MW04			MW08			MW05			MW07			
			18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09
OR IC																		
P (µg/l)																		
C6 - C9 Fraction			<50	<50	<50	<50	40	30	50	50	50	60	40	50	50	30	50	50
C10 - C14 Fraction			<50	<50	<50	70	280	90	400	410	230	310	450	370	590	140	800	590
C15 - C28 Fraction			<100	<100	<100	120	800	<100	850	880	700	700	1200	1190	1900	300	1480	1300
C29 - C36 Fraction			<50	<50	<50	60	370	<50	170	290	280	240	380	410	680	<50	170	270
Total C10 - C36 Fraction			<50	<50	<50	250	1450	90	1420	1580	1210	1250	1930	1970	3170	440	2450	2180
Pesticides (µg/l)																		
C10 - C14 Fraction						<50								<50				<50
C15 - C28 Fraction						<100								<100				<100
C29 - C36 Fraction						<50								<50				<50
Total C10 - C36 Fraction (sum)	600	600				<50								<50				<50
Pesticides (µg/l)																		
Aliphatic C10-C14						<50							<50	<50		<50	<50	
Aliphatic C15-C28						<100							400	<100		<100	<100	
Aliphatic C29-C36						<50							150	<50		<50	<50	
Total C10 - C36 Aliphatic						<50							550	<50		<50	<50	
Aromatic C10-C14						60							180	60		70	90	
Aromatic C15-C28						<100							<100	<100		<100	<100	
Aromatic C29-C36						<50							<50	<50		<50	<50	
Total C10 - C36 Aromatic						60							180	60		70	90	
Total C10 - C36 Aliphatic/Aromatic	600	600				60							730	60		70	90	
(µg/l)																		
Benzene	2000	10	<1			6				6	2			3	5			4
Toluene	180	1000	<2			<2				<2				<2	<2			<2
Ethylbenzene	80	150	<2			<2				<2	11			<2	4			3
meta- & para-Xylene	340	200	<2			4	3			4	10			<2	4			3
ortho-Xylene	640	1400	<2			<2	<2			<2	4			<2	<2			<2

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Offsite Wells														
			Upgradient					Cross-gradient					Downgradient				
			MW01					CR14					CR15				
			18/5/09	2/6/09	17/9/09	7/10/09	28/2/09	19/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	2/6/09	17/10/09
OR IC																	
P (µg/l)																	
C6 - C9 Fraction			<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction			<50	<50	<50	60	50	<50	<50	<50	<50	<50	<50	<50	70	110	110
C15 - C28 Fraction			<100	<100	<100	130	400	200	<100	<100	<100	<100	<100	200	400	500	330
C29 - C36 Fraction			<50	<50	<50	60	240	120	<50	<50	<50	<50	<50	60	110	530	80
Total C10 - C36 Fraction			<50	<50	<50	250	690	320	<50	<50	<50	<50	<50	420	510	11	520
Pesticides (µg/l)																	
C10 - C14 Fraction						<50					<50						<50
C15 - C28 Fraction						<100					<100						<100
C29 - C36 Fraction						<50					<50						<50
Total C10 - C36 Fraction (sum)	600	600				<50					<50						<50
Pesticides (µg/l)																	
Aliphatic C10-C14																	
Aliphatic C15-C28																	
Aliphatic C29-C36																	
Total C10 - C36 Aliphatic																	
Aromatic C10-C14																	
Aromatic C15-C28																	
Aromatic C29-C36																	
Total C10 - C36 Aromatic																	
Total C10 - C36 Aliphatic/Aromatic (µg/l)	600	600															
Benzene	2000	10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	180	1000	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	80	150	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	340	200	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	640	1400	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Drain Downgradient				
			26/2/09	2/6/09	9/6/09	17/9/09	7/10/09
OR IC							
P (µg/l)							
C6 - C9 Fraction			<10	<10	<20	<20	<20
C10 - C14 Fraction			<50	<50	<50	<50	80
C15 - C28 Fraction			<100	<100	200	200	350
C29 - C36 Fraction			<50	<50	100	80	130
Total C10 - C36 Fraction			<50	<50	300		
P ilica el Clean (µg/l)							
C10 - C14 Fraction							<50
C15 - C28 Fraction							<100
C29 - C36 Fraction							<50
Total C10 - C36 Fraction (sum)	600	600					<50
P li atic/romatic (µg/l)							
Aliphatic C10-C14							
Aliphatic C15-C28							
Aliphatic C29-C36							
Total C10 - C36 Aliphatic							
Aromatic C10-C14							
Aromatic C15-C28							
Aromatic C29-C36							
Total C10 - C36 Aromatic							
Total C10 - C36 Aliphatic/Aromatic	600	600					
(µg/l)							
Benzene	2000	10			<1		<1
Toluene	180	1000			<2		<2
Ethylbenzene	80	150			<2		<2
meta- & para-Xylene	340	200			<2		<2
ortho-Xylene	640	1400			<2		<2

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Cronulla Park Groundwater Monitoring Results

Parameter		Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill													
				Cross-gradient MW02						Downgradient							
				18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09
OCs																	
Monocyclic aromatic hydrocarbons (µg/l)																	
Styrene																	
Benzene		2000	10														
Toluene		180	1000														
Ethylbenzene		80	150					9	7		4						
meta- & para-Xylene		340	200								2						
ortho-Xylene		640	1400														
* Isopropylbenzene		30															
* n-Propylbenzene		128	150														
* 1,3,5-Trimethylbenzene																	
* 1,2,4-Trimethylbenzene		33															
sec-Butylbenzene																	
tert-butylbenzene																	
n-Butylbenzene																	
p-Isopropyltoluene		85															
Octanone																	
Vinyl Acetate																	
2-Butanone (MEK)																	
4-Methyl-2-pentanone (MIBK)																	
2-Hexanone																	
Undecanone																	
Carbon disulphide																	
Chlorinated hydrocarbons (µg/l)																	
2,2-Dichloropropane																	
1,2-Dichloropropane																	
cis-1,3-Dichloropropylene																	
trans-1,3-Dichloropropylene																	
1,2-Dibromoethane (EDB)																	

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Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Within Former Landfill															
			Cross-gradient				MW08				MW05				Downgradient			
			MW04				MW03				MW05				MW07			
			18/5/09	26/09	17/9/09	7/10/09	18/5/09	26/09	17/9/09	7/10/09	19/5/09	26/09	17/9/09	7/10/09	18/5/09	26/09	17/9/09	7/10/09
OCs																		
Monocyclic aromatic hydrocarbons ($\mu\text{g/l}$)																		
Styrene																		
Benzene	2000	10	<5	<5	<2		5	<5	4		<5	<5	2		<5	<5	5	
Toluene	180	1000	<5	<5	<2			<5			<5	10	<2		<5	<5	<2	
Ethylbenzene	80	150	<5	<5	<2		<5	<5			<5	<5	<2		<5	<5	5	
meta- & para-Xylene	340	200	<5	<5	<4		<5	<5			10	8	3		<5	<5	6	
ortho-Xylene	640	1400	<5	<5	<2		<5	<5			9	9	5		<5	<5	3	
* Isopropylbenzene	30		<5	<5			<5	5	<5		<5	<5	<2		<5	<5	<2	
* n-Propylbenzene	128	150	<5	<5			6	8	7		<5	<5	<2		<5	<5	<2	
* 1,3,5-Trimethylbenzene			<5	<5			<5	<5	<5		<5	<5	<2		<5	<5	<2	
* 1,2,4-Trimethylbenzene	33		<5	<5			<5	<5	<5		24	17	7		<5	<5	5	
sec-Butylbenzene			<5	<5			<5	<5	<5		<5	<5	<2		<5	<5	<2	
tert-butylbenzene			<5	<5			<5	<5	<5		<5	<5	<2		<5	<5	<2	
n-Butylbenzene			<5	<5			<5	<5	<5		<5	<5	<2		<5	<5	<2	
p-Isopropyltoluene	85		<5	<5			<5	<5	<5		19	29	16		<5	<5	<2	
O-nonylphenol ($\mu\text{g/l}$)			<5	<5			<5	<5	<5		<5	<5	<2		<5	<5	<2	
Vinyl Acetate			<50	<50	<50		<50	<50	<50		<50	<50	<50		<50	<50	<50	
2-Butanone (MEK)			<50	<50	<50		<50	<50	<50		<50	<50	<50		<50	<50	<50	
4-Methyl-2-pentanone (MIBK)			<50	<50	<50		<50	<50	<50		<50	<50	<50		<50	<50	<50	
2-Hexanone			<50	<50	<50		<50	<50	<50		<50	<50	<50		<50	<50	<50	
ulonate ($\mu\text{g/l}$)																		
Carbon disulphide			<5	<5	<5		<5	<5	<5		<5	<5	<5		<5	<5	<5	
unigants ($\mu\text{g/l}$)																		
2,2-Dichloropropane			<5	<5	<5		<5	<5	<5		<5	<5	<5		<5	<5	<5	
1,2-Dichloropropane			<5	<5	<5		<5	<5	<5		<5	<5	<5		<5	<5	<5	
cis-1,3-Dichloropropylene			<5	<5	<5		<5	<5	<5		<5	<5	<5		<5	<5	<5	
trans-1,3-Dichloropropylene			<5	<5	<5		<5	<5	<5		<5	<5	<5		<5	<5	<5	
1,2-Dibromoethane (EDB)			<5	<5	<5		<5	<5	<5		<5	<5	<5		<5	<5	<5	

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Offsite Wells													
			Upgradient					Cross-gradient					Downgradient			
			MW01					CR14					CR15			
			18/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09
OCs																
Monocyclic aromatic hydrocarbons (µg/l)																
Styrene																
Benzene	2000	10														
Toluene	180	1000														
Ethylbenzene	80	150														
meta- & para-Xylene	340	200														
ortho-Xylene	640	1400														
* Isopropylbenzene	30															
* n-Propylbenzene	128	150														
* 1,3,5-Trimethylbenzene																
* 1,2,4-Trimethylbenzene	33															
sec-Butylbenzene																
tert-butylbenzene																
n-Butylbenzene																
p-Isopropyltoluene	85															
Octanate Compounds (µg/l)																
Vinyl Acetate																
2-Butanone (MEK)																
4-Methyl-2-pentanone (MIBK)																
2-Hexanone																
Octanate Compounds (µg/l)																
Carbon disulphide																
Volatiles (µg/l)																
2,2-Dichloropropane																
1,2-Dichloropropane																
cis-1,3-Dichloropropylene																
trans-1,3-Dichloropropylene																
1,2-Dibromomethane (EDB)																

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Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Drain				
			25/2/09	2/6/09	9/6/09	17/9/09	7/10/09
OCs							
Monocyclic aromatic hydrocarbons ($\mu\text{g/l}$)							
Styrene			<5	<5	<5	<5	<5
Benzene	2000	10	<5	<5	<5	<5	<5
Toluene	180	1000	<5	<5	<5	<5	<5
Ethylbenzene	80	150	<5	<5	<5	<5	<5
meta- & para-Xylene	340	200	<5	<5	<5	<5	<5
ortho-Xylene	640	1400	<5	<5	<5	<5	<5
* Isopropylbenzene	30		<5	<5	<5	<5	<5
* n-Propylbenzene	128	150	<5	<5	<5	<5	<5
* 1,3,5-Trimethylbenzene			<5	<5	<5	<5	<5
* 1,2,4-Trimethylbenzene	33		<5	<5	<5	<5	<5
sec-Butylbenzene			<5	<5	<5	<5	<5
tert-butylbenzene			<5	<5	<5	<5	<5
n-Butylbenzene			<5	<5	<5	<5	<5
p-Isopropyltoluene	85		<5	<5	<5	<5	<5
O-ginate Compounds ($\mu\text{g/l}$)							
Vinyl Acetate			<50	<50	<50	<50	<50
2-Butanone (MEK)			<50	<50	<50	<50	<50
4-Methyl-2-pentanone (MIBK)			<50	<50	<50	<50	<50
2-Hexanone			<50	<50	<50	<50	<50
ul onate Compounds ($\mu\text{g/l}$)							
Carbon disulphide			<5	<5	<5	<5	<5
unigants ($\mu\text{g/l}$)							
2,2-Dichloropropane			<5	<5	<5	<5	<5
1,2-Dichloropropane			<5	<5	<5	<5	<5
cis-1,3-Dichloropropylene			<5	<5	<5	<5	<5
trans-1,3-Dichloropropylene			<5	<5	<5	<5	<5
1,2-Dibromoethane (EDB)			<5	<5	<5	<5	<5

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill													
			Cross-gradient MW02							Downgradient MW06						
			18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	MW09	
alogenate li atic Com ou n s (µg/l)	390	390														
Dichlorodifluoromethane																
Chloromethane																
Vinyl chloride																
Bromomethane																
Chloroethane																
Trichlorofluoromethane																
1,1-Dichloroethene																
Iodomethane																
trans-1,2-Dichloroethene																
1,1-Dichloroethane																
cis-1,2-Dichloroethene																
1,1,1-Trichloroethane																
1,1-Dichloropropylene																
Carbon Tetrachloride																
1,2-Dichloroethane																
Trichloroethene																
Dibromomethane																
1,1,2-Trichloroethane																
1,3-Dichloropropane																
Tetrachloroethene																
1,1,1,2-Tetrachloroethane																
trans-1,4-Dichloro-2-butene																
cis-1,4-Dichloro-2-butene																
1,1,2,2-Tetrachloroethane																
1,2,3-Trichloropropane																
Pentachloroethane																
1,2-Dibromo-3-chloropropane																
Hexachlorobutadiene																

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Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Within Former Landfill																	
			Cross-gradient						Downgradient											
			MW04						MW08						MW05					
18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	
alogenate li atic Com ou n s (µg/)																				
Dichlorodifluoromethane	390	390	<50	<50	<50	60	50						<50	<50	<50		<50	<50	<50	
Chloromethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Vinyl chloride			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Bromomethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Chloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Trichlorofluoromethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,1-Dichloroethene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Iodomethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
trans-1,2-Dichloroethene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,1-Dichloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
cis-1,2-Dichloroethene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,1,1,1-Trichloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,1-Dichloropropylene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Carbon Tetrachloride			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,2-Dichloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Trichloroethene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Dibromomethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,1,2-Trichloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,3-Dichloropropane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Tetrachloroethene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,1,1,2-Tetrachloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
trans-1,4-Dichloro-2-butene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
cis-1,4-Dichloro-2-butene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,1,2,2-Tetrachloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,2,3-Trichloropropane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Pentachloroethane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
1,2-Dibromo-3-chloropropane			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	
Hexachlorobutadiene			<50	<50	<50	<50	<50						<50	<50	<50		<50	<50	<50	

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Cronulla Park Groundwater Monitoring Results

Cronulla Park Groundwater Monitoring Results			Environmental Assessment Criteria	Human Health Assessment Criteria	Offsite Wells																		
Parameter					Upgradient					Cross-gradient					Downgradient								
					MW01					CR14					CR15					CR13			
			18/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	26/2/09	19/5/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09
alogenate li atic Com ou n s (µg/)																							
Dichlorodifluoromethane	390	390						<50					<50				<50				<50		
Chloromethane								<50					<50				<50				<50		
Vinyl chloride								<50					<50				<50				<50		
Bromomethane								<50					<50				<50				<50		
Chloroethane								<50					<50				<50				<50		
Trichlorofluoromethane								<50					<50				<50				<50		
1,1-Dichloroethene								<50					<50				<50				<50		
Iodomethane								<50					<50				<50				<50		
trans-1,2-Dichloroethene								<50					<50				<50				<50		
1,1-Dichloroethane								<50					<50				<50				<50		
cis-1,2-Dichloroethene								<50					<50				<50				<50		
1,1,1-Trichloroethane								<50					<50				<50				<50		
1,1-Dichloropropylene								<50					<50				<50				<50		
Carbon Tetrachloride								<50					<50				<50				<50		
1,2-Dichloroethane								<50					<50				<50				<50		
Trichloroethene								<50					<50				<50				<50		
Dibromomethane								<50					<50				<50				<50		
1,1,2-Trichloroethane								<50					<50				<50				<50		
1,3-Dichloropropane								<50					<50				<50				<50		
Tetrachloroethene								<50					<50				<50				<50		
1,1,1,2-Tetrachloroethane								<50					<50				<50				<50		
trans-1,4-Dichloro-2-butene								<50					<50				<50				<50		
cis-1,4-Dichloro-2-butene								<50					<50				<50				<50		
1,1,2,2 Tetrachloroethane								<50					<50				<50				<50		
1,2,3-Trichloropropane								<50					<50				<50				<50		
Pentachloroethane								<50					<50				<50				<50		
1,2-Dibromo-3-chloropropane								<50					<50				<50				<50		
Hexachlorobutadiene								<50					<50				<50				<50		

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Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Drain Downgradient			
			26/09	9/6/09	17/9/09	7/10/09
alogenate li atic Com oun s (µg/)						
Dichlorodifluoromethane	390	390	<50	<50	<50	<50
Chloromethane			<50	<50	<50	<50
Vinyl chloride			<50	<50	<50	<50
Bromomethane			<50	<50	<50	<50
Chloroethane			<50	<50	<50	<50
Trichlorofluoromethane			<50	<50	<50	<50
1,1-Dichloroethene			<50	<50	<50	<50
Iodomethane			<50	<50	<50	<50
trans-1,2-Dichloroethene			<50	<50	<50	<50
1,1-Dichloroethane			<50	<50	<50	<50
cis-1,2-Dichloroethene			<50	<50	<50	<50
1,1,1-Trichloroethane			<50	<50	<50	<50
1,1-Dichloropropylene			<50	<50	<50	<50
Carbon Tetrachloride			<50	<50	<50	<50
1,2-Dichloroethane			<50	<50	<50	<50
Trichloroethene			<50	<50	<50	<50
Dibromomethane			<50	<50	<50	<50
1,1,2-Trichloroethane			<50	<50	<50	<50
1,3-Dichloropropane			<50	<50	<50	<50
Tetrachloroethene			<50	<50	<50	<50
1,1,1,2-Tetrachloroethane			<50	<50	<50	<50
trans-1,4-Dichloro-2-butene			<50	<50	<50	<50
cis-1,4-Dichloro-2-butene			<50	<50	<50	<50
1,1,2,2 Tetrachloroethane			<50	<50	<50	<50
1,2,3-Trichloropropane			<50	<50	<50	<50
Pentachloroethane			<50	<50	<50	<50
1,2-Dibromo-3-chloropropane			<50	<50	<50	<50
Hexachlorobutadiene			<50	<50	<50	<50

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[illegible]

Cronulla Park	round	ater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Within Former Landfill																
			Cross-gradient						Downgradient										
			MW03			MW04			MW08				MW05				MW07		
18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09				
alogenate aromatic Comp oun s (µg/)																			
Chlorobenzene	55	300			8	6	6							26	14	24	13	7	7
Bromobenzene																			
2-Chlorotoluene																			
4-Chlorotoluene																			
1,3-Dichlorobenzene	520																		
1,4-Dichlorobenzene	60	40			6									28	47		26	15	
1,2-Dichlorobenzene	160	1500												5	8				
1,2,4-Trichlorobenzene	300																		
1,2,3-Trichlorobenzene	30																		
ri alomet anes (µg/)																			
Chloroform																			
Bromodichloromethane																			
Dibromochloromethane																			
Bromoform																			
a t alene (µg/)																			
Napthalene	85	70			20	17								14	20		10	11	

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Offsite Wells														
			Upgradient					Cross-gradient					Downgradient				
			MW01					CR14					CR15				
			18/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	2/6/09	17/9/09	7/10/09	
alogenate aromatic Compounds (µg/l)																	
Chlorobenzene	55	300															
Bromobenzene																	
2-Chlorotoluene																	
4-Chlorotoluene																	
1,3-Dichlorobenzene	520																
1,4-Dichlorobenzene	60	40															
1,2-Dichlorobenzene	160	1500															
1,2,4-Trichlorobenzene	300																
1,2,3-Trichlorobenzene	30																
trichloroethenes (µg/l)																	
Chloroform																	
Bromodichloromethane																	
Dibromochloromethane																	
Bromoform																	
o-chlorophenol (µg/l)																	
Naphthalene	85	70															

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Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Drain			
			Downgradient			
			26/09	9/8/09	17/9/09	7/10/09
alogenate aromatic Compounds ($\mu\text{g/l}$)						
Chlorobenzene	55	300	<5	<5	<5	<5
Bromobenzene			<5	<5	<5	<5
2-Chlorotoluene			<5	<5	<5	<5
4-Chlorotoluene			<5	<5	<5	<5
1,3-Dichlorobenzene	520		<5	<5	<5	<5
1,4-Dichlorobenzene	60	40	<5	<5	<5	<5
1,2-Dichlorobenzene	160	1500	<5	<5	<5	<5
1,2,4-Trichlorobenzene	300		<5	<5	<5	<5
1,2,3-Trichlorobenzene	30		<5	<5	<5	<5
Trihalomethanes ($\mu\text{g/l}$)						
Chloroform			<5	<5	<5	<5
Bromodichloromethane			<5	<5	<5	<5
Dibromochloromethane			<5	<5	<5	<5
Bromoform			<5	<5	<5	<5
total alene ($\mu\text{g/l}$)						
Napthalene	85	70	<5	<5	<5	<5

RTI DL RELEASE - EHP

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill												
			Cross-gradient MW02				Downgradient								
			18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09
OCs															
P s (µg/)															
Naphthalene	85	70					7.5		8.1	2.6					
2-Methylnaphthalene															
Acenaphthylene															
Acenaphthene															
Fluorene															
Phenanthrene	2						1.8		1.3						
Anthracene															
Fluoranthene															
Pyrene															
Benz(a)anthracene															
Chrysene															
Benzo(b)fluoranthene															
Benzo(k)fluoranthene															
Benzo(a)pyrene															
Indeno(1,2,3-cd)pyrene															
Dibenz(a,h)anthracene															
Benzo(g,h,i)perylene															
Sum of PAHs							9.3		8.1	2.6					
P enols (µg/)															
Phenol	1200														
2-Chlorophenol	870														
2-Methylphenol	13						1.8		2						
3- & 4-Methylphenol	543														
Cresols (sum of methylphenols)		200					1.8		2						
2-Nitrophenol															
2,4-Dimethylphenol	2	730							1.2						
2,4-Dichlorophenol	120	200													
2,6-Dichlorophenol															
4-Chloro-3-methylphenol	350	350													
2,4,6-Trichlorophenol															
2,4,5-Trichlorophenol	0.5	1													
Pentachlorophenol															
2,3,4,6-Tetrachlorophenol															
PC s (µg/)															
Total Polychlorinated biphenyls															

Cronulla Park Groundwater Monitoring Results

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Within Former Landfill																	
			Cross-gradient					MW08					Downgradient							
			MW03					MW04					MW05							
18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	
OCs																				
Pesticides (µg/l)																				
Naphthalene	85	70	<1	<1	<1.0			7.1	19.5	12.3			2.4	1.8			11.2	24	5.9	6.7
2-Methylnaphthalene																				
Acenaphthylene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Acenaphthene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Fluorene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Phenanthrene	2		<1	<1	<1.0			<1	<1.0	<1.0			1.1	<1.0	<1.0		<1	<1.0	<1.0	
Anthracene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Fluoranthene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Pyrene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Benz(a)anthracene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Chrysene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Benzo(b)fluoranthene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Benzo(k)fluoranthene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Benzo(a)pyrene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Benzo(a)pyrene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Indeno(1,2,3-cd)pyrene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Dibenz(a,h)anthracene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Benzo(g,h,i)perylene			<1	<1	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Sum of PAHs			<1	<1	<1.0			7.1	19.5	12.3			3.5	1.8			11.2	24	5.9	6.7
Pesticides (µg/l)																				
Phenol	1200		<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2-Chlorophenol	870		<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2-Methylphenol	13		<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
3- & 4-Methylphenol	543		<2	<2.0	<2.0			<2	<2.0	<2.0			<2	<2.0	<2.0		<2	<2.0	<2.0	
Cresols (sum of methylphenols)		200	<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2-Nitrophenol			<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2,4-Dimethylphenol	2	730	<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2,4-Dichlorophenol	120	200	<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2,6-Dichlorophenol			<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
4-Chloro-3-methylphenol	350	350	<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2,4,6-Trichlorophenol			<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2,4,5-Trichlorophenol			<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
Pentachlorophenol	0.5	1	<1	<1.0	<1.0			<1	<1.0	<1.0			<1	<1.0	<1.0		<1	<1.0	<1.0	
2,3,4,6-Tetrachlorophenol			<2	<2.0	<2.0			<2	<2.0	<2.0			<2	<2.0	<2.0		<2	<2.0	<2.0	
PCBs (µg/l)																				
Total Polychlorinated biphenyls			<1					<1					<1				<1			

Cronula Park round water Monitoring Results

Cronulla Park round water Monitoring Results			Offsite Wells																			
Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Upgradient					Cross-gradient					Downgradient									
			MW01					CR14					CR15					CR13				
			18/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	26/09	17/9/09	7/10/09	26/2/09	19/5/09	26/09	17/9/09	7/10/09	26/2/09	19/5/09	26/09	17/9/09	7/10/09	
OCs																						
P s (µg/)		70																				
Naphthalene	85																					
2-Methylnaphthalene																						
Acenaphthylene																						
Acenaphthene																						
Fluorene																						
Phenanthrene	2																					
Anthracene																						
Fluoranthene																						
Pyrene																						
Benz(a)anthracene																						
Chrysene																						
Benzo(b)fluoranthene																						
Benzo(k)fluoranthene																						
Benzo(a)pyrene																						
Indeno(1,2,3-cd)pyrene																						
Dibenz(a,h)anthracene																						
Benzo(g,h,i)perylene																						
Sum of PAHs																						
P enols (µg/)																						
Phenol	1200																					
2-Chlorophenol	870																					
2-Methylphenol	13																					
3- & 4-Methylphenol	543																					
Cresols (sum of methylphenols)		200																				
2-Nitrophenol																						
2,4-Dimethylphenol	2	730																				
2,4-Dichlorophenol	120	200																				
2,6-Dichlorophenol																						
4-Chloro-3-methylphenol	350	350																				
2,4,6-Trichlorophenol																						
2,4,5-Trichlorophenol	0.5	1																				
Pentachlorophenol																						
2,3,4,6-Tetrachlorophenol																						
PC s (µg/)																						
Total Polychlorinated biphenyls																						

RTI DL RELEASE - EHP

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Drain			
			26/2/09	2/6/09	9/6/09	7/10/09
OCs						
P s (µg/l)						
Naphthalene	85	70	<1.0			
2-Methylnaphthalene						
Acenaphthylene			<1.0			
Acenaphthene			<1.0			
Fluorene			<1.0			
Phenanthrene	2		<1.0			
Anthracene			<1.0			
Fluoranthene			<1.0			
Pyrene			<1.0			
Benz(a)anthracene			<1.0			
Chrysene			<1.0			
Benzo(b)fluoranthene			<1.0			
Benzo(k)fluoranthene			<1.0			
Benzo(a)pyrene			<0.5			
Indeno(1,2,3-cd)pyrene			<1.0			
Dibenz(a,h)anthracene			<1.0			
Benzo(g,h,i)perylene			<1.0			
Sum of PAHs						
P enols (µg/l)						
Phenol	1200		<1.0			
2-Chlorophenol	870		<1.0			
2-Methylphenol	13		<1.0			
3- & 4-Methylphenol	543		<2.0			
Cresols (sum of methylphenols)		200	<1.0			
2-Nitrophenol			<1.0			
2,4-Dimethylphenol	2	730	<1.0			
2,4-Dichlorophenol	120	200	<1.0			
2,6-Dichlorophenol			<1.0			
4-Chloro-3-methylphenol	350	350	<1.0			
2,4,6-Trichlorophenol			<1.0			
2,4,5-Trichlorophenol	0.5	1	<1.0			
Pentachlorophenol			<2.0			
2,3,4,6-Tetrachlorophenol						
PC s (µg/l)						
Total Polychlorinated biphenyls						

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Beneath Former Landfill											
			Cross-gradient MW02				Downgradient							
			18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09
OC Pesticides ($\mu\text{g/l}$)							<0.5				<0.5			
Hexachlorobenzene (HCB)							<0.5				<0.5			
alpha-BHC							<0.5				<0.5			
beta-BHC							<0.5				<0.5			
gamma-BHC							<0.5				<0.5			
delta-BHC							<0.5				<0.5			
Aldrin							<0.5				<0.5			
Dieldrin							<0.5				<0.5			
Endrin							<0.5				<0.5			
Heptachlor							<0.5				<0.5			
Heptachlor epoxide							<0.5				<0.5			
cis-Chlordane							<0.5				<0.5			
trans-Chlordane							<0.5				<0.5			
4,4'-DDD							<0.5				<0.5			
4,4'-DDE							<0.5				<0.5			
4,4'-DDT							<0.5				<0.5			
alpha-Endosulfan							<0.5				<0.5			
beta-Endosulfan							<0.5				<0.5			
Endrin aldehyde							<0.5				<0.5			
Endosulfan sulphate							<0.5				<0.5			
Endrin ketone							<0.5				<0.5			
Methoxychlor							<0.5				<0.5			
OP Pesticides ($\mu\text{g/l}$)							<0.5				<0.5			
Dichlorvos							<0.5				<0.5			
Demeton-S-methyl							<0.5				<0.5			
Monocrotophos							<0.5				<0.5			
Dimethoate							<0.5				<0.5			
Diazinon							<0.5				<0.5			
Chlorpyrifos-methyl							<0.5				<0.5			
Parathion-methyl							<0.5				<0.5			
Malathion							<0.5				<0.5			
Fenthion							<0.5				<0.5			
Chlorpyrifos							<0.5				<0.5			
Parathion							<0.5				<0.5			
Phospho-ethyl							<0.5				<0.5			
Chlorfenvinphos							<0.5				<0.5			
Bromophos-ethyl							<0.5				<0.5			
Fenamiphos							<0.5				<0.5			
Prothiofos							<0.5				<0.5			
Ethion							<0.5				<0.5			
Carbophenothion							<0.5				<0.5			
Azinphos Methyl							<0.5				<0.5			

Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Groundwater Within Former Landfill																
			Cross-gradient					Downgradient											
			MW03					MW04					MW05						
18/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	19/5/09	2/6/09	17/9/09	7/10/09	18/5/09	2/6/09	17/9/09	7/10/09
OC Pesticides (µg/)																			
Hexachlorobenzene (HCB)																			
alpha-BHC																			
beta-BHC																			
gamma-BHC																			
delta-BHC																			
Aldrin																			
Dieldrin																			
Endrin																			
Heptachlor																			
Heptachlor epoxide																			
cis-Chlordane																			
trans-Chlordane																			
4,4'-DDD																			
4,4'-DDE																			
4,4'-DDT																			
alpha-Endosulfan																			
beta-Endosulfan																			
Endrin aldehyde																			
Endosulfan sulphate																			
Endrin ketone																			
Methoxychlor																			
OP Pesticides (µg/)																			
Dichlorvos																			
Demeton-S-methyl																			
Monocrotophos																			
Dimethoate																			
Diazinon																			
Chlorpyrifos-methyl																			
Parathion-methyl																			
Malathion																			
Fenthion																			
Chlorpyrifos																			
Parathion																			
Phosphos-ethyl																			
Chlorfenvinphos																			
Bromophos-ethyl																			
Fenamiphos																			
Prothiofos																			
Ethion																			
Carbophenothion																			
Azinphos Methyl																			

Cronulla Park round water Monitoring Results

Offsite Wells																					
Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Upgradient												Cross-gradient				Downgradient		
			MW01				CR14								CR15				CR13		
			18/5/09	2/6/09	17/9/09	7/10/09	26/2/09	19/5/09	26/09	17/9/09	7/10/09	26/2/09	19/5/09	26/09	17/9/09	7/10/09	26/2/09	19/5/09	26/09	17/9/09	7/10/09
OC Pesticides (µg/ l)																					
Hexachlorobenzene (HCB)																					
alpha-BHC																					
beta-BHC																					
gamma-BHC																					
delta-BHC																					
Aldrin																					
Dieldrin																					
Endrin																					
Heptachlor																					
Heptachlor epoxide																					
cis-Chlordane																					
trans-Chlordane																					
4,4'-DDD																					
4,4'-DDE																					
4,4'-DDT																					
alpha-Endosulfan																					
beta-Endosulfan																					
Endrin aldehyde																					
Endosulfan sulphate																					
Endrin ketone																					
Methoxychlor																					
OP Pesticides (µg/ l)																					
Dichlorvos																					
Demeton-S-methyl																					
Monocrotophos																					
Dimethoate																					
Diazinon																					
Chlorpyrifos-methyl																					
Parathion-methyl																					
Malathion																					
Fenthion																					
Chlorpyrifos																					
Parathion																					
Phosphos-ethyl																					
Chlorfenvinphos																					
Bromophos-ethyl																					
Fenamiphos																					
Prothiofos																					
Ethion																					
Carbophenothion																					
Azinphos Methyl																					

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Parameter	Environmental Assessment Criteria	Human Health Assessment Criteria	Drain			
			25/2/09	2/6/09	9/6/09	17/9/09
OC Pesticides ($\mu\text{g/l}$)						
Hexachlorobenzene (HCB)						
alpha-BHC						
beta-BHC						
gamma-BHC						
delta-BHC						
Aldrin						
Dieldrin						
Endrin						
Heptachlor						
Heptachlor epoxide						
cis-Chlordane						
trans-Chlordane						
4,4'-DDD						
4,4'-DDE						
4,4'-DDT						
alpha-Endosulfan						
beta-Endosulfan						
Endrin aldehyde						
Endosulfan sulphate						
Endrin ketone						
Methoxychlor						
OP Pesticides ($\mu\text{g/l}$)						
Dichlorvos						
Demeton-S-methyl						
Monocrotophos						
Dimethoate						
Diazinon						
Chlorpyrifos-methyl						
Parathion-methyl						
Malathion						
Fenthion						
Chlorpyrifos						
Parathion						
Phosphor-ethyl						
Chlorfenvinphos						
Bromophos-ethyl						
Fenamiphos						
Prothiofos						
Ethion						
Carbophenothion						
Azinphos Methyl						

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Cronulla Park: Cr1 Monitoring Results			Environmental Assessment Criteria										Human Health Assessment Criteria																		
Analyte	Environmental Assessment Criteria	Human Health Assessment Criteria	22-Jan-01	06-Jul-01	17-Apr-02	22-Jan-02	18-Oct-02	24-Jan-03	16-Apr-03	29-Jul-03	24-Oct-03	23-Jan-04	16-Apr-04	29-Jul-04	03-Nov-04	04-Feb-05	28-Apr-05	28-Jul-05	27-Oct-05	03-Feb-06	03-May-06	26-Jul-06	24-Oct-06	30-Jan-07	24-Apr-07	24-Jul-07	23-Oct-07	11-Feb-08	31-May-08	31-Aug-08	
pH (pH units)	6.5-8.0	EC (µS/cm)	5.78	5.31	5.86	6.25	5.83	6.11	6.77	6.43	6.57	6.07	5.79	6.38	5.88	5.82	5.48	5.45	6.03	5.82	5.78	5.75	6.15	6.49	5.96	6.11	5.87	6.08	5.37	6.12	
			346	282	302	245	349	333	343	276	337	342	305	350	366	274	285	353	378	315	385	378	315	357	385	378	315	261	320		
			4	4	4	5	6	5	5	5	5	6.9	2.9	5.4	2	3.5	2.9	2.6	4.5	5.1	5.1	4.4	6.3	4.1	4.6	2.6	4.2				
			29	34	34	33	38	36	35	28	24	34	32	51	43	51	43	37	41	50	39	45	39	38	38	35	37	35			
			1	1	1	1	1	1	1	1	1	0.62	1.6	0.5	0.6	0.1	0.4	0.3	0.8	0.7	0.3	1	0.2	0.8	0.5	0.3	1.1				
			10	16	10	10	10	10	10	9.7	16	10	5.3	6.5	6.7	6.3	7.5	9.4	10	9	11	11	11	9.5	8.4	8.7					
			74	48	46	34	61	65	53	48	29	16.4	56.6	21	51	40.2	37.7	52	90	65.6	82.03	66.4	53.3	50	40	27					
			17	12	15	14	13	11	13	11	14	12	13	11	13	13	9	13	15	13	12	15	12	14	10	13					
			45	49	49	93	60	43	54	53	49	59	46	51	62	55	53	52	50	52	48	50	52	48	55	58					
			Fluoride																												
Aluminium																															
Iron			19.8	1.55	12	11.2	14.5	14	2.42	8.39	6.77	2.69	4.94	78	13	0.03	14	14	0.02	8.6	0.91	0.02	8.6	18	12	0.12	17	15	10	0.08	
Copper	0.0025	1	0.001																												
Manganese	3.6	0.5	0.049	0.039	0.046	0.039	0.043	0.042	0.04	0.039	0.038	0.038	0.042	0.03	0.047	0.03	0.05	0.03	0.04	0.03	0.03	0.022	0.045	0.045	0.045	0.047	0.034	0.029	0.025	0.08	
Nickel	0.1		0.002		0.009	0.001																									
Lead	0.0094	0.05	0.002																												
Zinc	0.031	5	0.007	0.002	0.007	0.009	0.007	0.013	0.003	0.003	0.004	0.004	0.004	0.004	0.017	0.011	0.03	0.03	0.04	0.004	0.009	0.013	0.0097	0.013	0.025	0.003	0.004	0.008	0.008	0.008	
Ammonia	2.3	0.5	0.48	0.06	0.72	0.57	0.59	0.61	0.53	0.57	0.57	0.52	0.56	0.7	0.5	0.5	0.8	0.6	0.6	0.6	0.5	0.4	0.5	0.7	0.8	0.7	0.6	0.6	0.4	0.3	
Nitrate	17	10000	0.01												0.01	0.03	0.16	0.09	0.04	0.027	0.05	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02	
Phosphate																															
Total Organic Carbon																															
Chemical Phosphorus			0.18	0.7	0.07																										
Chemical Oxygen Demand	0.05		104	193	104	31																									
Biological Oxygen Demand			4	8																											
Organics (µg/l)																															
TPH (C6-C9)																															
TPH (C10-C14)			89																												
TPH (C15-C28)			165																												
TPH (C29-C36)			99																												
TPH (C10-C36)	600	600	353			55																									



D.3 Landfill Gas Data

D.3.1 Historical Data

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Cronulla Park: Historical Gas Monitoring Results

Date	Eastern Boundry						Northern Boundary			Western Boundary		
	G1			CR13			G2			G3		
	CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2
22-Mar-95	0.2	3.4	20.3				0	10.9	11.4	0	0.8	20.2
29-Mar-95	0.2	4	19				0	9	12.7	0	5.4	20
31-Mar-95	0	3.5	20.5				0	0.3	21.9	0	0.02	21.7
01-Apr-95	0.198	1.96	20.5									
08-Aug-00				0.3			0.2			0		
27-Oct-00				0			0.2			0.2		
22-Jan-01				0			0.3			0.3		
06-Jul-01				1.7			0			0		
22-Jan-02				0.2			0			0.2		
17-Apr-02				0.2			0			0.2		
18-Oct-02				0			0.1			0.1		
24-Jan-03				0.3			0.3			0.1		
16-Apr-03				0			0.2			0		
29-Jul-03				0			0			0		
24-Oct-03				0			0			0		
23-Jan-04				0.1			0.1			0		
16-Apr-04				0.3			0.1			0		
27-Jul-04				0.2			0.2			0.1		
03-Nov-04				0.1	12	15.1	0	0	20.6	0	0	20.6
04-Feb-05				0.1	4.9	17.5	0	4.9	12.7	0	3.4	17.5
28-Apr-05				0	2.9	19.5	0	5.3	15.5	0	2.8	18.7
27-Jul-05				0.3	11.2	17.7	0	5.7	12	0.1	0.3	20.3
27-Oct-05				0.1	0.8	20.8	0	1	19.5	0	2.3	19.3
03-Feb-06				0.1	0.1	20.3	0	0	19.8	0.1	3.7	16.8
03-May-06				0	0.2	20.1	0	7.8	13.5	0	0.1	20.3
27-Jul-06				0	1	20.9	0	6.1	14.6	0	0.1	21.3
24-Oct-06				0.1	1.2	19.6	0.1	6.3	14.9	0.1	2	19.1
30-Jan-07				0	2	18.1	0.2	8	15.1	0.2	1.6	19.8
24-Apr-07				0	0.9	20.1	0	5.2	15.2	0	1.8	19.5
24-Jul-07				0.2	4	19.3	0	0.4	20.3	0	1.1	20.5
23-Oct-07				0	0.7	19.9	0	1.2	19.4	0	7.3	14.2
01-Feb-08				0.1	0	20	0.1	3.8	14.7	0	4.2	15.8
01-May-08				0	0.2	20.5	0	0	20.4	0	0.1	20.7
01-Aug-08				0	3.5	20.2	0	1.3	18.5	0	1.9	19.2

Cronulla Park: Historical as Monitorin Results

Date	Southern Boundary									South-Western Boundary		
	GW1			CR15			GW3			CR14		
	CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2
22-Mar-95							0	0.8	21.1			
29-Mar-95							0	0.3	21			
31-Mar-95							0	0.1	22.4			
01-Apr-95							0.001	0.17	20.9			
08-Aug-00	0									0.2		
27-Oct-00	0.3									0.2		
22-Jan-01	0.3			0						0		
06-Jul-01	0			0						0		
22-Jan-02	0.2			0.3						0.2		
17-Apr-02	0.2			0.2						0.2		
18-Oct-02	0.3			0.3						0.1		
24-Jan-03	0			0.1						0.1		
16-Apr-03	0			0						0		
29-Jul-03	0			0						0		
24-Oct-03	0			0						0		
23-Jan-04	0			0.1						0.1		
16-Apr-04	0.1			0.2						0		
27-Jul-04	0.3			0.3						0.1		
03-Nov-04	0	0	20.5	0	0	20.3				0	0	20.7
04-Feb-05	0	7.6	12.4	0	0	20.4				0	4.7	14.5
28-Apr-05	0	0	20.6	0	0.4	20.4						
27-Jul-05	0.1	5.1	16.8	0.2	7.4	17.2						
27-Oct-05	0.1	5.5	14.8	0.1	1.6	19.8				0.1	0.1	20.8
03-Feb-06	0	3.6	16.9	0	0.5	19.5				0	3.5	16.8
03-May-06	0	1.9	18.5	0.1	1.5	18.9				0.1	1.4	19
27-Jul-06	0	5.5	15.2	0	1.2	20.6				0	6.1	14.5
24-Oct-06	0.1	4.8	16.2	0.1	6.6	16.9				0	8.7	6.5
30-Jan-07	0.3	9.2	11.9	0	0.6	19.8				0.1	4.3	14.2
24-Apr-07	0	7.1	14.6	0	1.6	19.7				0	2.4	16.1
24-Jul-07	0.1	2.6	18.5	0.1	2.5	19.6				0	9.4	7.9
23-Oct-07	0	5.2	15.8	0	1.1	19.7				0	9.8	7.1
01-Feb-08	0	6.9	13.8	0.1	0.7	19.9				0	0	20.4
01-May-08	0	0.1	20.6	0	0.1	20.6				0	1.6	19
01-Aug-08	0	4.4	17.4	0	1.1	20.2				0	10.1	9

Cronulla Park: Historical as Monitorin Results

Date	Within Former Landfill											
	G5			G6			G7			GW2		
	CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2	CH4	CO2	O2
22-Mar-95	14.7	6	18	12.3	15	25.5	0	17.9	14.2			
29-Mar-95	19	7	17	28	16	9.6	0	5.4	20			
31-Mar-95	19	7	18	20	15	9	0.2	7.5	14.5			
01-Apr-95	2.849	3.05	19.5	16.06	10.15	14.8	0.36	7.02	14.9			
08-Aug-00										0.7		
27-Oct-00										8		
22-Jan-01												
06-Jul-01												
22-Jan-02												
17-Apr-02												
18-Oct-02												
24-Jan-03												
16-Apr-03												
29-Jul-03												
24-Oct-03												
23-Jan-04												
16-Apr-04												
27-Jul-04												
03-Nov-04										1.9	0	21.2
04-Feb-05												
28-Apr-05												
27-Jul-05												
27-Oct-05												
03-Feb-06												
03-May-06												
27-Jul-06												
24-Oct-06												
30-Jan-07												
24-Apr-07												
24-Jul-07												
23-Oct-07												
01-Feb-08												
01-May-08												
01-Aug-08												

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D.3.2 2009 Investigation Data

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Cronulla Park: Gas Monitoring Results

Background Locations

Well ID	Barometric Pressure (kpa)	Sample Date	Reading	Gas Measurements (%)				
				Methane / Vapours	Carbon Dioxide	Oxygen	Hydrogen Sulfide	Carbon Monoxide
MW01	1013	18/05/2009	Average	0	0	20.3	0	0
		18/05/2009	Peak	0.2	0	21.5	0	0
	1021	2/06/2009	Average	0.1	0	21.3	0	10
		2/06/2009	Peak	0.1	0.1	21.3	0	16
	1009	23/06/2009	Average	0	0	20.4	0	0
		23/06/2009	Peak	0.1	0	20.3	0	0
	1013	17/09/2009	Average	0	0	20.7	0	0
		17/09/2009	Peak	0	0	20.7	0	0
	1017	10/10/2009	Average	0	0	21.4	0	0
		10/10/2009	Peak	0	0	21.4	0	0
MW02	1009	23/06/2009	Average	0	0	20.4	0	0
		23/06/2009	Peak	0.1	0	20.3	0	0
	1022	2/06/2009	Average	0	0.1	20.8	0	0
		2/06/2009	Peak	0.2	0.2	20.9	0	0
	1009	23/06/2009	Average	0	0	20.9	0	0
		23/06/2009	Peak	0	0	21.4	0	0
	1013	17/09/2009	Average	0	0	20.7	0	0
		17/09/2009	Peak	0	0	20.7	0	0
	1017	10/10/2009	Average	0	0	21.4	0	0
		10/10/2009	Peak	0	0	21.4	0	0

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Cronulla Park: Gas Monitoring Results
Locations within Landfill

Well ID	Barometric Pressure (kpa)	Sample Date	Reading	Gas Measurements (%)				
				Methane / Vapours	Carbon Dioxide	Oxygen	Hydrogen Sulfide	Carbon Monoxide
MW03	1014	18/05/2009	Average	0	0	22.03	0	0
		18/05/2009	Peak	0.1	0	22.6	0	0
	1021	2/06/2009	Average	0	0	20.8	0	0
		2/06/2009	Peak	0	0	20.9	0	0
	1009	23/06/2009	Average	0	0	20.5	0	0
		23/06/2009	Peak	0	0	20.9	0	0
	1013	17/09/2009	Average	0	0	20.7	0	0
		17/09/2009	Peak	0	0	20.8	0	0
	1017	10/10/2009	Average	0	0	21.4	0	0
		10/10/2009	Peak	0	0	21.4	0	0
	1014	29/10/2009	Peak	0.02	6.2	17.7	0	0
MW04	1014	18/05/2009	Average	0.1	0	21.8	0	0
		18/05/2009	Peak	0.2	0	22	0	0
	1022	2/06/2009	Average	0.1	0	21.1	0	0
		2/06/2009	Peak	61	0	21.1	0	0
	1009	23/06/2009	Average	79.2	13.9	4.2	1	4
		23/06/2009	Peak	83	14.1	4.4	1	6
	1013	17/09/2009	Average	33.3	2.4	14.3	0	1
		17/09/2009	Peak	42.2	2.8	13.3	0	1
	1017	10/10/2009	Average	17.6	14.8	5.7	0	0
		10/10/2009	Peak	21.3	15.5	14.5	0	0
	1015	29/10/2009	Peak	69.5	5.9	1.7	0	0
MW05	1014	18/05/2009	Average	0	0	21.6	0	0
		18/05/2009	Peak	0	0	22.2	0	0
	1022	2/06/2009	Average	69.1	0	0	0	18
		2/06/2009	Peak	69.7	0	0	0.3	18.1
	1009	23/06/2009	Average	61.5	14.5	6	14	0
		23/06/2009	Peak	62.4	14.9	8.1	17	1
	1013	17/09/2009	Average	14.2	12	2.5	0	1
		17/09/2009	Peak	16.1	12.5	4.1	0	2
	1017	10/10/2009	Average	9.8	0.5	11.4	0	0
		10/10/2009	Peak	10.8	0.6	12.4	0	0
	1015	29/10/2009	Peak	0	0	21.4	0	0
MW07	1015	18/05/2009	Average	0.1	0	20.9	0	0
		18/05/2009	Peak	0.2	0	21.6	0	0
	1022	2/06/2009	Average	34.9	8.7	4.7	0	0
		2/06/2009	Peak	49.7	9.5	5.5	0	0
	1009	23/06/2009	Average	0	0	20.4	0	0
		23/06/2009	Peak	0.1	0	22.3	0	0
	1013	17/09/2009	Average	29.5	5.8	4.6	0	4
		17/09/2009	Peak	34.3	6.1	6.1	0	4
	1017	10/10/2009	Average	23.6	4.9	5.5	0	0
		10/10/2009	Peak	25.8	5.1	6.3	0	0
	1015	29/10/2009	Peak	31.8	7.8	0.9	0	0
MW08	1014	18/05/2009	Average	0.2	0	20.9	0	0
		18/05/2009	Peak	0.6	0	22.7	0	0
	1021	2/06/2009	Average	98.7	12.5	0	0	3
		2/06/2009	Peak	99.3	12.5	0	0	4
	1009	23/06/2009	Average	74.8	7.5	4.8	1	2
		23/06/2009	Peak	75.8	10.8	7.8	2	2
	1014	17/09/2009	Average	39.3	8.2	5.9	0	3
		17/09/2009	Peak	55.7	10.2	8	0	4
	1017	10/10/2009	Average	45	10.5	8.3	0	0
		10/10/2009	Peak	49.1	12.2	12.9	0	0
	1015	29/10/2009	Peak	45.7	13.6	2.8	0	3

Cronulla Park: Gas Monitoring Results

Landfill Vents

Vent ID	Barometric Pressure (kpa)	Sample Date	Reading	Gas Measurements (%)				
				Methane / Vapours	Carbon Dioxide	Oxygen	Hydrogen Sulfide	Carbon Monoxide
VENT01	1012	18/05/2009	Average	0	0	21.4	0	0
		18/05/2009	Peak	0	0	21.4	0	0
	1012	2/06/2009	Average	0	0	21.4	0	0
		2/06/2009	Peak	0.1	0	21.4	0	0
	1009	23/06/2009	Average	0	0	21.3	0	0
		23/06/2009	Peak	0	0	21.4	0	0
	1011	4/11/2009	Average	0	0	20.8	0	0
		4/11/2009	Peak	0	0	20.8	0	0
VENT02	1012	18/05/2009	Average	0	0	21.3	0	0
		18/05/2009	Peak	0	0	21.3	0	0
	1012	2/06/2009	Average	0	0	21.2	0	0
		2/06/2009	Peak	0	0	21.3	0	0
	1009	23/06/2009	Average	0	0	21.3	0	0
		23/06/2009	Peak	0	0	21.3	0	0
	1011	4/11/2009	Average	24.5	5	12.8	0	2
		4/11/2009	Peak	29	4.9	13.9	1	4
VENT03	1012	18/05/2009	Average	0	0	21.2	0	0
		18/05/2009	Peak	0	0	21.2	0	0
	1012	2/06/2009	Average	0	0	21.3	0	0
		2/06/2009	Peak	0	0	21.4	0	0
	1009	23/06/2009	Average	0	0	21.2	0	0
		23/06/2009	Peak	0	0	21.2	0	0
	1011	4/11/2009	Average	0.5	0.3	19.7	0	0
		4/11/2009	Peak	0.5	0.3	19.8	0	0
VENT04	1012	18/05/2009	Average	0	0	21.3	0	0
		18/05/2009	Peak	0	0	21.3	0	0
	1012	2/06/2009	Average	0	0	21.3	0	0
		2/06/2009	Peak	0	0	21.3	0	0
	1009	23/06/2009	Average	0	0	21.2	0	0
		23/06/2009	Peak	0	0	21.4	0	0
	1011	4/11/2009	Average	0	0.1	20.3	0	0
		4/11/2009	Peak	0	0.1	20.3	0	0



D.4 Groundwater Monitoring Observations

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Perce monitor (annual) monitoring wells

Well ID	Sample Date	Water Head			Quality Parameters					Comments		
		Depth to Water (mbgs)	Total Depth (mbgs)	Elevation (mAHD)	Corrected Static Water Level	DO mg/L	Total Dissolved Solids		pH		Reduction Potential	Temperature Celsius
							ppK	eH				
MW03	18/05/09	1.985	2.669	31.77	29.785	7.06	0.46	5.43	179	22.5	Brown water. Dry at 4L	
	2/06/09	1.832	2.637	31.77	29.938	6.27	0.444	5.46	262	20.5	Clear water. Dry at 5L	
	17/09/09	2.064	2.639	31.77	29.706	5.48	0.385	5.19	108	21.6	Clear water. Dry at 4L	
	7/10/09	2.095	2.638	31.77	29.675	5.8	0.385	4.39	62	21.8	Clear water. Dry at 2L	
MW04	18/05/09	4.446	6.062	29.73	25.284	Hydrocarbon Sheen Encountered (No Parameters Taken)					Dark grey milky water. Strong synthetic odour. Dry at 15L	
	2/06/09	4.274	5.913	29.73	25.456	Hydrocarbon Sheen Encountered (No Parameters Taken)					Grey water. Strong synthetic odour.	
	17/09/09	4.459	5.921	29.73	25.271	0.84	1.51	7.12	-144	25.3	Grey water. Strong synthetic odour.	
	7/10/09	4.457	5.94	29.73	25.273	Hydrocarbon Sheen Encountered (No Parameters Taken)					Grey water. Strong synthetic odour.	
MW05	18/05/09	5.432	7.04	27.58	22.148	Hydrocarbon Sheen Encountered (No Parameters Taken)					Dark grey milky water. Strong synthetic odour.	
	2/06/09	4.682	6.933	27.58	22.898	1.25	1.1	6.10	-103	21.8	Developed to slight hydrocarbon sheen. Strong synthetic odour.	
	17/09/09	5.574	6.943	27.58	22.006	0.81	1.77	6.39	-126	23.5	Dark grey milky water. Strong synthetic odour.	
	7/10/09	5.663	6.931	27.58	21.917	Hydrocarbon Sheen Encountered (No Parameters Taken)					Developed to slight hydrocarbon sheen. Strong synthetic odour.	
MW07	18/05/09	2.537	5.673	28.48	25.943	0.06	3.12	7.48	-150	22.6	Dark grey milky water.	
	2/06/09	3.026	5.656	28.48	25.454	1.89	1.54	7.16	-87	20.3	Grey water. Strong synthetic odour. Dry at 25L	
	17/09/09	3.283	5.555	28.48	25.197	0.39	3.19	7.55	-139	23.7	Grey water. Strong synthetic odour.	
	7/10/09	3.347	5.545	28.48	25.133	Hydrocarbon Sheen Encountered (No Parameters Taken)					Grey water. Strong synthetic odour.	
MW08	18/05/09	3.336	3.606	30.65	27.314	Insufficient Sample Volume Achieved					Brown water. Dry at <2L. Visible gas was noted to be escaping from well during sampling (19/5).	
	2/06/09	3.239	3.576	30.65	27.411	3.82	1.92	6.99	-58	19.4	Brown opaque water. High sediment load. Strong gas odour. Dry at 5L	
	17/09/09	3.351	3.578	30.65	27.299	1.21	2.23	6.73	-59	22.2	Brown opaque water. High sediment load. Strong gas odour. Dry at 0.5L	
	7/10/09	3.384	3.574	30.65	27.266	0.13	2.2	7.73	-197	22.2	Brown opaque water. High sediment load. Strong gas odour. Dry at 0.3L	

Well ID	Sample Date	Water Head			Quality Parameters						Comments	
		Depth to Water	Total Depth	Elevation	Corrected Static Water Level	DO	Total Dissolved Solids		pH	Reduction Potential		Temperature
							(mbgs)	(mbgs)				
MW02	18/05/09	2.701	8.09	31.75	29.049	5.5	4.87	4.09	279	23.7	Developed to red milky water. Dry at 50L.	
	20/06/09	3.721	8.039	31.75	28.029	3.96	4.04	3.65	380	22.4	Clear to murky brown water.	
	17/09/09	2.752	8.045	31.75	28.998	1.13	2.92	3.41	416	23.2	Clear to murky brown water.	
	7/10/09	2.671	8.041	31.75	29.079	5.79	4.34	3.86	458	22.4	Clear to murky brown water.	
MW06	18/05/09	6.262	10.109	27.81	21.548	1.27	2.22	6.27	-44	19.5	Brown water. Dry at 28L.	
	20/06/09	5.973	10.084	27.81	21.837	3.52	1.86	6.00	-20	20.9	Clear to milky white water. Dry at 10L.	
	17/09/09	6.466	10.09	27.81	21.344	1.09	1.36	5.87	-9	24.1	Grey milky water. Synthetic odour.	
	7/10/09	6.441	10.079	27.81	21.369	2.34	1.33	6.41	-30	22.7	Clear to milky white water. Dry at 15L.	
MW09	18/05/09	3.897	8.945	28.99	25.093	4.97	0.58	5.12	124	20.2	Clear water developing to milky. Dry at 30L.	
	20/06/09	3.902	8.910	28.99	25.088	4.11	0.33	4.44	242	20.7	Milky white water. Dry at 30L.	
	17/09/09	4.097	8.908	28.99	24.893	1.42	2.42	3.75	267	20.4	Greyish red water develop to clear. Dry at 16L.	
	7/10/09	4.12	8.909	28.99	24.87	3.79	0.492	4.99	275	22.1	Milky white water. Dry at 15L.	

Well ID	Sample Date	Water Head				Quality Parameters					Comments
		Depth to Water (mbgs)	Total Depth (mbgs)	Elevation (mAHD)	Corrected Static Water Level	DO mg/L	Total Dissolved Solids ppK	pH	Reduction Potential eH	Temperature Celsius	
MW01	18/05/09	2.967	7.978	33.96	30.993	4.63	3.9	3.9	369	22.6	Developed to red milky water. Dry at 30L.
	2/06/09	2.961	7.932	33.96	30.999	5.94	4.38	3.62	184	21.2	Reddish brown water, high turbidity.
	17/09/09	2.945	7.954	33.96	31.015	1.89	7.25	3.29	345	21.5	Reddish brown water, high turbidity.
	7/10/09	2.905	7.938	33.96	31.055	4.38	5.46	3.7	407	20.8	Reddish brown water, high turbidity.
CR13	18/05/09	1.247	5.479	21.97	20.723	3.51	0.436	Probe Error	2	22.1	Clear water developing to milky.
	2/06/09	1.082	5.482	21.97	20.888	3.51	0.381	4.99	111	21.6	Clear water. Dry at 15L.
	17/09/09	1.371	5.516	21.97	20.599	2.88	0.237	5.24	88	22.4	Clear water developing to milky. Dry at 17L
	7/10/09	1.365	5.51	21.97	20.605	4.04	0.279	5.74	90	21.6	Clear water. Dry at 15L.
CR14	18/05/09	1.334	8.425	32.67	31.336	3.8	4.9	Probe Error	269	21.2	Clear water.
	2/06/09	1.345	8.384	32.67	31.325	2.79	0.148	3.75	148	21.4	Clear water.
	17/09/09	1.076	8.387	32.67	31.594	1.93	0.188	4.26	215	23.3	Clear water.
	7/10/09	1.306	8.63	32.67	31.384	3.37	0.164	4.16	214	21.4	Clear water.
CR15	18/05/09	2.043	2.898	29.8	27.757	3.45	0.944	Probe Error	100	19.7	Clear water.
	2/06/09	1.885	2.883	29.8	27.915	2.69	0.113	5.00	79	19.8	Opaque brown water. Dry at 25L.
	17/09/09	2.123	2.981	29.8	27.677	2.4	0.13	5.65	51	21.2	Opaque brown water. Dry at 5L.
	7/10/09	2.211	2.981	29.8	27.589	4.61	0.143	6.02	18	20.6	Opaque brown water. Dry at 2L.



D.5 Calibration Records

RTI DL RELEASE - EHP



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - GEOTECHNICAL INSTRUMENTS GA2000

This Gas Meter has been performance checked / calibrated* as follows:

Calibration	Cal Value	Reading	Cal Value	Reading	Pass?
CH4	50/ 60% vol	60%	0.00% vol	0 %	☒
CH4 LEL -check	50% LEL (2.5%CH4)	2.5 %			☐
H2s	25ppm	25 ppm	0 ppm	0 ppm	☒
O2	21.0% vol	21 %	0.00% vol	0 %	☒
CO	100ppm	100 ppm	0 ppm	0 ppm	☒
CO2	10/ 40% vol	40%			☒
Operations Check					
☒ Cleaned/checked		☒ In line Filter Check		☒ Charged 100 %	

* Calibration gas traceability information is available upon request.

Date: 27/10 Checked by: J. Ann

Signed: 49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Sampling Probe with In-Line Filter
☒	☐	☐	1m of Sampling Tube
☒	☐	☐	Carry Strap
☒	☐	☐	Battery Charger and AC/DC Power Supply
☒	☐	☐	Operating Quick Guide behind foam on lid of case
☒	☐	☐	Manual behind foam on lid of case
☒	☐	☐	Spare Inline Filters Qty (2)
☒	☐	☐	Carry case
☐	☐	☐	Data Cable and Software CD or Diskette
☐	☐	☐	
☐	☐	☐	
Processors Signature/ Initials			49-Sch4 - Signature

EE Quote Reference		Condition on return
Customer Ref	17097	
Equipment ID		
Equipment serial no.		
Return Date	/ /	
Return Time		

Melbourne	Sydney	Brisbane	Perth	Auckland	Kuala Lumpur
Brisbane 2/5 Ross Street, Newstead, Qld 4006					
Telephone: 07 3852 6111			FreeCall: 1-800-675-756		
Fax: 073852 6155			Internet: www.rentals.enviroequip.com		
Email: rentals.bris@enviroequip.com					

Filename: Eq Rep GA2000 ver 06.02.doc



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - MINIRAE 2000 PID

This PID has been performance checked / calibrated* as follows:

Calibration	Actual Value	Reading	Pass?		
Zero - fresh air	0.0 ppm	0.0 ppm	☒		
Span - Isobutylene	100 ppm	100 ppm	☒		
Operations Check					
☒ Performance Check (pump, lamp, sensor & battery voltage check)					
☒ Battery Charged	☒ Filters Check	☒ Spare battery Voltage (5.0v minimum)		V	

* Calibration gas traceability information is available upon request.

Date: 11/8/9 Checked by: AA

Signed: _____

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	MiniRae 2000 PID / Operational Check, plus Battery Voltage @ <u>5.5</u> V
☒	☐	☐	Protective yellow rubber boot
☒	☐	☐	Inlet probe (attached to PID)
☒	☐	☐	Water trap filter.
☒	☐	☐	Spare water trap filter(s) Qty <u>1</u> @ \$ <u>7.50</u> +GST / filter if opened.
☒	☐	☐	Charger 240V to 12V 500mA
☒	☐	☐	Instruction Manual behind foam on the lid of case "
☒	☐	☐	Quick Guide Sheet behind foam on the lid of case "
☒	☐	☐	Spare Alkaline Battery Compartment with/without batteries
☒	☐	☐	Carry Case
☒	☐	☐	Calibration regulator & tubing (optional)
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials _____

EE Quote Reference	<u>16306</u>	Condition on return
Customer Ref		
Equipment ID	PIDMINBJ	
Equipment serial no.	110-901247	
Return Date	<u>/ /</u>	
Return Time		

Melbourne Sydney Brisbane Perth Auckland Kuala Lumpur

Brisbane- 2/5 Ross St, Newstead, QLD 4006

Telephone: 07 3852 6111

FreeCall: 1-800-675-756

Email: rentals.bris@enviroequip.com

Internet: www.rentals.enviroequip.com



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - MINIRAE 2000 PID

This PID has been performance checked / calibrated* as follows:

Calibration	Actual Value	Reading	Pass?		
Zero - fresh air	0.0 ppm	0.0 ppm	☒		
Span - Isobutylene	100 ppm	100 ppm	☒		
Operations Check					
☒ Performance Check (pump, lamp, sensor & battery voltage check)					
☒ Battery Charged	☐ Filters Check	☒ Spare battery Voltage (5.0v minimum) <u>5.5</u> V			

* Calibration gas traceability information is available upon request.

Date: 21/8/9 Checked by: ALV

Signed: _____ 49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	MiniRae 2000 PID / Operational Check, plus Battery Voltage @ <u>5.5</u> V
☒	☐	☐	Protective yellow rubber boot
☒	☐	☐	Inlet probe (attached to PID)
☒	☐	☐	Water trap filter.
☒	☐	☐	Spare water trap filter(s) Qty <u>1</u> @ \$ <u>7.50</u> +GST / filter if opened.
☒	☐	☐	Charger 240V to 12V 500mA
☒	☐	☐	Instruction Manual behind foam on the lid of case "
☒	☐	☐	Quick Guide Sheet behind foam on the lid of case "
☒	☐	☐	Spare Alkaline Battery Compartment with/without batteries
☒	☐	☐	Carry Case
☒	☐	☐	Calibration regulator & tubing (optional)
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials _____

EE Quote Reference	<u>16102</u>	Condition on return
Customer Ref		
Equipment ID	PIDMINBH	
Equipment serial no.	110-900679	
Return Date	<u>/ /</u>	
Return Time		

Melbourne

Sydney

Brisbane

Perth

Auckland

Kuala Lumpur

Brisbane- 2/5 Ross St, Newstead, QLD 4006

Telephone: 07 3852 6111

FreeCall: 1-800-675-756

Email: rentals.bris@enviroequip.com

Internet: www.rentals.enviroequip.com

Filename: En Ren Minirae 2000 PID ver 08 01 doc



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - GEOTECHNICAL INSTRUMENTS GA2000

This Gas Meter has been performance checked / calibrated* as follows:

Calibration	Cal Value	Reading	Cal Value	Reading	Pass?
CH4	50 / 60% vol	60 %	0.00% vol	0 %	☒
CH4 LEL -check	50% LEL (2.5%CH4)	2.5 %			☐
H2s	25ppm	2.5 ppm	0 ppm	0 ppm	☒
O2	21.0% vol	21 %	0.00% vol	0 %	☒
CO	100ppm	100 ppm	0 ppm	0 ppm	☒
CO2	10 / 40% vol	40 %			☐
Operations Check					
☒ Cleaned/checked	☒ In line Filter Check		☒ Charged 100 %		

* Calibration gas traceability information is available upon request.

Date: 9/10/2009 Checked by: John R

Signed: _____ 49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Sampling Probe with In-Line Filter
☒	☐	☐	1m of Sampling Tube
☒	☐	☐	Carry Strap
☒	☐	☐	Battery Charger and AC/DC Power Supply
☒	☐	☐	Operating Quick Guide <u>behind foam on lid of case</u>
☒	☐	☐	Manual <u>behind foam on lid of case</u>
☒	☐	☐	Spare Inline Filters Qty (2)
☒	☐	☐	Carry case
☐	☐	☐	Data Cable and Software CD or Diskette
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials

49-Sch4 - Signature

EE Quote Reference	<u>16881</u>	Condition on return
Customer Ref		
Equipment ID		
Equipment serial no.		
Return Date	<u>/ /</u>	
Return Time		

Melbourne Sydney Brisbane Perth Auckland Kuala Lumpur

Brisbane 2/5 Ross Street, Newstead, Qld 4006

Telephone: 07 3852 6111

FreeCall: 1-800-675-756

Fax: 073852 6155

Email: rentals.bris@enviroequip.com

Internet: www.rentals.enviroequip.com

Filename: Eq Rep GA2000 ver 06.02.doc



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report – Solinst Model 122 Interface Meter

This Meter has been performance checked / calibrated* as follows:

Cleaned/Tested

Pass?

Probe

☒

Tape/Reel

☒

☒ Performance Test & Battery Voltage Check (12.2 v) 8.0v minimum

Date: 11/08/09

Checked by: AG

Signed: _____

49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Interface meter: <u>30 m</u>
☒	☐	☐	Plastic Box / Bag
☒	☐	☐	Spare 9V Battery Qty <u>2</u>
☒	☐	☐	Probe Cleaning Brush
☒	☐	☐	Decon
☒	☐	☐	Instruction leaflet
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials _____

Quote Reference	Condition on return
Customer Ref	
Equipment ID	SOL12230BC
Equipment serial no.	122 007445-1
Return Date	<u>1 / 1</u>
Return Time	

Melbourne Sydney Brisbane Perth Auckland Kuala Lumpur

Melbourne - 13A Rocklea Drive, Port Melbourne VIC 3207 Australia
Telephone: +61-3-9646-4190 FreeCall (interstate): 1-800-675-756
Rentals Direct Fax: +61-3-9681-9251 Head Office Fax: +61-3-9646-4195
Email: rentals.melb@enviroequip.com Internet: www.rentals.enviroequip.com

Filename: SOL12230BC



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - Solinst Model 122 Interface Meter

This Meter has been performance checked / calibrated* as follows:

Cleaned/Tested Pass?
Probe ☒
Tape/Reel ☒
☒ Performance Test & Battery Voltage Check (8.0v minimum)

Date: 21/9/9

Checked by

Alb

Signed:

49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Interface meter: 32m
☒	☐	☐	Plastic Box / Bag
☒	☐	☐	Spare 9V Battery Qty 2
☒	☐	☐	Probe Cleaning Brush
☒	☐	☐	Decon
☐	☐	☐	Instruction leaflet
☐	☐	☐	

Processors Signature/ Initials

EE Quote Reference	16772	Condition on return
Customer Ref		
Equipment ID	SOL12230BA	
Equipment serial no.		
Return Date	1 / 1	
Return Time		

Melbourne

Sydney

Brisbane

Perth

Auckland

Kuala Lumpur

Brisbane - 2/5 Ross St, Newstead, QLD 4086

Telephone: 07 3852 6111

FreeCall: 1-800-675-756

Fax: 07 3852 6155

Email: rentals.bris@enviroequip.com

Internet: www.rentals.enviroequip.com

Filename: SOL12230BA



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - TPS 90FLMV Water Quality Meter

This Water Quality Meter has been performance checked / calibrated* as follows:

pH ☒ pH 6.88 ☐ pH 7.00 ☐ pH 4.00 ☐ pH 10.00 ☐ pH
Conductivity ☒ 0.0mS/cm ☒ 2.76mS/cm ☐ 12.68mS/cm ☐ 50.0mS/cm ☐ mS/cm
TDS ☒ 0.0 ppk ☒ 36 ppk ☐ ppk
Dissolved Oxygen ☒ 0.00ppm in Sodium Sulphite ☐ 100% Saturation in Air
Redox (ORP)** ☐ Electrode operability test 240mV +/- 10%. Actual: 233 mV
☐ Electrodes cleaned/checked ☒ Charged 8.12 v (min 7.2V)

* Calibration solution traceability information is available upon request.

** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information, refer to www.enviroequip.com/quipnotes/ORP.htm.

Date: 17/9/2004

Checked by: J. H. H.

Signed: 49-Sch4 - Signature

Sent	Received	Returned	Item
☒	☐	☐	90FLMV Unit. Ops check / Battery Voltage @
☒	☐	☐	pH sensor 5m
☒	☐	☐	Conductivity / TDS / Temperature k=10 sensor 5m
☒	☐	☐	Dissolved Oxygen YSI5739 sensor 5m
☒	☐	☐	Redox (ORP) sensor 5m
☒	☐	☐	Battery charger: 240V AC to 12V DC 200mA
☒	☐	☐	Instruction Manual
☒	☐	☐	Quick Guide
☐	☐	☐	Synge with storage solution for pH & ORP sensors
☐	☐	☐	Carry Case
☐	☐	☐	
☐	☐	☐	

Processors Signature/Initials

49-Sch4 - Signature

EE Quote Reference	16990	Condition on return
Customer Ref		
Equipment ID	90FLMV/BH	
Equipment serial no.	T7931	
Return Date	/ /	
Return Time		

Melbourne

Sydney

Brisbane

Perth

Auckland

Kuala Lumpur

Brisbane- 2/5 Ross St. Newstead Qld 4006
Telephone: 07 3582 6111 FreeCall: 1-800-675-756
Fax: 07 3852 6155

Email: rentals.bris@enviroequip.com

Internet: www.rentals.enviroequip.com

Filename: Eq Rep TPS 90FLMV ver 06.01.doc GENERIC.doc



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - GEOTECHNICAL INSTRUMENTS GA2000

This Gas Meter has been performance checked / calibrated* as follows:

Calibration	Cal Value	Reading	Cal Value	Reading	Pass?
CH4	60% vol	60 %	0.00% vol	0 %	☒
CH4 -check only	2.5%CH4	2.6 %			☒
H2s	25ppm	25 ppm	0 ppm	0 ppm	☒
O2	21.0% vol	21 %	0.00% vol	0 %	☒
CO	100ppm	100 ppm	0 ppm	0 ppm	☒
CO2	40% vol	40 %			☒
Operations Check					
☒ Cleaned/checked	☒ In line Filter Check		☒ Battery Status @ 100 %		

* Calibration gas traceability information is available upon request.

Date: 16/9/04 Checked by: Softwa

Signed: _____ 49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Sampling Probe with In-Line Filter
☒	☐	☐	1m of Sampling Tube
☒	☐	☐	Carry Strap
☒	☐	☐	Battery Charger and AC/DC Power Supply
☒	☐	☐	Operating Quick Guide <u>behind foam on lid of case</u>
☒	☐	☐	Manual <u>behind foam on lid of case</u>
☒	☐	☐	Spare Inline Filters Qty (2)
☒	☐	☐	Carry case
☐	☐	☐	Data Cable and Software CD or Diskette
☐	☐	☐	Instrument Battery Status @ <u>100</u> %
☐	☐	☐	

Processors Signature/ Initials

49-Sch4 - Signature

EE Quote Reference	<u>1699-1</u>	Condition on return
Customer Ref		
Equipment ID	GA2000BD	
Equipment serial no.	GA 105771/07	
Return Date	<u>1 / 1</u>	
Return Time		

Phone: (Free Call) 1800 675 756		Fax: (Free Call) 1800 657 123	Email: info@enviroequip.com	
Melbourne Branch 5 Caribbean Drive, Scoresby 3179 Local Tel: 03 9757 4577 Local Fax: 03 9763 2083	Sydney Branch Level 1, 4 Talavera Road, North Ryde 2113 Local Tel: 02 8817 4250 Local Fax: 02 9889 4622	Adelaide Branch 27 Boulash Road, Norwood, South Australia 5067 Local Tel: 08 8334 0000 Local Fax: 08 8363 3110	Brisbane Branch Unit 2/5 Ross St, Newstead 4006 Local Tel: 07 3852 6111 Local Fax: 07 3852 6155	Perth Branch 121 Beringarra Ave Malaga WA 6090 Local Tel: 08 9262 7599 Local Fax: 08 9248 6836

Issue 1

Mar 09

G540



ENVIROEQUIP RENTALS

Your Friend in the Field

Oct 09

Equipment Report - TPS 90FLMV Water Quality Meter

This Water Quality Meter has been performance checked / calibrated* as follows:

pH ☒ pH 6.88 ☐ pH 7.00 ☒ pH 4.00 ☒ pH 10.00 ☐ pH
Conductivity ☒ 0.0mS/cm ☒ 2.76mS/cm ☐ 12.88mS/cm ☐ 58.6mS/cm ☐ mS/cm
TDS ☒ 0.0 ppk ☒ 36 ppk ☐ ppk
Dissolved Oxygen ☒ 0.00ppm in Sodium Sulphite ☒ 100% Saturation in Air
Redox (ORP)** ☒ Electrode operability test 240mV +/- 10%. Actual: 240 mV
☒ Electrodes cleaned/checked ☒ Charged 80V v (min 7.2V)

* Calibration solution traceability information is available upon request.

** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information, refer to www.enviroequip.com/quipnotes/ORP.htm.

Date: 02/10/09 Checked by: AL

Signed: _____

Sent	Received	Returned	Item
☒	☐	☐	90FLMV Unit. Ops check / Battery Voltage @ 80V
☒	☐	☐	pH sensor 5m
☒	☐	☐	Conductivity / TDS / Temperature k=10 sensor 5m
☒	☐	☐	Dissolved Oxygen YSI5739 sensor 5m
☒	☐	☐	Redox (ORP) sensor 5m
☒	☐	☐	Battery charger 240V AC to 12V DC 200mA
☒	☐	☐	Instruction Manual
☒	☐	☐	Quick Guide
☒	☐	☐	Syringe with storage solution for pH & ORP sensors
☒	☐	☐	Carry Case
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials _____

EE Quote Reference	16792	Condition on return
Customer Ref		
Equipment ID	90FLMVBH	
Equipment serial no.	T7931	
Return Date	/ /	
Return Time		

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ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - MINIRAE 2000 PID

This PID has been performance checked / calibrated* as follows:

Calibration	Actual Value	Reading	Pass?		
Zero – fresh air	0.0 ppm	0.0 ppm	☒		
Span – Isobutylene	100 ppm	100 ppm	☒		
Operations Check					
☒ Performance Check (pump, lamp, sensor & battery voltage check)					
☒ Battery Charged	☒ Filters Check	☒ Spare battery Voltage (5.0v minimum)		V	

* Calibration gas traceability information is available upon request.

Date: 30/4/9 Checked by: AB

Signed: _____ 49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	MiniRae 2000 PID / Operational Check, plus Battery Voltage @ <u>3.5V</u>
☒	☐	☐	Protective yellow rubber boot
☒	☐	☐	Inlet probe (attached to PID)
☒	☐	☐	Water trap filter.
☒	☐	☐	Spare water trap filter(s) Qty <u>1</u> @ \$ <u>7.50</u> +GST / filter if opened.
☒	☐	☐	Charger 240V to 12V 500mA
☒	☐	☐	Instruction Manual behind foam on the lid of case "
☒	☐	☐	Quick Guide Sheet behind foam on the lid of case "
☒	☐	☐	Spare Alkaline Battery Compartment with/without batteries
☒	☐	☐	Carry Case
☒	☐	☐	Calibration regulator & tubing (optional)
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials _____

EE Quote Reference	<u>14278</u>	Condition on return
Customer Ref		
Equipment ID	PIDMINBI	
Equipment serial no.	110-901144	
Return Date	/ /	
Return Time		

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ENVIROEQUIP RENTALS

Your Friend in the Field



EQUIPMENT CERTIFICATION REPORT

SOLINST INTERFACE METER.

This Interface Meter has been performance checked as follows:

Cleaned/Tested	Description
☒	Probe/Sensor pins
☒	Tape/Reel
☒	Performance Test & Battery Voltage Check (9.0v) 9.0v

Date: 20/4/9

Checked by: AB

Signature: 49-Sch4 - Signature

Please check that the following items are received and that all items are returned. Please clean equipment before returning. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items.

Sent	Received	Returned	Description
☒	☐	☐	Solinst Interface Meter Operational
☒	☐	☐	Solinst Interface Meter : <u>50</u> m ^{Check}
☒	☐	☐	Carry Bag/Box
☒	☐	☐	Spare 9V Batteries Qty (<u>2</u>)
☒	☐	☐	Instruction Guide
☒	☐	☐	Cleaning Brush

QUOTE NO.: 110270

CLIENTS REF: P/o No:

CLIENTS REF: Job No:

ID: SOL12230BF

SERIAL NO.: 122-007046-1

RETURN DATE: / /

TIME:

CONDITION ON RETURN:

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File: Eq Cert Interface meters



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - GEOTECHNICAL INSTRUMENTS GA2000

This Gas Meter has been performance checked / calibrated* as follows:

Calibration	Cal Value	Reading	Cal Value	Reading	Pass?
CH4	50 / 60% vol	44 %	0.00% vol	0.0 %	☒
CH4 LEL -check	50% LEL (2.5%CH4)	49 % (2.5%)			☒
H2s	25ppm	25 ppm	0 ppm	0.0 ppm	☒
O2	21.0% vol	18 %	0.00% vol	0.0 %	☒
CO	100ppm	100 ppm	0 ppm	0.0 ppm	☒
CO2	10 / 40% vol	10 %			☒
Operations Check					
☒ Cleaned/checked	☒ In line Filter Check		☒ Charged 100 %		

* Calibration gas traceability information is available upon request.

Date: 8/5/9 Checked by: ALG

Signed: _____ 49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Sampling Probe with In-Line Filter
☒	☐	☐	1m of Sampling Tube
☒	☐	☐	Carry Strap
☒	☐	☐	Battery Charger and AC/DC Power Supply
☒	☐	☐	Operating Quick Guide <u>behind foam on lid of case</u>
☒	☐	☐	Manual <u>behind foam on lid of case</u>
☒	☐	☐	Spare Inline Filters Qty (1)
☐	☐	☐	Carry case
☐	☐	☐	Data Cable and Software CD or Diskette
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials

EE Quote Reference	14272	Condition on return
Customer Ref		
Equipment ID		
Equipment serial no.		
Return Date	/ /	
Return Time		

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ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - TPS 90FLMV Water Quality Meter

This Water Quality Meter has been performance checked / calibrated* as follows:

pH ☒ pH 6.88 ☒ pH 7.00 ☒ pH 4.00 ☒ pH 10.00 ☒ pH
Conductivity ☒ 0.0mS/cm ☒ 2.76mS/cm ☒ 42.88mS/cm ☒ 58.6mS/cm ☒ mS/cm
TDS ☒ 0.0 ppk ☒ 36 ppk ☒ ppk
Dissolved Oxygen ☒ 0.00ppm in Sodium Sulphite ☒ 100% Saturation in Air
Redox (ORP)** ☒ Electrode operability test 240mV +/- 10%. Actual: 240 mV
☒ Electrodes cleaned/checked ☒ Charged 80V (min 7.2V)

* Calibration solution traceability information is available upon request.

** This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading. For further information, refer to www.enviroequip.com/quipnotes/ORP.htm.

Date: 7/5/9

Checked by: Aht

Signed: _____

49-Sch4 - Signature

Sent	Received	Returned	Item
☒	☐	☐	90FLMV Unit. Ops check / Battery Voltage @ 80V
☒	☐	☐	pH sensor 5m
☒	☐	☐	Conductivity / TDS / Temperature k=10 sensor 5m
☒	☐	☐	Dissolved Oxygen YSI5739 sensor 5m
☒	☐	☐	Redox (ORP) sensor 5m
☒	☐	☐	Battery charger: 240V AC to 12V DC 200mA
☒	☐	☐	Instruction Manual
☒	☐	☐	Quick Guide
☒	☐	☐	Syringe with storage solution for pH & ORP sensors
☐	☐	☐	Carry Case
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials

EE Quote Reference	14248	Condition on return
Customer Ref		
Equipment ID	90FLMBH	
Equipment serial no.	T7931	
Return Date	/ /	
Return Time		

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ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report – Solinst Model 122 Interface Meter

This Meter has been performance checked / calibrated* as follows:

Cleaned/Tested

Pass?

Probe

☒

Tape/Reel

☒

☒ Performance Test & Battery Voltage Check (9.0v) 8.0v minimum

Date: 18/11/9

Checked by: ALY

Signed:

49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Interface meter: 30m
☒	☐	☐	Plastic Box / Bag
☒	☐	☐	Spare 9V Battery Qty 2
☒	☐	☐	Probe Cleaning Brush
☒	☐	☐	Decon
☒	☐	☐	Instruction leaflet
☐	☐	☐	
☐	☐	☐	
Processors Signature/ Initials			

EE Quote Reference	14791	Condition on return
Customer Ref		
Equipment ID	SOL1223083	
Equipment serial no.		
Return Date	1 / 1	
Return Time		

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Filename: SOL12230BA



ENVIROEQUIP RENTALS

Your Friend in the Field

Equipment Report - GEOTECHNICAL INSTRUMENTS GA2000

This Gas Meter has been performance checked / calibrated* as follows:

Calibration	Cal Value	Reading	Cal Value	Reading	Pass?
CH4	50 / 60% vol	44 %	0.00% vol	0.0 %	☒
CH4 LEL -check	50% LEL (2.5%CH4)	49 % (2.5)			☐
H2s	25ppm	25 ppm	0 ppm	0.0 ppm	☐
O2	18.21.0% vol	18 %	0.00% vol	%	☐
CO	100ppm	100 ppm	0 ppm	0.0 ppm	☐
CO2	10 / 40% vol	10 %			☐
Operations Check					
☒ Cleaned/checked	☒ In line Filter Check		☒ Charged		%

* Calibration gas traceability information is available upon request.

Date: 22/1/9

Checked by: [Signature]

Signed: _____

49-Sch4 - Signature

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	Sampling Probe with In-Line Filter
☒	☐	☐	1m of Sampling Tube
☒	☐	☐	Carry Strap
☒	☐	☐	Battery Charger and AC/DC Power Supply
☒	☐	☐	Operating Quick Guide behind foam on lid of case "
☒	☐	☐	Manual behind foam on lid of case "
☒	☐	☐	Spare Inline Filters Qty (1)
☒	☐	☐	Carry case
☒	☐	☐	Data Cable and Software CD or Diskette
☐	☐	☐	
☐	☐	☐	

Processors Signature/ Initials

EE Quote Reference	14791	Condition on return
Customer Ref		
Equipment ID		
Equipment serial no.		
Return Date	/ /	
Return Time		

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