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GROUNDWATER ASSESSMENT

50 Wyllie Road, Kembla Grange NSW

prepared for

Bicorp Pty Ltd

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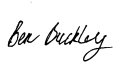
Author		Benjamin Buckley	20/06/14

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1.0 INTRODUCTION

Benviron Group was appointed by Mr Adam Blackwell of Bicorp Pty Ltd to undertake an Groundwater Assessment for the property situated at 50 Wyllie Road, Kembla Grange ("the site").

Refer to **Figure 1** - Site Locality and **Figure 2** - Site Locality

This report has been prepared to assess the existing groundwater conditions and any potential for contamination to migrate from the site.

This assessment was performed in accordance with the Benviron Group Environmental Protocols and in general accordance to relevant environmental regulatory criteria including the NSW EPA regulatory guidelines and National Environmental Protection (*Assessment of Site Contamination*) Measure, 1999.

1.1 Objectives

The primary objectives of the groundwater works were to:

- Assess the nature and extent of any potential groundwater contamination at the site by providing a baseline groundwater contamination status of the site;
- Investigate on and off site groundwater concentration levels and flow directions; and
- Provide background information for the site.

1.2 Scope

The scope of the groundwater assessment was to identify existing groundwater quality characteristics, identify suitable management controls and determine the likely impact of the proposed increase of processing capacities of up to 230,000 tonnes of construction and demolition waste materials per annum with associated waste storage and stockpile areas and ancillary structures (i.e plant and equipment) and also includes the construction of a large warehouse.

The groundwater works included the following:

- Collecting site information.
- A review of previous environmental reports.
- A technical assessment of the existing groundwater conditions and any potential for contamination from the existing and future working areas to migrate from the premises via groundwater;
- Groundwater sampling and testing to assess the status of the groundwater.
- Assessment of laboratory analytical results, based on currently accepted and applicable guidelines.
- Assessment of field and laboratory quality assurance (QA) and quality control (QC).
- The preparation of a report.

2.0 REVIEW OF INFORMATION AVAILABLE

2.1 Site Identification

The site is identified as follows:

Table 1: Site Identification Details

Site Identifier	Site Details
Site Location	50 Wyllie Road, Kembla Grange NSW
Lot/DP	Lot 10 DP 878167
Parish	Kembla County
County	Camden
Site Area	*Entire Site* - Approximately 21 Hectare. *Development Area* - 40,000m^2
Local Government Area (LGA)	Wollongong City Council
Surrounding Land Uses	North – Ridgeline. South – Vacant Land East – Vacant Land West – Industrial Facilities.

Refer to **Figure 1** - Site Locality and **Figure 2** - Site Locality

2.2 Geology and Hydrogeology

The Geological Map of Wollongong (Geological Series Sheet S1 56-9, Scale 1:250,000, 1966), published by the Department of Mineral Resources indicates the residual soils within the site to be underlain by Shoalhaven Group geological profiles, comprising red, brown and grey lithic sandstone.

Based on a search of the NSW Groundwater Works website database, there were three wells located within a 2.0 kilometre radius of the site. The closest groundwater bore with available information (GW075139) is located to the north of the site. The maximum depth of drilling was 193m, and the standing water level was 15m. The bore was used as a test bore.

Given the geology of the region, groundwater flow rates are likely to be extremely low. The hydraulic conductivity of the aquifer can be calculated by using intrinsic permeability values. Based on the unweathered layered clay geology overlying a sandstone bedrock the conductivity of this is expected to be from 10^{-6} to 10^{-8} m/day (Bear 1972).

The nearest surface water body an unnamed creek that flows through the central portion of the site from north to south. Stormwater from the local and surrounding areas would flow towards this area.

The closest large body of water is Port Kembla Bay, approximately 7.3km to the east.

2.3 Topography and Surface Drainage

Topographic information indicates the site is situated in a sloping area ranging from approximately 15-30 metres above sea level. The majority of the site slopes towards Wyllie Road and also is intersected by an onsite creek with the surrounding topography being undulating. Site stormwater runoff is expected to be either captured for reuse within the onsite-retention dams or is expected to flow via stormwater drains and site surfaces into the onsite creek within the site.

2.4 NSW EPA Records

The NSW EPA publishes records of contaminated sites under Section 58 of the Contaminated Land Management (CLM) Act 1997. The notices relate to investigation and/or remediation of site contamination considered to pose a significant risk of harm under the definition in the CLM Act.

A search of the database revealed that the subject site is not listed, and there were no listed properties in the Kembla Grange area.

It should be noted that the DECC record of Notices for Contaminated Land does not provide a record of all contaminated land in NSW.

2.5 Proposed Development

The proposed development consists of the increase of processing capacities of up to 230,000 tonnes of construction and demolition waste materials per annum with associated waste storage and stockpile areas and ancillary structures (i.e plant and equipment) and also includes the construction of a large warehouse. No works are expected to intercept or connect with the groundwater sources on site.

3.0 REVIEW OF QUALITY OF DATA

3.1 General

The National Environment Protection (Assessment of Site Contaminated) Measure 1999 (NEPM) and Australian Standard (AS) 4482.1-2005 recommend that data quality objectives (DQOs) be implemented during the investigation of potentially contaminated sites.

The DQOs process outlines the use of seven steps to ensure an investigation is performed in a structured and efficient manner. These steps include:

- State the problem
- Identify the decisions
- Identify inputs to decision
- Define the study boundaries
- Develop a decision rule
- Specify limits on decision errors
- Optimise the design for obtaining data

3.2 State the Problem

The site is required to be assessed in regards to the nature and extent of any potential groundwater contamination at the site and investigating on and off site groundwater concentration levels and flow directions. This assessment is proposed to find a baseline groundwater contamination status of the site and any potential for contamination to migrate from the premises via groundwater.

3.3 Identify the Decisions

The decisions made in completing this assessment are as follows:

- Does the site or is the site likely to present a risk of harm to humans or the environment
- Is the site currently suitable for the proposed land use being commercial / industrial
- Is there a potential for groundwater contamination
- Is there a potential for offsite migration issues
- Does the sampling results meet the site criteria proposed
- If not, does the site require remediation works

3.4 Identify Inputs into the Decisions

Inputs to the decision include:

- Existing site information
- Site history
- Regional geology, topography and hydrogeology
- Potential contaminants
- Site assessment criteria
- Results as measured against criteria

3.5 Define the Study Boundaries

The site boundary is identified as the entire boundary of the subject site as shown on the site plans (Refer to **Figure 1** - Site Locality and **Figure 2** - Site Locality) and known as Lots 10 in DP878167 located at 50 Wyllie Road, Kembla Grange NSW.

3.6 Develop a Decision Rule

The information obtained through this assessment will be used to characterise the groundwater on the site in terms of contamination issues and risks to human health and the environment. The decision rule in characterising the site will be as follows:

- Laboratory test results will be measured against the criteria provided within this report
- The site will be deemed suitable for the proposed/current landuse if the following criteria are fulfilled
    - Groundwater concentrations are within background levels
    - QA/QC shows data can be relied upon
    - Results generally meet regulatory criteria
    - Results are from NATA accredited laboratories
    - Detection limits are below assessment criteria

3.7 Specify Limits on Decision Error

The limits on decision errors for this assessment are as follows:

- The assessment criteria adopted from the guidelines within this report have risk probabilities already incorporated.
- The acceptable limits for inter/intra laboratory duplicate sample comparisons are laid out within our protocols.
- The acceptable limits for laboratory QA/QC parameters are based upon the laboratory reported acceptable limits and those stated within the NEPM 1999 Guidelines.

3.8 Optimise the Design for Obtaining Data

The design for optimising data was achieved by the installation and construction of seven groundwater monitoring wells from which the collection of groundwater samples was undertaken.

Further to this, only laboratories accredited by NATA for the analysis undertaken will be used. The laboratory data will be assessed from quality data calculated during this assessment. Field QA/QC protocols adopted and listed within appendices incorporate traceable documentation of procedures used in the sampling and analytical program and in data verification procedures

4.0 ASSESSMENT CRITERIA

4.1 Groundwater

The nearest surface water receptor is an unnamed creek, which flows through the site. The threshold concentrations presented in the ANZECC (2000) *Fresh and Marine Waters Quality Guidelines* are considered applicable for the protection of aquatic ecosystems of the receiving waters. As these guidelines apply to receiving waters, it is generally conservative to apply these to groundwater discharging to receiving waters. It is considered that based on the expected estuarine conditions of this nearby water body that the marine and fresh water trigger values are applicable for investigating chemical concentrations in groundwater at the site.

It is important to note that these are not threshold values at which an environmental problem is likely to occur if exceeded, rather, if the trigger values are exceeded, then further action is required which may include either further site-specific investigations to assess whether or not there is an actual problem or management / remedial action if required.

ANZECC (2000) states that there is currently insufficient data to derive high reliability trigger values for TPH, but propose a low reliability trigger value for TPH of 7ug/L. This guideline is generally considered by industry to be overly conservative and is also well below the TPH detection limit that most laboratories can achieve. Another commonly internationally used guideline for TPH is contained in MHSPE (1999), which present a target and intervention values for mineral oils (including TPH). For this site, the Dutch intervention value (600ug/L) has been adopted as investigation criteria to assess TPH contamination in groundwater.

Guidelines for the recreational water quality and aesthetics are also presented in the ANZECC (2000) *Fresh and Marine Waters Quality Guidelines* (section 5.2.3 of the guidelines). It is possible that groundwater downgradient of the site would be used for industrial purposes based on the surrounding industrial area and these have been assessed as part of the investigation.

Table 2: Groundwater Assessment Criteria

Groundwater Assessment Criteria			
ANZ Guidelines for Fresh and Marine Water Quality (2000)			
	AQUATIC ECOSYSTEMS (Trigger Values)		Water for Recreational Purposes
Analyte	Freshwater	Marine	
	(µg/L)		
HEAVY METALS			
Lead	3.4	4.4	50
TOTAL PETROLEUM HYDROCARBONS			
(C10-C36)	-	7.0[a]	-
(C6-C36)	600[b]	600[b]	-
BTEX			
Benzene	950	500	10
Toleune	180[a]	180[a]	-
Ethyl Benzene	80[a]	5[a]	-
Xylene (0, p)	350, 200	ID	-
Xylene (m)	75[a]	ID	-
Total Xylene	-	625[a]	-
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)			
Naphthalene	16	50	-
Anthracene	0.4[a]	0.01[a]	-
Phenanathrene	2[a]	0.6[a]	-
Fluoranthene	1.4[a]	1.0[a]	-
Benzo(a)pyrene	0.2[a]	0.1[a]	0.01

Notes a: Interim working values in the absence of reliable trigger values (Section 8.3.7).

b: Dutch Intervention Level, MHSPE (1999)

ID: Insufficient Data to derive a reliable trigger value

The wells should be sampled by suitably qualified environmental consultant on a quarterly basis, however, this sampling frequency may change dependant upon:

- If the strata is highly permeable or contains highly vulnerable groundwater, then a more frequent sampling program should be adopted.

If the occupier can demonstrate that there are no seasonal effects and that the data is statistically constant after data has been collected for at least five consecutive years, then the sampling program can be reduced.

4.2 Unlikely Uses

It is considered unlikely that groundwater in the vicinity of the site would be used for drinking as groundwater is not the source of potable water in the Wollongong area. There are no grazing properties between the site and the unnamed creek; therefore, the groundwater in the vicinity of the site would not be used for stock watering purposes.

5.0 GROUNDWATER SAMPLING METHODOLOGY

5.1 Monitoring Well Installation

Seven groundwater monitoring wells were installed as part of this assessment using a truck mounted drilling rig. The wells were designated GW1 to GW7 (groundwater well) and drilled to depths ranging from 8.0 to 10m BGL.

Refer to **Appendix C** - Groundwater Logs

The wells were constructed using a 50mm diameter Class PVC piping and consisted of an unslotted PVC casing from the surface to a depth ranging from 8.0-10.0m BGL, followed by a slotted PVC casing (screen) to the final depth of the monitoring well.

The monitoring wells are situated in locations that would maximise the likelihood of intercepting groundwater across the site. During the investigation, groundwater seepage was only detected in four wells ranging between 7.0m to 7.3m, with no groundwater seepage encountered at GW5 - GW7 during the installation.

Standing groundwater levels were measured at depths ranging from 6.5m to 6.7m in the monitoring wells after initial development, with no groundwater encountered at GW5 - GW7 during the sampling period. Reasons for this non detection of water were are attributed to the surrounding geology and the topography of the site.

Based on the sampling event and subsequent investigations groundwater flow direction is most likely to be in a south easterly direction. This calculation is based on the depths to standing water levels and localised RLs from the survey plan of the site.

5.2 Monitoring Well Development

Groundwater was purged from the monitoring wells using a dedicated disposable polyethylene bailer. During purging the pH, temperature and electrical conductivity were monitored (where possible) using calibrated field instruments to assess the development of steady state conditions.

Steady State conditions were considered to have been achieved when the difference in pH measurements were less than 0.1 units and the difference in conductivity was less than 10%. Typically a minimum of three monitoring well volumes were purged to remove stagnant water and sediment from the monitoring well prior to sampling to obtain samples representatives of the general aquifer conditions, however, in some cases the monitoring well was pumped 'dry' prior to these conditions being established.

A new bailer was used at each monitoring well during each pumping event.

5.3 Monitoring Well Purging and Sampling

Groundwater samples were obtained from the monitoring wells using low flow / micro-purge sampling equipment to reduce the disturbance of the water column and loss of volatiles. During pumping to purge the wells, the pH, temperature, electrical conductivity and groundwater levels were monitored using calibrated field instruments to assess the development of steady state conditions. Steady state conditions were considered to have been achieved when the difference in the pH measurements was less than 0.1 units and the difference in conductivity were less than 10%.

Once steady state conditions were considered to have been achieved, groundwater samples were obtained directly from the pump tubing and placed in appropriate glass bottles, BTEX vials or plastic bottles. All samples were preserved in accordance with water sampling requirements detailed in the NEPC Guidelines (1999) and placed in an insulated container with ice. On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody procedures.

The low flow pump unit was decontaminated between sampling events by using new single use bladders and plastic tubing at each sampling location and these were dedicated to their relevant monitoring wells.

5.4 Monitoring Well Details

Seven groundwater monitoring wells were installed as part of this assessment using a truck mounted drilling rig. The wells were designated GW1 to GW7 (groundwater well) and drilled to depths ranging from 8.0 to 10.0m BGL. A summary of the monitoring well details are provided below:

Table 3: Monitoring Well Details

Well ID	Depth of Well (m)	Screened depth interval (m)	Depth to Standing water (m) 2/7/13	Depth to Standing water (m) 9/7/13
GW1	9.0	6.0-9.0	6.5	6.5
GW2	9.0	6.0-9.0	6.6	6.6
GW3	9.5	6.5-9.5	6.7	6.7
GW4	9.0	6.0-9.0	6.7	6.7
GW5	10.0	7.0-10.0	ND	ND
GW6	10.0	7.0-10.0	ND	ND
GW7	10.0	7.0-10.0	ND	ND

*ND= no water

5.5 Field Parameters

A calibrated Multiparameter Meter was used to measure pH, Electrical Conductivity (EC) and Temperature of the groundwater, as summarised in the following tables. After purging and reaching stable readings for each of the parameters mentioned above, the groundwater samples were collected.

Table 4: Summary of Field Parameter Results

	Date	pH	Electrical Conductivity (EC)	Temperature
GW1	09.07.13	6.9	210	20
GW2	09.07.13	6.9	216	20
GW3	09.07.13	7.1	212	21
GW4	09.07.13	7.1	215	21
GW5	09.07.13	ND	ND	ND
GW6	09.07.13	ND	ND	ND
GW7	09.07.13	ND	ND	ND

*ND= no water

5.6 Laboratory Analysis Information

Groundwater samples were dispatched under chain of custody (CoC) conditions to Eurofins MGT and Envirolab laboratories. The samples were selected for analysis based on the contaminants of concern recorded during the assessment of the site.

The laboratory analysis information for the samples is shown in the following table.

Table 5: Summary of laboratory analysis information

Analyte / Analyte Group Sample	Depth (m)	TYPE	SAMPLING DATE	DUPLICATE	SPLIT	MET-8	TPH & BTEX	OCP & PCB	PAH	MAJOR ANIONS / CATIONS
Groundwater										
GW1	-	GW	9.07.13	D1	SS1	¶	¶	¶	¶	¶
GW2	-	GW	9.07.13			¶	¶		¶	¶
GW3	-	GW	9.07.13			¶	¶	¶	¶	¶
GW4	-	GW	9.07.13			¶	¶		¶	¶

Notes
MET-8: arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc
PAH: Polycyclic Aromatic Hydrocarbons
TPH: Total Petroleum Hydrcarbons
BTEX: Benzene, Toluene, Ethyl Benzene, Xylene
MAH: Monocyclic Aromatic Hydrocarbons
OCP: Organochlorine Pesticides
TDS: Total Dissolved Solids
EC: Electrical Conductivity
NAP: Natural Attenuation Parameters
GW: Groundwater

5.7 DQO's for Groundwater Sampling

The following table provides a list of the data quality objectives for the groundwater sampling and the methods adopted in ensuring that the data quality objectives were met.

Table 6: DQO's for Groundwater Sampling

DATA QUALITY OBJECTIVE	METHODS OF ACHIEVEMENT
Documentation Completeness	Preparation of chain of custody records Laboratory sample receipt information NATA registered laboratory results certificates
Data Completeness	Analysis for all potential contaminants of concern
Data Comparability	Using appropriate techniques for sample recovery Experienced samplers used Using appropriate sample storage and transportation methods Use of a NATA registered laboratory
Data Representativeness	Reasonable sampling coverage Representative sampling Representative coverage of contaminants through analysis
Data Precision and Accuracy	Use of trained and qualified field staff Appropriately calibrated equipment used Appropriate industry standard sampling equipment and decontamination procedures Check of laboratory quality control methods and results

6.0 GROUNDWATER RESULTS

6.1 Results of Groundwater Sampling

A summary of the test results are presented in the following tables together with the assessment criteria adopted. A discussion of the test data is also presented in the following sub-sections. Reference may be made to **Appendix B** - NATA Laboratory Results for the laboratory certificates.

6.2 Laboratory Results

Table 7: Summary of Laboratory Groundwater Results – Heavy Metals

Analyte / Sample Location	HEAVY METALS (µg/L)							
	ARSENIC (As) - Total	CADMIUM (Cd)	CHROMIUM (Cr) - Total	COPPER (Cu)	LEAD (Pb)	MERCURY (Hg) - Total	NICKEL (Ni)	ZINC (Zn)
GROUNDWATER SAMPLES								
GW1	<1	<0.1	<1	**4**	<1	0.1	<1	<5
GW2	<1	<0.1	<1	**5**	2	<0.1	<1	5
GW3	<1	<0.1	<1	**4**	<1	<0.1	<1	<5
GW4	<1	<0.1	<1	**3**	<1	<0.1	<1	<5
Practical Quantitation Limits (PQL)	1	0.1	1	1	1	0.1	1	5
ANZ [a] Guidelines for Fresh and Marine Water Quality (2000)								
Aquatic Ecosystems (Trigger Values)								
Fresh Water	24 [b] 13 [c]	0.2	3.3 [d, h] 1 [e]	1.4	3.4	0.6 [f] 0.4 [g, h]	11	8
Marine Water	2.3 [b, h] 4.5 [c, h]	5.5	27.4 [d] 4.4 [e]	1.3	4.4	ID ID	70	15
Irrigation Water (Trigger Values)								
LTV	100	10	100	200	2000	2	200	2000
STV	2000	50	1000	5000	5000	2	2000	5000
Water for recreational purposes	50	5	50	1000	50	1	100	5000
Livestock Drinking water	0.5	0.01	1	0.4-5	0.1	0.002	1	20
Australian Drinking Water Guidelines								
Drinking water (Health Values)	0.007	0.002	0.05 [e]	2	0.01	0.001	0.02	ID
Drinking water (Aesthetic Values)				1				3

Notes
a: ANZ = Australia and New Zealands
b: as As (III)
c: as As (V)
d: as Cr (III)
e: as Cr (VI)
f: as Hg (Inorganic)
g: as Hg (methyl)
h: Interim working values in the absence of reliable trigger values (Section 8.3.7)
ID: Insufficient Data to derive a reliable trigger value
LTV: Long Term Trigger Value (up to 100 years)
STV: Short Term Trigger Value (up to 20 years)

As shown in Table 7, the concentration of Heavy Metals was below the relevant trigger values for aquatic ecosystems with the exception of copper in samples GW1-GW4.

As shown in Table 7, the concentrations of Heavy Metals were below the relevant trigger values for the relevant guidelines of water for recreational purposes in the ANZ Guidelines 2000.

Table 8: Summary of Laboratory Groundwater Results – TPH and BTEX

Analyte / Sample Location	TPH (µg/L)					BTEX (µg/L)			
	C6-C9	C10-C14	C15-C28	C29-C36	C10-C36	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES
GROUNDWATER SAMPLES									
GW1	< 20	7	<100	< 100	<100	<1	<1	<1	<3
GW2	<20	7	<100	<100	<100	<1	<1	<1	<3
GW3	<20	7	<100	<100	<100	<1	<1	<1	<3
GW4	<20	7	<100	<100	<100	<1	<1	<1	<3
Practical Quantitation Limits (PQL)	20	50	100	100		1	1	1	3
ANZ [a] Guidelines for Fresh and Marine Water Quality (2000)									
Aquatic Ecosystems (Trigger Values)									
Fresh water					-	950	180 [e]	80 [e]	350[b] 75[c, e] 200[d]
Marine water (C10-C36)					7	500	180 [e]	5 [e]	625
Dutch Intervention Guidelines (Mineral Oil)			C6-C36 = 600						
Water for recreational purposes					-	10			
Livestock Drinking water						0.001	0.8	0.3	0.6
Australian Drinking Water Guidelines (2004)									
Drinking water (Health Values)						0.001	0.8	0.3	0.6
Drinking water (Aesthetic Values)							0.025	0.003	0.02

Notes
a: ANZ = Australia and New Zealand
b: as o-Xylene
c: as m-Xylene
d: as p-Xylene
e: Interim working values in the absence of reliable trigger values (Section 8.3.7)
f: Contaminated Sites: "Guidelines for Assessing Service Station Sites", 1994, EPA

As shown in Table 8, the concentrations of BTEX were all below the relevant trigger values for aquatic ecosystems and also for recreational purposes in the ANZ Guidelines 2000.

Levels of TPH C_{10}-C_{14} were detected within the samples; however all results were below the conservative ANZ Guidelines 2000 and also the Dutch Intervention Guidelines.

Table 9: Summary of Laboratory Groundwater Results – PAH and PCB

Analyte / Sample Location	PAH (µg/L)					
	NAPHTHALENE	ANTHRANCENE	PHENANTHRENE	FLUORANTHENE	BENZO(a)PYRENE	TOTAL PCB
GROUNDWATER SAMPLES						
GW1	<1	<1	<1	<1	<1	<5
GW2	<1	<1	<1	<1	<1	=
GW3	<1	<1	<1	<1	<1	<5
GW4	<1	<1	<1	<1	<1	-
Practical Quantitation Limits (PQL)	1	1	1	1	1	5
ANZ [a] Guidelines for Fresh and Marine Water Quality (2000) Aquatic Ecosystems (Trigger Values)						
Fresh	16	0.4[b]	2[b]	1.4[b]	0.2[b]	
Marine	50	0.01[b]	0.6[b]	1.0[b]	0.1[b]	
Water for recreational purposes					0.01	100
Livestock Drinking water					0.01	100
Australian Drinking Water Guidelines (2004)						
Drinking water (Health Values)					0.01	

Notes a: ANZ = Australia and New Zealands
b: Interim working values in the absence of reliable trigger values (Section 8.3.7)

As shown in Table 9, the concentrations of PAH and PCB were all below the relevant trigger values for aquatic ecosystems and also for recreational purposes in the ANZ Guidelines 2000.

Table 10: Summary of laboratory Groundwater results – OCP

Analyte / Sample Location	OCP (µg/L)											
	HCB	Lindane	Heptachlor	Methoxychlor	Aldrin	Dieldrin	Endrin	Endosulfan	Endosulfan Sulphate	DDE	DDT	Chlordane (trans & sis)
GROUNDWATER SAMPLES												
GW1	<0.05	<0.05	<0.05	<2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GW2	-	-	-	-	-	-	-	-	-	-	-	-
GW3	<0.05	<0.05	<0.05	<2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GW4	-	-	-	-	-	-	-	-	-	-	-	-
Practical Quantitation Limits (PQL)	0.05	0.05	0.05	2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
ANZ [a] Guidelines for Fresh and Marine Water Quality (2000) Aquatic Ecosystems (Trigger Values)												
Fresh	0.1[b]	0.2	0.09	0.005[b]	0.001[b]	0.01[b]	0.02	0.2	0.03[b]	0.03[b]	0.01	0.08
Marine		0.007[b]	0.004[b]	0.004[b]	0.003[b]	0.01[b]	0.008	0.001		0.0005[b]	0.0004[b]	0.001[b]
Water for recreational purposes		10	3		1	1	1	40			3	6

Notes a: ANZ = Australia and New Zealands
b: Interim working values in the absence of reliable trigger values (Section 8.3.7)

As shown in Table 10, the concentrations of OCP were all below the relevant trigger values for aquatic ecosystems and also for recreational purposes in the ANZ Guidelines 2000.

Table 11: Summary of laboratory Groundwater results – Anions and Cations

Sample / Analyte	Unit	LAB PQL	GW1 mg/L	GW2 mg/L	GW3 mg/L	GW4 mg/L	ANZECC Agriculture	ANZECC Recreational Use	ANZECC Livestock Water	ANZECC 2000 Fresh Water
Dissolved Metals in Water										
Calcium	mg/L	0.5	8.8	10	11	11			1,000	
Magnesium	mg/L	0.5	3.8	4.4	4.8	4.6			0	
Potassium	mg/L	0.5	2.8	3.3	3.4	3				
Sodium	mg/L	0.5	20	23	24	23		6,000		
Alkalinity in Water (as $CaCO_3$)										
Bicarbonate	mg/L	5	25	24	160	25				
Carbonate	mg/L	5	< 5	< 5	270	< 5				
Anions in Water										
Ammonia	mg/L	0.01	0.04	0.04	0.05	0.05				0.9
Chloride	mg/L	1	29	29	29	28				
Nitrate	mg/L	0.01	0.69	0.67	0.66	0.64				0.7
Sulphate	mg/L	2	4	4	4.1	4				

As shown in Table 11, the concentrations of Anions/Cations were all below the relevant trigger values for aquatic ecosystems and also for recreational purposes in the ANZ Guidelines 2000.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

7.1 Data Quality Objectives

Data Quality Objectives (DQOs) were created to produce quality assured, accurate and useful data for the sampling plan. Blind samples were split in the field for testing or at the laboratory. Other areas reviewed are:

- sampling methods;
- decontamination procedures;
- sample preservation;
- container type;
- headspace within containers;
- disturbed or undisturbed sampling for organics;
- PQL's;
- preparation of CoC forms;
- review of laboratory surrogate and spike % returns; and
- review of Laboratory duplicate results.

Eurofins MGT and Envirolab Laboratories performed all analyses using test methods accredited by the National Association of Testing Authorities (NATA). All data quality objectives were reviewed and met and we therefore conclude that the DQOs were satisfactory for our stated objectives.

The results of all quality checking have been reviewed and are considered adequate in satisfying the reliability of the results and meet Data Quality Objectives (DQOs).

7.2 Field QA/QC

Benviron Group procedures were followed throughout the field investigation, which are based on industry accepted standard practice. Groundwater samples were stored in laboratory preserved glass / plastic bottled and vials. Samples were then stored in an ice brick-cooled esky and transported to the laboratory under chain of custody conditions.

7.3 Intra Laboratory Duplicates

A total of one intra-laboratory duplicate sample was collected and analysed in order to assess the variation in analyte concentration between samples collected from the same sampling point. The duplicate sample frequency was computed using the total number of samples analysed as part of this assessment.

The duplicate sample frequencies computed are presented in the following table.

Table 12: Intra Laboratory Sample Frequency

Analyte – Groundwater	Samples Analysed	Duplicate Samples	Frequency
Heavy Metals	4	1	25%
TRH	4	1	25%
BTEX	4	1	25%
PAH	4	1	25%
OCP	2	1	50%
PCB	2	1	50%
Anions/Cations	4	1	25%

The duplicate frequency for most of the analytical suite adopted complies with the NEPM, which recommends a duplicate frequency of at least 5%.

It is considered that the number of duplicate samples collected is adequate to assess the variation in analyte concentration between samples collected from the same sampling point. A summary of the test results with the Relative Percentage Difference (RPD) is presented in the following tables. A discussion of the test data is also presented below.

Table 13: Groundwater Intra Laboratory RPD's

ANALYTE	GW2 - µg/L	DUPLICATE D1 µg/L	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	<1	<1	-
Cadmium	<0.1	<0.1	-
Chromium	<1	<1	-
Copper	5	5	0
Lead	2	<1	-
Mercury	<0.1	<0.1	-
Nickel	<1	<1	-
Zinc	5	6	18
TOTAL PETROLEUM HYDROCARBONS (TPH)			
C6 - C9	<20	<20	-
C10 - C14	7	5	33
C15 - C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<1	<1	-
Toluene	<1	<1	-
Ethyl Benzene	<1	<1	-
Total Xylenes	<3	<3	-
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)			
Naphthalene	<1	<1	-
Anthracene	<1	<1	-
Phenanthrene	<1	<1	-
Fluoranthrene	<1	<1	-
Benzo(a)pyrene	<1	<1	-
ORGANOCHLORINE PESTICIDES (OCP)			
HCB	<0.05	<0.05	-
Lindane	<0.05	<0.05	-
Heptachlor	<0.05	<0.05	-
Methoxychlor	<2	<2	-
Aldrin	<0.05	<0.05	-
Dieldrin	<0.05	<0.05	-
Endrin	<0.05	<0.05	-
Endosulfan	<0.05	<0.05	-
Endosulfan Sulphate	<0.05	<0.05	-
DDE	<0.05	<0.05	-
DDT	<0.05	<0.05	-
Chlordane (trans & sis)	<0.05	<0.05	-
POLYCHLORINATED BIPHENYLS (PCB)			
Total PCB	<5	<5	-

Table 14: Groundwater Intra Laboratory RPD's (cont)

ANALYTE	GW2 - mg/L	DUPLICATE D1 mg/L	RELATIVE PERCENTAGE DIFFERENCE %
Dissolved Metals in Water			
Calcium	10	9	12
Magnesium	4	4	10
Potassium	3	3	10
Sodium	23	21	9
Alkalinity in Water (as $CaCO_3$)			
Bicarbonate	24	21	13
Carbonate	< 5	< 5	-
Anions in Water			
Ammonia	0.04	0.04	-
Chloride	29	28	4
Nitrate	0.67	0.68	1
Sulphate	4	3.9	3

The comparisons between the intra-laboratory duplicates and corresponding original samples indicated generally acceptable RPD's with the exception of:

- TRH C10-C14 (33%) in Table 13

The above RPDs exceeded the DQOs for this project, however this exceedance is not considered to be significant as samples that have higher RPDs have very low concentrations of the relevant analytes which are below guideline criteria. Based on this information it should be assessed that RPDs should not be set for such analytes.

Overall, the duplicate sample comparisons indicate that the laboratory test data provided by Eurofins MGT are of adequate accuracy and reliability for this assessment.

7.4 Inter Laboratory Duplicates

A total of one (1) groundwater sample was collected and analysed in order to assess the variation in analyte concentration between samples collected from the same sampling point. The inter-laboratory duplicate (split) sample frequency was computed using the total number of samples analysed as part of this assessment.

The split sample frequencies computed are presented in the following table.

Table 15: Inter Laboratory Sample Frequency

Analyte – Groundwater	Samples Analysed	Duplicate Samples	Frequency
Heavy Metals	4	1	25%
TRH	4	1	25%
BTEX	4	1	25%
PAH	4	1	25%
OCP	2	1	50%
PCB	2	1	50%
Anions/Cations	4	1	25%

The split frequency for most of the analytical suite adopted complies with the NEPM, which recommends a duplicate frequency of at least 5%.

It is considered that the number of split samples collected is adequate to assess the variation in analyte concentration between samples collected from the same sampling point. A summary of the test results with the Relative Percentage Difference (RPD) are presented in the following tables. A discussion of the test data is also presented below.

Table 16: Groundwater Interlab RPD's

ANALYTE	GW2 - MGT (Syd) µg/L	SPLIT SS1 Envirolab µg/L	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	<1	<1	-
Cadmium	<0.1	<0.1	-
Chromium	<1	<1	-
Copper	5	4	22
Lead	2	<1	-
Mercury	<0.1	<0.05	-
Nickel	<1	<1	-
Zinc	5	4	22
TOTAL PETROLEUM HYDROCARBONS (TPH)			
C6 - C9	<20	<10	-
C10 - C14	7	<50	-
C15 - C28	<100	<100	-
C29-C36	<100	<100	-
BTEX			
Benzene	<1	<1	-
Toluene	<1	<1	-
Ethyl Benzene	<1	<1	-
Total Xylenes	<3	<3	-
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)			
Naphthalene	<1	<1	-
Anthracene	<1	<1	-
Phenanthrene	<1	<1	-
Fluoranthrene	<1	<1	-
Benzo(a)pyrene	<1	<1	-
ORGANOCHLORINE PESTICIDES (OCP)			
HCB	<0.05	<0.2	-
Lindane	<0.05	<0.2	-
Heptachlor	<0.05	<0.2	-
Methoxychlor	<2	<0.2	-
Aldrin	<0.05	<0.2	-
Dieldrin	<0.05	<0.2	-
Endrin	<0.05	<0.2	-
Endosulfan	<0.05	<0.2	-
Endosulfan Sulphate	<0.05	<0.2	-
DDE	<0.05	<0.2	-
DDT	<0.05	<0.2	-
Chlordane (trans & sis)	<0.05	<0.2	-
POLYCHLORINATED BIPHENYLS (PCB)			
Total PCB	<5	<2	-

Table 17: Groundwater Interlab RPD's (cont)

ANALYTE	GW2 - MGT (Syd) mg/L	SPLIT SS1 Envirolab (Syd) mg/L	RELATIVE PERCENTAGE DIFFERENCE %
Dissolved Metals in Water			
Calcium	10	8.7	14
Magnesium	4.4	4.0	10
Potassium	3.3	3.3	0
Sodium	23	21	9
Alkalinity in Water (as $CaCO_3$)			
Bicarbonate	24	22	9
Carbonate	< 5	< 5	-
Anions in Water			
Ammonia	0.04	-	-
Chloride	29	34	16
Nitrate	0.67	-	-
Sulphate	4	9	**77**

The comparisons between the intra-laboratory duplicates and corresponding original samples indicated generally acceptable RPD's with the exception of:

- Sulphate (77%) in Table 17

The above RPDs exceeded the DQOs for this project, however this exceedance is not considered to be significant as samples that have higher RPDs have very low concentrations of the relevant analytes which are below guideline criteria. Based on this information it should be assessed that RPDs should not be set for such analytes with such low limits of resolution.

Overall, the split sample comparisons indicate that the laboratory test data provided by Envirolab are of adequate accuracy and reliability for this assessment.

7.5 Trip Spike

Trip Spike samples were obtained from the laboratory prior to conducting field sampling where volatile substances are suspected. Benviron Group QA/QC procedures for the collection of environmental samples involves the collection of trip blanks, trip spikes and duplicate samples both intra and inter laboratory.

Trip Spike samples were collected as part of this investigation and can be seen in the following table:

Table 18: Trip Spike Results

ANALYTE	TRIP SPIKE % 09.07.2013
TRH C6-C9	83
Benzene	103
Toluene	101
Ethyl Benzene	99
Meta & Para Xylenes	101
Ortho Xylenes	104

Results indicate that samples are within relevant data quality objectives and therefore indicate that loss of volatiles is minimal.

7.6 Trip Blank

A trip blank accompanied the sampling for the sampling process and is not separated from the sample collection and transportation process. The purpose of the trip blank is to identify whether cross-contamination is occurring during the sample collection and transport process.

Trip Blank samples were collected as part of this investigation and can be seen in the following table.

Table 19: Trip Blank Results

ANALYTE	TRIP BLANK µg/L 09.07.2013	LABORATORY PQL
C6-C9	<20	20
Benzene	<0.5	0.5
Toluene	<1	1
Ethyl Benzene	<1	1
Total Xylenes	<3	3

Results indicate that samples are within relevant data quality objectives and therefore indicate that any cross contamination is minimal.

7.7 QA/QC Data Evaluation

The following table provides a list of the data quality indicators for the analytical phase of the assessment and the methods adopted in ensuring that the data quality indicators were met.

DATA QUALITY INDICATOR	METHOD(S) OF ACHIEVEMENT
Data Precision and Accuracy	Use of analytical laboratories experienced in the analyses undertaken, with appropriate NATA certification. NATA accreditation requires adequately trained and experienced testing staff. Appropriate and validated laboratory test methods used Adequate laboratory performance based on results of the blank samples, matrix spike samples, control samples, duplicates and surrogate spike samples
Data Representativeness	Representative coverage of potential contaminants, based on history, site activities and site features Adequate laboratory internal quality control and quality assurance methods, complying with the NEPM.
Documentation Completeness	Preparation of chain of custody records Laboratory sample receipt information received confirming receipt of samples intact and appropriate chain of custody NATA registered laboratory results certificates provided
Data Comparability	Use of NATA registered laboratories Test methods consistent for each sample Test methods comparable between primary and secondary laboratory
Data Completeness	Analysis for all potential contaminants of concern.

Based on the above, it is considered that the quality assurance and quality control data quality indicators have been complied with, both in the field and in the laboratory. As such, it is concluded that the laboratory test data obtained as part of this assessment is reliable and useable for this assessment.

7.8 Conclusion for the QA/QC

The sampling methods (including sample preservation, transport and decontamination procedures) and laboratory methods followed during this investigation works were consistent with Benviron Group protocols and were found to meet the DQOs for this project. It is therefore considered that the data is sufficiently precise and accurate and that the results can be used for the purpose of this project.

8.0 DISCUSSION

Seven groundwater monitoring wells were installed as part of this assessment using a truck mounted drilling rig. The wells were designated GW1 to GW7 (groundwater well) and drilled to depths ranging from 8.0 to 10m BGL.

The monitoring wells are situated in locations that would maximise the likelihood of intercepting groundwater across the site. During the investigation, groundwater seepage was only detected in four wells ranging between 7.0m to 7.3m, with no groundwater seepage encountered at GW5 - GW7 during the installation.

Standing groundwater levels were measured at depths ranging from 6.5m to 6.7m in the monitoring wells after initial development, with no groundwater encountered at GW5 - GW7 during the sampling period. Reasons for this non detection of water were are attributed to the surrounding geology and the topography of the site.

Based on the sampling event and subsequent investigations groundwater flow direction is most likely to be in a south easterly direction. This calculation is based on the depths to standing water levels and localised RLs from the survey plan of the site.

Based on a review of the proposed development and the depths to groundwater it is not expected that the development will intercept any natural groundwater flows within the site including the On-site detention basins (OSD Basin A and B). However it is to be noted that groundwater may be discovered during construction if undertaken during adverse weather or if a significant period lapses between the investigation and construction. Should this happen then further assessment should be undertaken and the Office of Water will be notified and an accurate quantification of the likely take of groundwater will be provided to allow for authorisation from the Office of Water.

To reach our stated objectives, four (4) groundwater samples were submitted for analysis. One QA/QC intra-laboratory duplicate sample and one QA/QC inter-laboratory split sample was analysed by the NATA accredited laboratories of Euorfins MGT and Envirolab for each sampling period. Laboratory results and QA/QC data fulfil the DQOs for the investigation.

Laboratory results were generally lower than the relevant regulatory guideline criteria adopted with the exception of copper in groundwater wells GW1-GW4.
However the results are not seen to be cause for concern for the following reasons:

- The heavy metal concentrations exceeding the guidelines within the recovered groundwater samples could be expected to be regional water quality as metal results from the samples are similar.
- The attenuation of the sandstone bedrock, being of low permeability, would minimise any impact of the copper contamination;

Based on the above, it is considered that the potential for significant contamination of soil and groundwater from current and previous activities within the site is low. However, there is potential for minor contaminant concentrations or localised surface soil contamination in the future during the operation of the site.

Off-site impacts of contaminants in soil are generally governed by the transport media available and likely receptor(s). The most common transport medium is water, whilst receptors include uncontaminated soils, groundwater, surface water bodies, humans, flora & fauna.

Migration of soil contaminants to the deeper soils or groundwater regime would generally be via leaching of contaminants from the surface soil or fill, facilitated by infiltration of surface water.

Surface water run-off from within the site would generally be deposited in the stormwater drainage pits and potentially the nearby creek within the site. Based on this reason and the proposed development the potential for migration of contamination via surface runoff is moderate, however, as the site geology is mostly heavy clay any infiltration of contaminants is expected to be low. The potential for significant impact of site soils, if contaminated, on the water bodies collecting surface water run-off from the region is considered low

9.0 CONCLUSION

Based on the results of this investigation it is considered that the risks to human health and the environment associated with soil and groundwater contamination at the site are low in the context of the proposed use of the site. The site can therefore considered ***to be suitable*** for the proposed development, subject to the following recommendations:

- Development of a Soil and Water Management Plan to minimise the amount of surface runoff and potential migration of contamination.
- Engineering of the development working platform including leachate control to minimise the infiltration of any contaminants into the underlying soils.
- Quarterly Testing of the groundwater on site to identify any future trends and characterise the groundwater within the local area.

If during any potential site works, significant odours and / or evidence of gross contamination not previously detected are encountered, or any other significant unexpected occurrence, site works should cease in that area, at least temporarily, and the environmental consultant should be notified immediately.

We would be pleased to provide further information or discuss any aspect of our report. Please do not hesitate to contact the undersigned should you have any queries.

For and behalf of

Benviron Group

Ben Buckley

Director

Environmental Forensic Scientist

LIMITATIONS

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, although subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

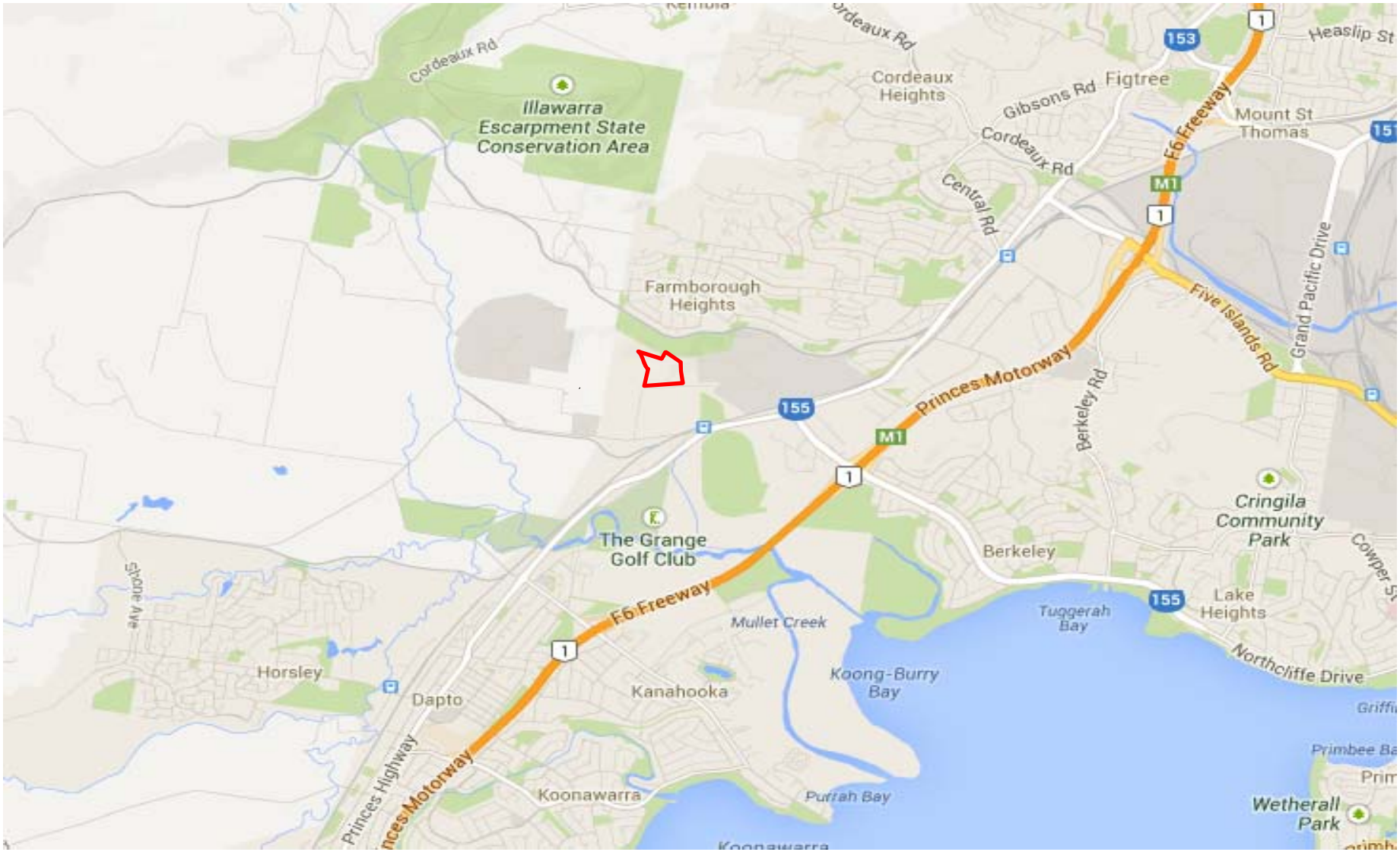
There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions are judgements that are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions.

Although the information provided by a Groundwater Assessment can reduce exposure to risks, no assessment, however diligently carried out, can eliminate them. It must be noted that these findings are professional findings and have limitations. Even a rigorous professional assessment may fail to detect all contaminants on a site. Contaminants may be present in areas that were not surveyed or sampled.

APPENDIX A

FIGURES 1 & 2: SITE LOCATION & FEATURES



Key

Site Location ——

Benviron group simple sustainable solutions	**DRAWN** BB	SITE LOCATION
	FIGURE 1	Bicorp Pty Ltd
	Job # E49/6	50 Wylie Road, Kembla Grange NSW

N

Expected Groundwater Flow Directions

Key

Site Boundary

Groundwater Well Location

	DRAWN BB
	FIGURE 2
	Job # E49/6

SITE PLAN

Bicorp Pty Ltd

50 Wylie Road, Kembla Grange NSW

APPENDIX B: NATA ACCREDITED LAB RESULTS

eurofins | mgt

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Benviron Group
64 Glenrock Parade
Koolewong
NSW 2256

Attention: **Ben Buckley**

Report **385710-W**
Client Reference KEMBLA GRANGE GROUNDWATER ASSESSMENT E49/6
Received Date Jul 11, 2013

Client Sample ID			**GW1**	**GW2**	**GW3**	**GW4**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**S13-Jl08784**	**S13-Jl08785**	**S13-Jl08786**	**S13-Jl08787**
Date Sampled			**Jul 09, 2013**	**Jul 09, 2013**	**Jul 09, 2013**	**Jul 09, 2013**
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	0.07	0.07	0.07	0.07
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	91	89	92	90
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	0.07	0.06	0.06	0.06
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	0.07	0.06	0.06	0.06
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			GW1	GW2	GW3	GW4
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S13-JI08784	S13-JI08785	S13-JI08786	S13-JI08787
Date Sampled			Jul 09, 2013	Jul 09, 2013	Jul 09, 2013	Jul 09, 2013
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH	0.002	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	116	106	115	121
p-Terphenyl-d14 (surr.)	1	%	88	79	87	89
Polychlorinated Biphenyls (PCB)						
Aroclor-1016	0.005	mg/L	< 0.005	-	< 0.005	-
Aroclor-1232	0.005	mg/L	< 0.005	-	< 0.005	-
Aroclor-1242	0.005	mg/L	< 0.005	-	< 0.005	-
Aroclor-1248	0.005	mg/L	< 0.005	-	< 0.005	-
Aroclor-1254	0.005	mg/L	< 0.005	-	< 0.005	-
Aroclor-1260	0.005	mg/L	< 0.005	-	< 0.005	-
Total PCB	0.005	mg/L	< 0.005	-	< 0.005	-
Dibutylchlorendate (surr.)	1	%	72	-	90	-
Organochlorine Pesticides (OC)						
4.4'-DDD	0.0005	mg/L	< 0.0005	-	< 0.0005	-
4.4'-DDE	0.0005	mg/L	< 0.0005	-	< 0.0005	-
4.4'-DDT	0.002	mg/L	< 0.002	-	< 0.002	-
a-BHC	0.0005	mg/L	< 0.0005	-	< 0.0005	-
a-Chlordane	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Aldrin	0.0005	mg/L	< 0.0005	-	< 0.0005	-
b-BHC	0.0005	mg/L	< 0.0005	-	< 0.0005	-
d-BHC	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Dieldrin	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Endosulfan I	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Endosulfan II	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Endosulfan sulphate	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Endrin	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Endrin aldehyde	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Endrin ketone	0.0005	mg/L	< 0.0005	-	< 0.0005	-
g-BHC (Lindane)	0.0005	mg/L	< 0.0005	-	< 0.0005	-
g-Chlordane	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Heptachlor	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Heptachlor epoxide	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Hexachlorobenzene	0.0005	mg/L	< 0.0005	-	< 0.0005	-
Methoxychlor	0.002	mg/L	< 0.002	-	< 0.002	-
Dibutylchlorendate (surr.)	1	%	72	-	90	-
Tetrachloro-m-xylene (surr.)	1	%	108	-	108	-
Ammonia (as N)	0.01	mg/L	0.04	0.04	0.05	0.05
Chloride	1	mg/L	29	29	29	29
Nitrate (as N)	0.01	mg/L	0.69	0.67	0.66	0.64
Sulphate (as S)	2	mg/L	4.0	4.0	4.1	4.0
Alkalinity						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	25	24	160	25
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	270	< 5
Alkali Metals						
Calcium	0.5	mg/L	8.8	10	11	11

Client Sample ID			GW1	GW2	GW3	GW4
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S13-Jl08784	S13-Jl08785	S13-Jl08786	S13-Jl08787
Date Sampled			Jul 09, 2013	Jul 09, 2013	Jul 09, 2013	Jul 09, 2013
Test/Reference	LOR	Unit				
Alkali Metals						
Magnesium	0.5	mg/L	3.8	4.4	4.8	4.6
Potassium	0.5	mg/L	2.8	3.3	3.4	3.3
Sodium	0.5	mg/L	20	23	24	23
Heavy Metals						
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.004	0.005	0.004	0.003
Lead (filtered)	0.001	mg/L	< 0.001	0.002	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Zinc (filtered)	0.005	mg/L	< 0.005	0.005	< 0.005	< 0.005

Client Sample ID			D1	TRIP SPIKE	TRIP BLANK
Sample Matrix			Water	Water	Water
Eurofins | mgt Sample No.			S13-Jl08788	S13-Jl08789	S13-Jl08790
Date Sampled			Jul 09, 2013	Jul 09, 2013	Jul 09, 2013
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	0.02	mg/L	< 0.02	83%	< 0.02
TRH C10-C14	0.05	mg/L	0.05	-	-
TRH C15-C28	0.1	mg/L	< 0.1	-	-
TRH C29-C36	0.1	mg/L	< 0.1	-	-
TRH C10-36 (Total)	0.1	mg/L	< 0.1	-	-
BTEX					
Benzene	0.001	mg/L	< 0.001	103%	< 0.001
Toluene	0.001	mg/L	< 0.001	101%	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	99%	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	101%	< 0.002
o-Xylene	0.001	mg/L	< 0.001	104%	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	102%	< 0.003
4-Bromofluorobenzene (surr.)	1	%	88	102	89
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
Naphthalene[N02]	0.02	mg/L	< 0.02	-	-
TRH C6-C10	0.02	mg/L	< 0.02	-	-
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	-	-
TRH >C10-C16	0.05	mg/L	0.05	-	-
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	0.05	-	-
TRH >C16-C34	0.1	mg/L	< 0.1	-	-
TRH >C34-C40	0.1	mg/L	< 0.1	-	-
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.001	mg/L	< 0.001	-	-
Acenaphthylene	0.001	mg/L	< 0.001	-	-
Anthracene	0.001	mg/L	< 0.001	-	-
Benz(a)anthracene	0.001	mg/L	< 0.001	-	-

Client Sample ID Sample Matrix Eurofins | mgt Sample No. Date Sampled Test/Reference	LOR	Unit	D1 Water S13-JI08788 Jul 09, 2013	TRIP SPIKE Water S13-JI08789 Jul 09, 2013	TRIP BLANK Water S13-JI08790 Jul 09, 2013
Polycyclic Aromatic Hydrocarbons					
Benzo(a)pyrene	0.001	mg/L	< 0.001	-	-
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	-	-
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	-	-
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	-	-
Chrysene	0.001	mg/L	< 0.001	-	-
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	-	-
Fluoranthene	0.001	mg/L	< 0.001	-	-
Fluorene	0.001	mg/L	< 0.001	-	-
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	-	-
Naphthalene	0.001	mg/L	< 0.001	-	-
Phenanthrene	0.001	mg/L	< 0.001	-	-
Pyrene	0.001	mg/L	< 0.001	-	-
Total PAH	0.002	mg/L	< 0.001	-	-
2-Fluorobiphenyl (surr.)	1	%	80	-	-
p-Terphenyl-d14 (surr.)	1	%	72	-	-
Polychlorinated Biphenyls (PCB)					
Aroclor-1016	0.005	mg/L	< 0.005	-	-
Aroclor-1232	0.005	mg/L	< 0.005	-	-
Aroclor-1242	0.005	mg/L	< 0.005	-	-
Aroclor-1248	0.005	mg/L	< 0.005	-	-
Aroclor-1254	0.005	mg/L	< 0.005	-	-
Aroclor-1260	0.005	mg/L	< 0.005	-	-
Total PCB	0.005	mg/L	< 0.005	-	-
Dibutylchlorendate (surr.)	1	%	124	-	-
Organochlorine Pesticides (OC)					
4.4'-DDD	0.0005	mg/L	< 0.0005	-	-
4.4'-DDE	0.0005	mg/L	< 0.0005	-	-
4.4'-DDT	0.002	mg/L	< 0.002	-	-
a-BHC	0.0005	mg/L	< 0.0005	-	-
a-Chlordane	0.0005	mg/L	< 0.0005	-	-
Aldrin	0.0005	mg/L	< 0.0005	-	-
b-BHC	0.0005	mg/L	< 0.0005	-	-
d-BHC	0.0005	mg/L	< 0.0005	-	-
Dieldrin	0.0005	mg/L	< 0.0005	-	-
Endosulfan I	0.0005	mg/L	< 0.0005	-	-
Endosulfan II	0.0005	mg/L	< 0.0005	-	-
Endosulfan sulphate	0.0005	mg/L	< 0.0005	-	-
Endrin	0.0005	mg/L	< 0.0005	-	-
Endrin aldehyde	0.0005	mg/L	< 0.0005	-	-
Endrin ketone	0.0005	mg/L	< 0.0005	-	-
g-BHC (Lindane)	0.0005	mg/L	< 0.0005	-	-
g-Chlordane	0.0005	mg/L	< 0.0005	-	-
Heptachlor	0.0005	mg/L	< 0.0005	-	-
Heptachlor epoxide	0.0005	mg/L	< 0.0005	-	-
Hexachlorobenzene	0.0005	mg/L	< 0.0005	-	-
Methoxychlor	0.002	mg/L	< 0.002	-	-
Dibutylchlorendate (surr.)	1	%	124	-	-
Tetrachloro-m-xylene (surr.)	1	%	125	-	-

Client Sample ID			D1	TRIP SPIKE	TRIP BLANK
Sample Matrix			**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**S13-JI08788**	**S13-JI08789**	**S13-JI08790**
Date Sampled			**Jul 09, 2013**	**Jul 09, 2013**	**Jul 09, 2013**
Test/Reference	LOR	Unit			
Ammonia (as N)	0.01	mg/L	0.04	-	-
Chloride	1	mg/L	28	-	-
Nitrate (as N)	0.01	mg/L	0.68	-	-
Sulphate (as S)	2	mg/L	3.9	-	-
Alkalinity					
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	21	-	-
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	-	-
Alkali Metals					
Calcium	0.5	mg/L	8.9	-	-
Magnesium	0.5	mg/L	4.0	-	-
Potassium	0.5	mg/L	3.0	-	-
Sodium	0.5	mg/L	21	-	-
Heavy Metals					
Arsenic (filtered)	0.001	mg/L	< 0.001	-	-
Cadmium (filtered)	0.0001	mg/L	< 0.0001	-	-
Chromium (filtered)	0.001	mg/L	< 0.001	-	-
Copper (filtered)	0.001	mg/L	0.005	-	-
Lead (filtered)	0.001	mg/L	< 0.001	-	-
Mercury (filtered)	0.0001	mg/L	< 0.0001	-	-
Nickel (filtered)	0.001	mg/L	< 0.001	-	-
Zinc (filtered)	0.005	mg/L	0.006	-	-

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite 7 (filtered metals)			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Jul 12, 2013	7 Day
- Method: E004 Petroleum Hydrocarbons (TPH)			
BTEX	Sydney	Jul 11, 2013	14 Day
- Method: E029/E016 BTEX			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Jul 12, 2013	7 Day
- Method: LM-LTM-ORG2010			
Polycyclic Aromatic Hydrocarbons	Sydney	Jul 12, 2013	7 Day
- Method: E007 Polyaromatic Hydrocarbons (PAH)			
Metals M8 filtered	Sydney	Jul 11, 2013	28 Day
- Method: E020/E030 Filtered Metals in Water & E026 Mercury			
Eurofins | mgt Suite 13			
Polychlorinated Biphenyls (PCB)	Sydney	Jul 12, 2013	7 Day
- Method: E013 Polychlorinated Biphenyls (PCB)			
Organochlorine Pesticides (OC)	Sydney	Jul 12, 2013	7 Day
- Method: E013 Organochlorine Pesticides (OC)			
Eurofins | mgt Suite 11			
Ammonia (as N)	Sydney	Jul 12, 2013	28 Day
- Method: E036/E050 Ammonia as N			
Chloride	Sydney	Jul 16, 2013	28 Day
- Method: E033 /E045 /E047 Chloride			
Nitrate (as N)	Sydney	Jul 15, 2013	28 Day
- Method: E037 /E051 Nitrate as N			
Sulphate (as S)	Sydney	Jul 16, 2013	28 Day
- Method: E045 Sulphate			
Alkalinity	Sydney	Jul 16, 2013	14 Day
- Method: E035 Alkalinity			
Alkali Metals	Sydney	Jul 11, 2013	180 Day
- Method: E022/E030 Unfiltered Cations in Water			

eurofins | mgt

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NATA # 1261 Site # 20794

Company Name: Benviron Group
Address: 64 Glenrock Parade
Koolewong
NSW 2256

Client Job No.: KEMBLA GRANGE GROUNDWATER ASSESSMENT E49/6

Order No.:
Report #: 385710
Phone:
Fax:

Received: Jul 11, 2013 1:20 PM
Due: Jul 18, 2013
Priority: 5 Day
Contact Name: Ben Buckley

Eurofins | mgt Client Manager: Jean Heng

Sample Detail					TRH C6-C9	BTEX	Eurofins | mgt Suite 13	Eurofins | mgt Suite 11	Eurofins | mgt Suite 7 (filtered metals)
Laboratory where analysis is conducted									
Melbourne Laboratory - NATA Site # 1254 & 14271									
Sydney Laboratory - NATA Site # 18217					X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794									
External Laboratory									
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
GW1	Jul 09, 2013		Water	S13-Jl08784			X	X	X
GW2	Jul 09, 2013		Water	S13-Jl08785				X	X
GW3	Jul 09, 2013		Water	S13-Jl08786			X	X	X
GW4	Jul 09, 2013		Water	S13-Jl08787				X	X
D1	Jul 09, 2013		Water	S13-Jl08788			X	X	X
TRIP SPIKE	Jul 09, 2013		Water	S13-Jl08789	X	X			
TRIP BLANK	Jul 09, 2013		Water	S13-Jl08790	X	X			

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions E004 Petroleum Hydrocarbons (TPH)							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX E029/E016 BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions LM-LTM-ORG2010							
Naphthalene	mg/L	< 0.02			0.02	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH C6-C10 less BTEX (F1)	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons E007 Polyaromatic Hydrocarbons (PAH)							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
Polychlorinated Biphenyls (PCB) E013 Polychlorinated Biphenyls (PCB)							
Aroclor-1016	mg/L	< 0.005			0.005	Pass	
Aroclor-1232	mg/L	< 0.005			0.005	Pass	
Aroclor-1242	mg/L	< 0.005			0.005	Pass	
Aroclor-1248	mg/L	< 0.005			0.005	Pass	
Aroclor-1254	mg/L	< 0.005			0.005	Pass	
Aroclor-1260	mg/L	< 0.005			0.005	Pass	
Total PCB	mg/L	< 0.005			0.005	Pass	
Method Blank							
Organochlorine Pesticides (OC) E013 Organochlorine Pesticides (OC)							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
4.4'-DDD	mg/L	< 0.0005			0.0005	Pass	
4.4'-DDE	mg/L	< 0.0005			0.0005	Pass	
4.4'-DDT	mg/L	< 0.002			0.002	Pass	
a-BHC	mg/L	< 0.0005			0.0005	Pass	
a-Chlordane	mg/L	< 0.0005			0.0005	Pass	
Aldrin	mg/L	< 0.0005			0.0005	Pass	
b-BHC	mg/L	< 0.0005			0.0005	Pass	
d-BHC	mg/L	< 0.0005			0.0005	Pass	
Dieldrin	mg/L	< 0.0005			0.0005	Pass	
Endosulfan I	mg/L	< 0.0005			0.0005	Pass	
Endosulfan II	mg/L	< 0.0005			0.0005	Pass	
Endosulfan sulphate	mg/L	< 0.0005			0.0005	Pass	
Endrin	mg/L	< 0.0005			0.0005	Pass	
Endrin aldehyde	mg/L	< 0.0005			0.0005	Pass	
Endrin ketone	mg/L	< 0.0005			0.0005	Pass	
g-BHC (Lindane)	mg/L	< 0.0005			0.0005	Pass	
g-Chlordane	mg/L	< 0.0005			0.0005	Pass	
Heptachlor	mg/L	< 0.0005			0.0005	Pass	
Heptachlor epoxide	mg/L	< 0.0005			0.0005	Pass	
Hexachlorobenzene	mg/L	< 0.0005			0.0005	Pass	
Methoxychlor	mg/L	< 0.002			0.002	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chloride	mg/L	< 1			1	Pass	
Nitrate (as N)	mg/L	< 0.01			0.01	Pass	
Sulphate (as S)	mg/L	< 2			2	Pass	
Method Blank							
Alkalinity E035 Alkalinity							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Carbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Method Blank							
Alkali Metals E022/E030 Unfiltered Cations in Water							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Metals M8 filtered E020/E030 Filtered Metals in Water & E026 Mercury							
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions E004 Petroleum Hydrocarbons (TPH)							
TRH C6-C9	%	96			70-130	Pass	
TRH C10-C14	%	81			70-130	Pass	
LCS - % Recovery							
BTEX E029/E016 BTEX							
Benzene	%	106			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Toluene	%	104			70-130	Pass	
Ethylbenzene	%	103			70-130	Pass	
m&p-Xylenes	%	104			70-130	Pass	
o-Xylene	%	105			70-130	Pass	
Xylenes - Total	%	104			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions LM-LTM-ORG2010							
Naphthalene	%	108			70-130	Pass	
TRH C6-C10	%	97			70-130	Pass	
TRH >C10-C16	%	90			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons E007 Polyaromatic Hydrocarbons (PAH)							
Acenaphthene	%	75			70-130	Pass	
Acenaphthylene	%	72			70-130	Pass	
Anthracene	%	84			70-130	Pass	
Benz(a)anthracene	%	71			70-130	Pass	
Benzo(a)pyrene	%	81			70-130	Pass	
Benzo(b&j)fluoranthene	%	71			70-130	Pass	
Benzo(g.h.i)perylene	%	75			70-130	Pass	
Benzo(k)fluoranthene	%	89			70-130	Pass	
Chrysene	%	87			70-130	Pass	
Dibenz(a.h)anthracene	%	77			70-130	Pass	
Fluoranthene	%	77			70-130	Pass	
Fluorene	%	76			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	70			70-130	Pass	
Naphthalene	%	73			70-130	Pass	
Phenanthrene	%	70			70-130	Pass	
Pyrene	%	78			70-130	Pass	
LCS - % Recovery							
Polychlorinated Biphenyls (PCB) E013 Polychlorinated Biphenyls (PCB)							
Aroclor-1260	%	106			70-130	Pass	
LCS - % Recovery							
Organochlorine Pesticides (OC) E013 Organochlorine Pesticides (OC)							
4.4'-DDD	%	100			70-130	Pass	
4.4'-DDE	%	125			70-130	Pass	
4.4'-DDT	%	100			70-130	Pass	
a-BHC	%	92			70-130	Pass	
a-Chlordane	%	108			70-130	Pass	
Aldrin	%	108			70-130	Pass	
b-BHC	%	83			70-130	Pass	
d-BHC	%	92			70-130	Pass	
Dieldrin	%	108			70-130	Pass	
Endosulfan I	%	117			70-130	Pass	
Endosulfan II	%	108			70-130	Pass	
Endosulfan sulphate	%	125			70-130	Pass	
Endrin	%	117			70-130	Pass	
Endrin aldehyde	%	92			70-130	Pass	
Endrin ketone	%	100			70-130	Pass	
g-BHC (Lindane)	%	100			70-130	Pass	
g-Chlordane	%	108			70-130	Pass	
Heptachlor	%	125			70-130	Pass	
Heptachlor epoxide	%	117			70-130	Pass	
Hexachlorobenzene	%	120			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Methoxychlor	%	100			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	94			70-130	Pass	
Chloride	%	101			70-130	Pass	
Nitrate (as N)	%	122			70-130	Pass	
Sulphate (as S)	%	102			70-130	Pass	
LCS - % Recovery							
Alkalinity E035 Alkalinity							
Bicarbonate Alkalinity (as CaCO3)	%	100			70-130	Pass	
LCS - % Recovery							
Alkali Metals E022/E030 Unfiltered Cations in Water							
Calcium	%	107			70-130	Pass	
Magnesium	%	98			70-130	Pass	
Potassium	%	92			70-130	Pass	
Sodium	%	99			70-130	Pass	
LCS - % Recovery							
Metals M8 filtered E020/E030 Filtered Metals in Water & E026 Mercury							
Arsenic (filtered)	%	105			70-130	Pass	
Cadmium (filtered)	%	107			70-130	Pass	
Chromium (filtered)	%	107			70-130	Pass	
Copper (filtered)	%	111			70-130	Pass	
Lead (filtered)	%	108			70-130	Pass	
Mercury (filtered)	%	111			70-130	Pass	
Nickel (filtered)	%	105			70-130	Pass	
Zinc (filtered)	%	107			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polychlorinated Biphenyls (PCB)				Result 1					
Aroclor-1260	S13-Jl08829	NCP	%	102			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	S13-Jl08736	NCP	%	105			70-130	Pass	
Chloride	S13-Jl08784	CP	%	103			70-130	Pass	
Nitrate (as N)	S13-Jl07920	NCP	%	101			70-130	Pass	
Sulphate (as S)	S13-Jl08784	CP	%	99			70-130	Pass	
Spike - % Recovery									
Alkalinity				Result 1					
Bicarbonate Alkalinity (as CaCO3)	S13-Jl08784	CP	%	96			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	S13-Jl09306	NCP	%	85			70-130	Pass	
Magnesium	S13-Jl09306	NCP	%	83			70-130	Pass	
Potassium	S13-Jl09306	NCP	%	80			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S13-Jl08785	CP	%	87			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S13-Jl08785	CP	%	96			70-130	Pass	
Toluene	S13-Jl08785	CP	%	94			70-130	Pass	
Ethylbenzene	S13-Jl08785	CP	%	93			70-130	Pass	
m&p-Xylenes	S13-Jl08785	CP	%	95			70-130	Pass	
o-Xylene	S13-Jl08785	CP	%	96			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Xylenes - Total	S13-Jl08785	CP	%	95			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S13-Jl08785	CP	%	106			70-130	Pass	
TRH C6-C10	S13-Jl08785	CP	%	88			70-130	Pass	
Spike - % Recovery									
Metals M8 filtered				Result 1					
Arsenic (filtered)	S13-Jl08785	CP	%	103			70-130	Pass	
Cadmium (filtered)	S13-Jl08785	CP	%	105			70-130	Pass	
Chromium (filtered)	S13-Jl08785	CP	%	105			70-130	Pass	
Copper (filtered)	S13-Jl08785	CP	%	106			70-130	Pass	
Lead (filtered)	S13-Jl08785	CP	%	109			70-130	Pass	
Mercury (filtered)	S13-Jl08785	CP	%	105			70-130	Pass	
Nickel (filtered)	S13-Jl08785	CP	%	101			70-130	Pass	
Zinc (filtered)	S13-Jl08785	CP	%	104			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S13-Jl04986	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S13-Jl04986	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	S13-Jl04986	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	S13-Jl04986	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	S13-Jl04986	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	S13-Jl04986	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	S13-Jl04986	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S13-Jl04986	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C6-C10	S13-Jl04986	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C6-C10 less BTEX (F1)	S13-Jl04986	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	S13-Jl10573	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Polychlorinated Biphenyls (PCB)				Result 1	Result 2	RPD			
Aroclor-1016	S13-Jl08828	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Aroclor-1232	S13-Jl08828	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Duplicate									
Polychlorinated Biphenyls (PCB)				Result 1	Result 2	RPD			
Aroclor-1242	S13-Jl08828	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Aroclor-1248	S13-Jl08828	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Aroclor-1254	S13-Jl08828	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Aroclor-1260	S13-Jl08828	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S13-Jl08784	CP	mg/L	29	30	2.0	30%	Pass	
Sulphate (as S)	S13-Jl08784	CP	mg/L	4.0	4.1	2.1	30%	Pass	
Duplicate									
Alkalinity				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	S13-Jl08784	CP	mg/L	25	24	4.0	30%	Pass	
Carbonate Alkalinity (as CaCO3)	S13-Jl08784	CP	mg/L	< 5	< 5	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	S13-Jl08784	CP	mg/L	8.8	9.5	8.0	30%	Pass	
Magnesium	S13-Jl08784	CP	mg/L	3.8	4.1	8.0	30%	Pass	
Potassium	S13-Jl08784	CP	mg/L	2.8	3.2	11	30%	Pass	
Sodium	S13-Jl08784	CP	mg/L	20	22	8.0	30%	Pass	
Duplicate									
Metals M8 filtered				Result 1	Result 2	RPD			
Arsenic (filtered)	S13-Jl08784	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	S13-Jl08784	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium (filtered)	S13-Jl08784	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	S13-Jl08784	CP	mg/L	0.004	0.004	1.0	30%	Pass	
Lead (filtered)	S13-Jl08784	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	S13-Jl08784	CP	mg/L	0.0001	< 0.0001	130	30%	Fail	Q15
Nickel (filtered)	S13-Jl08784	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	S13-Jl08784	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	S13-Jl08788	CP	mg/L	0.04	0.04	12	30%	Pass	
Nitrate (as N)	S13-Jl08788	CP	mg/L	0.68	0.67	1.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins | mgt's Acceptance Criteria as stipulated in SOP 05. Refer to Glossary Page of this report for further details

Authorised By

Jean Heng	Client Services
Bob Symons	Senior Analyst-Inorganic (NSW)
James Norford	Senior Analyst-Metal (NSW)
Ryan Hamilton	Senior Analyst-Organic (NSW)
Ryan Hamilton	Senior Analyst-Volatile (NSW)

Dr. Bob Symons

Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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CERTIFICATE OF ANALYSIS 93731

Client:
Benviron Group
64 Glenrock Pde
Koolewong
NSW 2256

Attention: Ben Buckley

Sample log in details:

Your Reference:	**E49/6, Kembla Grange**
No. of samples:	1 Water
Date samples received / completed instructions received	10/7/2013 / 11/7/2013

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

Report Details:

Date results requested by: / Issue Date:	18/07/13 / 17/07/13
Date of Preliminary Report:	Not issued

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

ACCREDITED FOR TECHNICAL COMPETENCE

vTRH(C6-C10)/BTEXN in Water		
Our Reference:	UNITS	93731-1
Your Reference	----------	SS1
Type of sample	----------	Water
Date extracted	-	12/07/2013
Date analysed	-	12/07/2013
$TRHC_6$ - C_9	µg/L	<10
$TRHC_6$ - C_{10}	µg/L	<10
$TRHC_6$ - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	104
Surrogate toluene-d8	%	99
Surrogate 4-BFB	%	97

svTRH (C10-C40) in Water		
Our Reference:	UNITS	93731-1
Your Reference	----------	SS1
Type of sample	----------	Water
Date extracted	-	12/07/2013
Date analysed	-	15/07/2013
TRHC$_{10}$ - C$_{14}$	µg/L	<50
TRHC$_{15}$ - C$_{28}$	µg/L	<100
TRHC$_{29}$ - C$_{36}$	µg/L	<100
TRH>C$_{10}$ - C$_{16}$	µg/L	<50
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	<50
TRH>C$_{16}$ - C$_{34}$	µg/L	<100
TRH>C$_{34}$ - C$_{40}$	µg/L	<100
Surrogate o-Terphenyl	%	94

PAHs in Water Our Reference: Your Reference Type of sample	UNITS ---------- ----------	93731-1 SS1 Water
Date extracted	-	12/07/2013
Date analysed	-	13/07/2013
Naphthalene	µg/L	<1
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	82

OCP in water Our Reference: Your Reference Type of sample	UNITS ---------- ----------	93731-1 SS1 Water
Date extracted	-	12/07/2013
Date analysed	-	13/07/2013
HCB	µg/L	<0.2
alpha-BHC	µg/L	<0.2
gamma-BHC	µg/L	<0.2
beta-BHC	µg/L	<0.2
Heptachlor	µg/L	<0.2
delta-BHC	µg/L	<0.2
Aldrin	µg/L	<0.2
Heptachlor Epoxide	µg/L	<0.2
gamma-Chlordane	µg/L	<0.2
alpha-Chlordane	µg/L	<0.2
Endosulfan I	µg/L	<0.2
pp-DDE	µg/L	<0.2
Dieldrin	µg/L	<0.2
Endrin	µg/L	<0.2
pp-DDD	µg/L	<0.2
Endosulfan II	µg/L	<0.2
pp-DDT	µg/L	<0.2
Endrin Aldehyde	µg/L	<0.2
Endosulfan Sulphate	µg/L	<0.2
Methoxychlor	µg/L	<0.2
Surrogate TCMX	%	87

PCBs in Water Our Reference: Your Reference Type of sample	UNITS ---------- ----------	93731-1 SS1 Water
Date extracted	-	12/07/2013
Date analysed	-	13/07/2013
Arochlor 1016	µg/L	<2
Arochlor 1221	µg/L	<2
Arochlor 1232	µg/L	<2
Arochlor 1242	µg/L	<2
Arochlor 1248	µg/L	<2
Arochlor 1254	µg/L	<2
Arochlor 1260	µg/L	<2
Surrogate TCLMX	%	87

HM in water - dissolved Our Reference: Your Reference Type of sample	UNITS ---------- ----------	93731-1 SS1 Water
Date prepared	-	12/07/2013
Date analysed	-	12/07/2013
Arsenic-Dissolved	µg/L	<1
Cadmium-Dissolved	µg/L	<0.1
Chromium-Dissolved	µg/L	<1
Copper-Dissolved	µg/L	4
Lead-Dissolved	µg/L	<1
Mercury-Dissolved	µg/L	<0.05
Nickel-Dissolved	µg/L	<1
Zinc-Dissolved	µg/L	4

Ion Balance Our Reference: Your Reference Type of sample	UNITS ---------- ----------	93731-1 SS1 Water
Date prepared	-	12/07/2013
Date analysed	-	12/07/2013
Calcium - Dissolved	mg/L	8.7
Potassium - Dissolved	mg/L	3.3
Sodium - Dissolved	mg/L	21
Magnesium - Dissolved	mg/L	4.0
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	22
Carbonate Alkalinity as $CaCO_3$	mg/L	<5
Total Alkalinity as $CaCO_3$	mg/L	22
Sulphate, SO4	mg/L	9
Chloride, Cl	mg/L	34
Ionic Balance	%	4.6

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA 22nd ED, 2320-B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.
Inorg-041	Gravimetric determination of the total solids content of water using APHA 22nd ED 2540B.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/07/2013	[NT]	[NT]	LCS-W1	12/07/2013
Date analysed	-			12/07/2013	[NT]	[NT]	LCS-W1	12/07/2013
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	100%
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	100%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	96%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	99%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	103%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	100%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	102%
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	103	[NT]	[NT]	LCS-W1	99%
Surrogate toluene-d8	%		Org-016	100	[NT]	[NT]	LCS-W1	97%
Surrogate 4-BFB	%		Org-016	99	[NT]	[NT]	LCS-W1	100%

QUALITY CONTROL svTRH (C10-C40) in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/07/2013	[NT]	[NT]	LCS-W1	12/07/2013
Date analysed	-			15/07/2013	[NT]	[NT]	LCS-W1	15/07/2013
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	89%
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	108%
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	109%
TRH>C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	89%
TRH>C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	108%
TRH>C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	109%
Surrogate o-Terphenyl	%		Org-003	117	[NT]	[NT]	LCS-W1	97%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/07/2013	[NT]	[NT]	LCS-W2	12/07/2013
Date analysed	-			13/07/2013	[NT]	[NT]	LCS-W2	13/07/2013
Naphthalene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W2	95%
Acenaphthylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W2	110%
Phenanthrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W2	97%

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W2	97%
Pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W2	104%
Benzo(a)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W2	97%
Benzo(b+k)fluoranthene	µg/L	2	Org-012 subset	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W2	101%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	96	[NT]	[NT]	LCS-W2	96%
QUALITY CONTROL OCP in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/07/2013	[NT]	[NT]	LCS-W1	12/07/2013
Date analysed	-			13/07/2013	[NT]	[NT]	LCS-W1	13/07/2013
HCB	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
alpha-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	113%
gamma-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
beta-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	121%
Heptachlor	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	97%
delta-BHC	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Aldrin	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	100%
Heptachlor Epoxide	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	101%
gamma-Chlordane	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
alpha-Chlordane	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Endosulfan I	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
pp-DDE	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	94%
Dieldrin	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	102%
Endrin	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	94%
pp-DDD	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	91%
Endosulfan II	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
pp-DDT	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	LCS-W1	105%
Methoxychlor	µg/L	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL OCP in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Surrogate TCMX	%		Org-005	107	[NT]	[NT]	LCS-W1	103%
QUALITY CONTROL PCBs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/07/2013	[NT]	[NT]	LCS-W1	12/07/2013
Date analysed	-			13/07/2013	[NT]	[NT]	LCS-W1	13/07/2013
Arochlor 1016	µg/L	2	Org-006	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1221	µg/L	2	Org-006	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1232	µg/L	2	Org-006	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1242	µg/L	2	Org-006	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1248	µg/L	2	Org-006	<2	[NT]	[NT]	[NR]	[NR]
Arochlor 1254	µg/L	2	Org-006	<2	[NT]	[NT]	LCS-W1	101%
Arochlor 1260	µg/L	2	Org-006	<2	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		Org-006	107	[NT]	[NT]	LCS-W1	101%
QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			12/07/2013	93731-1	12/07/2013 || 12/07/2013	LCS-W1	12/07/2013
Date analysed	-			12/07/2013	93731-1	12/07/2013 || 12/07/2013	LCS-W1	12/07/2013
Arsenic-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	93731-1	<1 || <1	LCS-W1	110%
Cadmium-Dissolved	µg/L	0.1	Metals-022 ICP-MS	<0.1	93731-1	<0.1 || <0.1	LCS-W1	112%
Chromium-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	93731-1	<1 || <1	LCS-W1	109%
Copper-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	93731-1	4 || 4 || RPD: 0	LCS-W1	102%
Lead-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	93731-1	<1 || <1	LCS-W1	103%
Mercury-Dissolved	µg/L	0.05	Metals-021 CV-AAS	<0.05	93731-1	<0.05 || [N/T]	LCS-W1	84%
Nickel-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	93731-1	<1 || <1	LCS-W1	103%
Zinc-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	93731-1	4 || 4 || RPD: 0	LCS-W1	103%

QUALITY CONTROL Ion Balance	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			12/07/2013	[NT]	[NT]	LCS-W1	12/07/2013
Date analysed	-			12/07/2013	[NT]	[NT]	LCS-W1	12/07/2013
Calcium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	99%
Potassium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	113%
Sodium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	110%
Magnesium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	96%
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NR]	[NR]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NR]	[NR]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NR]	[NR]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	LCS-W1	100%
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-W1	94%
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-W1	92%
Ionic Balance	%		Inorg-041	[NT]	[NT]	[NT]	[NR]	[NR]

Report Comments:

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

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

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

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

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

APPENDIX C: GROUNDWATER WELL LOGS

BOREHOLE & GROUNDWATER WELL LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**GW1**
PROJECT	Groundwater Assessment	**DATE.**	**2/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/6**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Plasticity, particle characteristics, colour, moisture, etc)	Observations	Well Construction	Design
				F	FILL: Sandy Clay, med plasticity, brown with traces of gravel and some inert materials	No HC Odour		Collar
1				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials			Bentonite/ Cement Slurry
2				SiC	NATURAL, CLAY, low-med plasticity, dark . brown/grey			Casing
3								
4								Sand
5								
6								Screen
7			▶			Seepage @ 7.0m BGL		
8								
9					End of Borehole @ 9.0m BGL in Natural Clay			
10								
11								
12								

Log Symbols

Standing groundwater level in borehole
Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa

BOREHOLE & GROUNDWATER WELL LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**GW2**
PROJECT	Groundwater Assessment	**DATE.**	**2/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/6**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Plasticity, particle characteristics, colour, moisture, etc)	Observations	Well Construction	Design
				F	FILL: Sandy Clay, med plasticity, brown with traces of gravel and some inert materials	No HC Odour		Collar
1				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials			Bentonite/ Cement Slurry
2				SiC	NATURAL, CLAY, low-med plasticity, dark . brown/grey			Casing
3								
4								Sand
5								
6								Screen
7			▶			Seepage @ 7.0m BGL		
8								
9					End of Borehole @ 9.0m BGL in Natural Clay			
10								
11								
12								

Log Symbols

Standing groundwater level in borehole
Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa

BOREHOLE & GROUNDWATER WELL LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**GW3**
PROJECT	Groundwater Assessment	**DATE.**	**2/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/6**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Plasticity, particle characteristics, colour, moisture, etc)	Observations	Well Construction	Design
				F	FILL: Sandy Clay, med plasticity, brown with traces of gravel and some inert materials	No HC Odour		Collar
1				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials			Bentonite/ Cement Slurry
2				SiC	NATURAL, CLAY, low-med plasticity, dark . brown/grey			Casing
3								
4								Sand
5								
6								Screen
7			▶			Seepage @ 7.3m BGL		
8								
9								
					End of Borehole @ 9.5m BGL in Natural Clay			
10								
11								
12								

Log Symbols

▼ Standing groundwater level in borehole

▶ Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa

BOREHOLE & GROUNDWATER WELL LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**GW4**
PROJECT	Groundwater Assessment	**DATE.**	**2/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/6**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Plasticity, particle characteristics, colour, moisture, etc)	Observations	Well Construction	Design
				F	FILL: Sandy Clay, med plasticity, brown with traces of gravel and some inert materials	No HC Odour		Collar
1				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials			Bentonite/ Cement Slurry
2				SiC	NATURAL, CLAY, low-med plasticity, dark . brown/grey			Casing
3								
4								Sand
5								
6								Screen
7			▶			Seepage @ 7.0m BGL		
8								
9					End of Borehole @ 9.0m BGL in Natural Clay			
10								
11								
12								

Log Symbols

Standing groundwater level in borehole
Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa

BOREHOLE & GROUNDWATER WELL LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**GW5**
PROJECT	Groundwater Assessment	**DATE.**	**2/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/6**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Plasticity, particle characteristics, colour, moisture, etc)	Observations	Well Construction	Design
				F	FILL: Sandy Clay, med plasticity, brown with traces of gravel and some inert materials	No HC Odour		Collar
				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials			Bentonite/ Cement Slurry
1								
2								Casing
				SiC	NATURAL, CLAY, low-med plasticity, dark . brown/grey			
3								
4								Sand
5								
6								Screen
7								
8								
9								
10								
					End of Borehole @ 10m BGL in Natural Clay			
11								
12								

Log Symbols

Standing groundwater level in borehole
Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa

BOREHOLE & GROUNDWATER WELL LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**GW6**
PROJECT	Groundwater Assessment	**DATE.**	**2/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/6**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Plasticity, particle characteristics, colour, moisture, etc)	Observations	Well Construction	Design
				F	FILL: Sandy Clay, med plasticity, brown with traces of gravel and some inert materials	No HC Odour		Collar
				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials			Bentonite/ Cement Slurry
1								
2								Casing
				SiC	NATURAL, CLAY, low-med plasticity, dark . brown/grey			
3								
4								Sand
5								
6								Screen
7								
8								
9								
10								
					End of Borehole @ 10m BGL in Natural Clay			
11								
12								

Log Symbols

Standing groundwater level in borehole
Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
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Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa

BOREHOLE & GROUNDWATER WELL LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**GW7**
PROJECT	Groundwater Assessment	**DATE.**	**2/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/6**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Plasticity, particle characteristics, colour, moisture, etc)	Observations	Well Construction	Design
				F	FILL: Sandy Clay, med plasticity, brown with traces of gravel and some inert materials	No HC Odour		Collar
				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials			Bentonite/ Cement Slurry
1								
2								Casing
				SiC	NATURAL, CLAY, low-med plasticity, dark . brown/grey			
3								
4								Sand
5								
6								Screen
7								
8								
9								
10								
					End of Borehole @ 10m BGL in Natural Clay			
11								
12								

Log Symbols

Standing groundwater level in borehole
Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth
S - Surface water sample
GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers
M Moist - Does not run freely but no free water visible on soil surface
W Wet - Free water visible on soil surface

Soil Classification

Clay - Particle size less than 0.002mm
Silt - Particle size between 0.002 and 0.06mm
Sand - Particle size between 0.06 and 2.0mm
Gravel - Particle size between 2.0 and 60mm

Strength

VS Very Soft - Unconfined compressive strength less than 25kPa
S Soft - Unconfined compressive strength 25-50kPa
F Firm - Unconfined compressive strength 50-100kPa
St Stiff - Unconfined compressive strength 100-200kPa
VSt Very Stiff - Unconfined compressive strength 200-400kPa
H Hard - Unconfined compressive strength greater than 400kPa