

# Light Horse Business Centre, Eastern Creek, NSW, Australia

Groundwater Assessment

ThaQuarry Pty Ltd

August 2008

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#### FINAL REPORT

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#### 1 INTRODUCTION

#### 1.1 GENERAL

ThaQuarry Pty Ltd and ACN 114 843 453 Pty Ltd seek project approval for the construction and operation of a resource recovery facility including a materials processing centre (MPC) and waste transfer station (WTS) and a general solid waste (non putrescible) landfill at their Eastern Creek site in Sydney's western suburbs. Project approval is sought under Part 3A of the *Environmental Planning and Assessment Act, 1979*. The application process is to be managed on behalf of both parties by ThaQuarry Pty Ltd under the project name Light Horse Business Centre.

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by the proponent to undertake a hydrogeological investigation at the site, as part of the overall Environmental Assessment. This investigation considers the Director-General's requirements for the Project and issues raised during consultation with the Department of Environment and Climate Change (DECC) and Blacktown City Council.

The hydrological data obtained in this investigation will assist in the development of a water balance model for the current quarry void and to provide information for the preliminary design of an appropriate leachate management system.

#### 1.2 BACKGROUND

The site is located off Archbold Road, Eastern Creek in the central western suburbs of Sydney, NSW (*Figure 1, Annex A*). The predominant feature at the proposed Project site is a breccia quarry known as the Pioneer Quarry, where extractive operations started in the 1950s. All quarrying activities at the site ceased in September 2006, though the quarry void remains.

#### 1.3 OBJECTIVES

The main objective of this investigation was to assess the geological and hydrogeological conditions and the groundwater and surface conditions (water balance) for the quarry to provide information for the preliminary design of a suitable landfill leachate management/collection system.

To meet the Director General's requirements for the Project and the requirements of the DECC and Blacktown Council, the following key objectives were developed for this investigation:

- provide quantitative data on the type of geology, water bearing units and hydraulic characteristics of the geology surrounding the quarry;
- characterise baseline groundwater quality, further delineate the value of the groundwater resource and estimate the ratio of groundwater and surface water influx into the quarry;
- delineate groundwater elevations around the quarry to understand potential groundwater seepage volumes into the quarry pit void and their association with potential water levels within the pit;
- assess the potential surface water and groundwater seepage rates into the landfill under different rainfall and evaporation conditions such that an appropriate water balance can be developed for the site; and
- assess the likely water level variations within the landfill associated with expected water influx.

# 1.4 LIMITATIONS

The findings of this report are based on the scope of work outlined in *Chapter* 2 of this report. ERM performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental profession. No warranties, expressed or implied, are made.

Subject to the scope of work, ERM's assessment is limited strictly to identifying typical environmental conditions associated with the site and does not evaluate structural conditions of any buildings on the site, nor any other issues.

All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved with the project and, while normal checking of the accuracy of data has been conducted, ERM assumes no responsibility or liability for errors in data obtained from regulatory agencies or any other external sources, nor from occurrences outside the scope of this project.

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#### 2 SCOPE OF WORKS

To meet the objectives the following scope of work was completed:

- a desktop assessment;
- field investigations;
- data analysis; and
- reporting.

Each of these components are discussed in further detail in Sections 2.1 to 2.4.

#### 2.1 DESKTOP ASSESSMENT

A desktop review of the existing geological and hydrogeological information for the site was completed. All available geological, hydrogeological and groundwater chemistry data was collated to develop a better understanding of the geological, hydrogeological and hydrochemical environment.

#### 2.2 FIELD INVESTIGATION

A field investigation was completed that included the following key tasks:

- drilling of nine boreholes around the perimeter of the quarry, to characterise the geology of the site and influencing groundwater flow into and out of the quarry. The boreholes were advanced at three locations to three different depths to target potential shallow, intermediate and deep water bearing zones;
- a photographic survey to delineate variations in pit geology and groundwater seepage;
- installation and development of three sets of nested monitoring wells in the boreholes drilled around the quarry. Monitoring wells were installed at depths of 20 m below ground level (bgl) to assess shallow groundwater, 50 m bgl to assess intermediate groundwater and 134 to 146 m bgl to assess deep groundwater at the maximum depth of the quarry;
- completion of hydraulic testing (slug tests) on the monitoring wells;
- surveying of the wells by a registered surveyor to Australian Height Datum (AHD); and
- completion of water level monitoring and two groundwater sampling events from the nine monitoring wells.

## 2.3 DATA ANALYSIS

The desktop assessment and field investigation data were used as the basis to complete key quantitative data analysis, which included:

- analysis of the borehole log data to characterise subsurface geology and water bearing layers around the quarry pit;
- analysis of the water elevations within groundwater wells to determine groundwater elevations, around the quarry;
- laboratory analysis of groundwater samples;
- analysis of the hydraulic data to determine the hydraulic conductivities of the geology surrounding the quarry; and
- development of a spreadsheet based water balance model to estimate the potential influx of groundwater and surface water into the quarry pit void, the impact on water elevations within the quarry pit, the requirement for leachate storage and the required discharge rates from the leachate collection system.

# 2.4 REPORTING

The results of this groundwater study have been documented in this report to:

- adequately describe the methodology and findings of *Tasks* 2.1 to 2.3 above;
- present information to meet the objectives of the investigation. Key outputs include the following:
- bore logs presenting the subsurface geology and water bearing zones surrounding the quarry and well installation details;
- tabulated baseline chemistry of groundwater surrounding the quarry which will form the baseline for any subsequent groundwater sampling events;
- data presenting baseline groundwater elevations and horizontal and vertical groundwater flow directions and gradients;
- tabulated results of hydraulic conductivity determined from hydraulic testing; and
- results of simulated seepage rates into landfill under different rainfall and evaporation conditions using a spreadsheet based water balance model; and
- act as a technical appendix in the Part 3A Environmental Assessment being prepared by ERM on behalf of ThaQuarry Pty Ltd and CAN 114843453 Pty Ltd for submission to the DoP.

#### 3 INVESTIGATION METHODOLOGY

#### 3.1 Environmental Setting

The desktop review included the investigation of currently available information to develop an initial conceptual understanding of the site. This included a review of the following sources of information:

- the previous groundwater investigation report completed for the site by Ian Grey Groundwater Consulting (IGGC) in May 2007;
- the preliminary geotechnical assessment for proposed development at Archbold Road, Eastern Creek, NSW completed by Jeffery and Katauskas Pty Ltd (2007);
- Penrith 1: 100,000 Geological Sheet 9030 1st Edition Geological Survey of New South Wales, Sydney, Clark N and Jones D (1991);
- NSW Topographical Map, 1:25,000 series, Sheet 9030-11-N, Prospect (1983);
- NSW DECC web atlas database for bore log and well location details; and
- the Australian Bureau of Meteorology (BoM) website for rainfall and evaporation data.

## 3.2 FIELD INVESTIGATION

## 3.2.1 Field Investigation Preliminaries

Prior to commencement of site works, a health and safety plan was prepared and all personnel on site including drilling contractors (McDermott Drilling) were inducted on the required health and safety procedures.

## 3.2.2 Drilling

A total of nine bores (designated as BH01 to BH09) were completed at three locations around the perimeter of the quarry. Three bores were advanced on the western side of the quarry near the existing weighbridge shed. Three bores were completed on an elevated roadway on the northern side of the quarry and three bores were completed on the eastern edge of the quarry near the Hanson carpark. At each location, a shallow borehole (20 m bgl), intermediate borehole (50 m bgl) and deep borehole (134 to 146 m bgl) was drilled. The locations of the bores are shown in *Figure 2* of *Annex A*.

The nine bores drilled around the quarry were completed between 3 October and 30 October 2007 by McDermott Drilling (McDermott's). The drilling method included a combination of solid flight auger (in shallow unconsolidated sediments) and water flush rotary drilling (in bedrock).

An ERM scientist was present onsite to log the boreholes during the site works. The ERM scientist also took photographs of the exposed faces of the quarry pit to aid in the geological characterisation of the site (refer *Annex B*).

## 3.2.3 Well Installation

Subsequent to drilling, monitoring wells were installed by McDermott's in the nine boreholes drilled around the quarry perimeter.

The monitoring wells were constructed from Class 15 threaded PVC casing. All monitoring wells were screened across the bottom six metres of the borehole using Class 15 threaded PVC with 1 mm slotted screen, with the remainder of the well being constructed of blank casing. Monitoring wells were installed under water to aid in the installation of the wells and prevent bridging of the gravel filter pack.

In the deep wells, the depth of the gravel pack could not be measured accurately due to the sheer depth of the wells. As such calculations were made to ensure that extra gravel was added so that the gravel pack extended at least 6 m above the top of well screen, which was followed by the installation of 1.0 m of fine sand before grouting. After this the grout tremie pipe was used as a secondary measure to probe the depth of the gravel pack and provide a general estimate on the depth to the top of the gravel pack. This ensured that the well screens were not impacted by the grout. Accurate measurement of the gravel pack depth was achievable for the shallow and intermediate wells using a depth probe supplied by the drillers. Further details of the well installation are presented on the bore logs in *Annex C*.

An ERM scientist supervised the installation of the wells, ensuring they were completed in accordance with the ERM Standard Operating Procedures (SOPs).

The remaining water in the monitoring wells was discharged and the wells developed between one and seven days after the installation of the monitoring wells. They were developed by air lift using a petrol air compressor, to ensure good connectivity between the monitoring well and the aquifer.

## 3.2.4 Surveying

To obtain an understanding of the relationship between groundwater and surface water elevations within the quarry pit pond/sump a survey of the wells was completed on 27 February 2008 by Michael S. Dunn Surveying.

## 3.2.5 Groundwater Sampling

Two groundwater sampling events were completed at the site. The initial sampling event was completed between 7 and 9 November 2007 and 22 and 23 November 2007. The second sampling event was completed between 20 February and 30 March 2008. The sampling was completed by a competent ERM scientist in accordance with ERM's SOPs.

The six shallow and intermediate wells (BH02, BH04, BH05, BH07, BH08 and BH09) were purged between 7 and 9 November 2007 using a Micropurge Groundwater Pump. BH04, BH07 and BH08 were pumped dry after 10 L, 20 L and 15 L were removed, respectively. The recovery of the water elevations within BH04, BH07 and BH08 was too slow to allow sufficient groundwater recharge to sample these wells and being certain that the recharge in the wells was representative of in-situ groundwater. As such only samples from BH02, BH05 and BH09 were obtained with a residual water sample being obtained from BH08.

Purging and sampling of the deep wells was attempted on 22 and 23 November 2007 using an air driven mechanical Bennett Sample Pump. Due to problems with the sampling equipment, the wells were unable to be purged and sampled during the sampling event on the 22 and 23 November 2007.

Due to the inability to obtain samples from the deep wells and the shallower wells potentially being impacted by introduced water a further sampling event was completed between the 20 February and 30 March 08. The Bennett Sample Pump was initially used to purge BH02 and BH09 and was then used to purge BH01. At the completion of purging BH01 the pump became wedged within the monitoring well and was unable to be retrieved. This prevented a sample from being obtained from BH01. In the absence of a suitable and available pump the remaining wells were purged manually using disposal bailers dedicated to each well. All wells were purged dry, except for BH05 which was purged of the recommended three well volumes. The recovery within boreholes BH02 (intermediate), BH04 (intermediate) and BH08 (shallow) was insufficient to be confident that samples from these wells were reflective of the in situ groundwater quality rather than water introduced during drilling and slug testing. Samples were obtained from BH02, BH03, BH05, BH06, BH07, BH08 and BH09. A surface water sample was also obtained from the quarry sump/pond on 26 February 2008.

Field chemical parameters were recorded during purging to ensure that the groundwater chemistry had stabilised before sampling was undertaken (*Annex D*).

The samples were taken from the monitoring wells, under low flow conditions, or using a bailer and placed into appropriate bottles. A new pair of disposable nitrile gloves was used for each sample taken. Field duplicates were obtained from BH03 and BH06 for intra-laboratory QA/QC purposes.

Samples from the sampling events were placed directly on ice in an insulated cool box and were transported to either Australian Laboratory Services (ALS) of Labmark laboratories (LABMARK) under standard chain of custody procedures.

## 3.2.6 Aquifer Testing

Hydraulic testing was conducted in all monitoring wells on 9 November 2007, to estimate the hydraulic properties surrounding the quarry.

The hydraulic tests (slug tests) were completed in accordance with ERM's SOPs for the hydraulic testing of water wells and Australian Standard ASTM D4044-96 (2002).

The groundwater elevation was determined at all wells prior to the test commencing.

A known volume (slug) of clean water was "instantaneously" introduced to each well and the rate at which the water elevation returned to its initial level was measured. Sufficient water was added to each well to raise the water level above the screen and gravel pack (typically between 5 and 40 L). The change in water elevation was then monitored using a dip meter and the depths recorded. The recorded water elevations are presented in *Annex E*. Water levels were typically recorded every minute for the first 10 minutes, and every 2 to 5 minutes thereafter, for up to 40 minutes. The water level was also measured several times over the following 24 hours.

Due to a lack of response in the deeper wells over the 24 hours of hydraulic testing, further analysis of the long-term water elevation recovery between the slug testing (9 November 2007) and the second groundwater sampling event February/March 2008 was undertaken. All groundwater elevation data recorded for each borehole is presented in *Annex F*.

Analysis of slug test data and long-term water elevation recovery was completed with the Aquifer Test V3.01 software (Waterloo Hydrogeologic, 2001), which uses the Horslev (1951) and Bouwer and Rice (1976) slug test analytical methods.

#### 3.2.7 Pit Seepage

Based on DECC feedback, actions were taken to quantify groundwater pit seepage by directly measuring pump out rates from the pit. Due to the potential sensitivity of the receiving waters, this approach was considered unfeasible. As such, groundwater seepage to the pit was estimated using a spreadsheet based water balance model and conservative analytical equations and compared with previous estimates of pump out rates reported in IGGC (2007).

To aid in the assessment of seepage into the pit void, a survey of the quarry pit walls was completed on 25 February 2008. This included entering the pit and photographically documenting zones of seepage to obtain an understanding of the overall seepage regime into the pit void. Photographs of seepage zones within the pit are presented in *Annex B*.

#### 3.3 LABORATORY ANALYSIS

To aid in the understanding of general groundwater chemistry, the relationships between the groundwater surrounding the quarry and the water within the quarry pit and the relative contributions of groundwater and rainfall to the quarry pit, the samples were scheduled for laboratory analysis of the following analytes:

- major cations (calcium, magnesium, sodium and potassium);
- major anions (sulfate, sulfide, chloride, fluoride, nitrate, nitrite);
- alkalinity; and
- ammonia (February/March 2008 sampling event only).

Samples were sent to ALS and LABMARK which are NATA accredited for the analytes requested.

The laboratory reports are presented in *Annex G*.

#### 3.4 ASSESSMENT CRITERIA

The analytical results reported were compared against the ANZECC (2000) High Reliability Trigger Values (HRTVs) for the Protection of 95% of Freshwater Species. Where HRTVs were not available, the Moderate Reliability Trigger Values (MRTVs) for the Protection of 95% of Freshwater Species were adopted. Field chemical parameters were compared against the ANZECC (2000) Southeast Australian Lower River Ecosystem Trigger values. The analytical results and field chemical parameters were also compared against the Australian Drinking Water Guidelines (NHMRC, 2004) for the protection of human health. Where human health criteria were unavailable the aesthetic trigger value was adopted.

The adopted investigation levels for each analyte reported are presented in *Table 1* of *Annex H*.

#### 4 INVESTIGATION FINDINGS

#### 4.1 ENVIRONMENTAL SETTING

A desktop review of available information was completed to establish the environmental setting in which the proposed landfilling will take place. The findings of the desktop review are presented in the following sections.

## 4.1.1 *Pit Void Dimensions*

*Figure 2* of *Annex A* presents the location of the pit void in its local surroundings. The pit is estimated to approximate a surface area of 265,000 m<sup>2</sup> at ground surface and 12,000 m<sup>2</sup> at the quarry base. The quarry has a depth approximating 135 m bgl. The natural ground surface around the quarry is between 70 and 85 metres above the Australian Height Datum (m AHD) and the base of the quarry is at -57 m AHD (i.e. below sea level).

## 4.1.2 Landfill Waste Characterisation

It is understood that it is proposed that the waste transported to and accepted at the site will consist of non-putrescible inert and solid waste from construction and demolition market sectors; commercial and industrial waste streams complying with acceptable waste of a general solid waste (non putrescible) landfill and green wastes. Accepted waste materials will be processed and recycled such that only classified solid waste, asbestos and asbestos contaminated materials, contaminated soils and unsalvageable materials left over from the recovery process will be landfilled.

The NSW DECC *Waste Classification Guidelines* 2008 provide threshold concentrations for leachate generated from solid waste material. The threshold concentrations for key solid waste contaminants are presented in *Table 2* of *Annex H* and are considered to represent the upper limits of contamination expected to leach from the landfill waste.

In reality, the concentrations discharging from the landfill are unlikely to reach these concentrations for the following reasons:

- the varied contents of the wastes landfilled at the site are unlikely to consistently contain maximum concentrations of the listed contaminants; and
- the TCLP data has potential to overstate the potential concentrations of contaminants leached from the soil.

Leachate analytical data from the Dial a Dump solid waste landfill at Alexandria, which is licensed to accept landfill waste of a similar composition to that proposed at this site, is also presented in *Table 2* of *Annex H*. This data provides a case study estimate of expected leachate concentrations within the proposed general solid waste landfill.

The leachate concentrations are compared against Sydney Water Trade Waste Criteria as this is the proposed primary means of discharging leachate water from the site. It is noted, however, that other technologies will be considered to facilitate leachate evaporation and/or re-use of treated water on-site, therefore reducing disposal to trade waste.

The leachate waste from Alexandria Landfill exceeds the Sydney Water Trade Waste Criteria for ammonia, barium, petroleum hydrocarbons and polycyclic aromatic hydrocarbons. These results suggest that treatment of leachate generated at the site to reduce these contaminant concentrations will be required before discharge can occur to trade waste.

The solid waste TCLP criteria suggest that there is potential for concentrations of BTEX, chlorinated phenols, chloroform, cyanide, fluoride, metals and phenols to exceed Sydney Water Trade Waste Criteria. However, given the varied nature of the waste materials and sources and the conservative nature of TCLP analysis the concentrations within the leachate are likely to be lower than the values listed. Restrictions on accepted waste from industries generating these contaminants or treatment to reduce the concentrations will be required before discharge to trade waste can occur. Initial monitoring of leachate water for these contaminants, in line with *Waste Classification Guidelines* 2008, will help determine treatment requirements.

All infrastructure developed to house and transport leachate (i.e. the leachate collection system) should be constructed of materials to withstand the chemicals present within the leachate. Therefore the data presented within *Table 2* of *Annex H* will form the base chemistry data for selecting suitable infrastructure materials when detailed design is undertaken following development application approval.

## 4.1.3 Climate

Average monthly rainfall and evaporation data from the Australian Bureau of Meteorology (BoM) weather station at Prospect Dam (approximately 6 km east of the site) are presented on *Figure 3* of *Annex A*. This site has 121 years of rainfall data (1887 to 2007) and 32 years of evaporation data (1974 to 2007). The data presented suggest that there is a net surplus of rainfall in the months of May, June and July and generally a large net rainfall deficit in other months.

The average annual rainfall is 870 mm and average annual evaporation is 1,354 mm. The highest rainfall occurs during summer months with a maximum average monthly rainfall of 96.3 mm in March.

The maximum monthly evaporation average is 182.9 mm in December. The lowest average monthly rainfall is in September (47.8 mm) and the lowest average monthly evaporation is in June (51 mm).

The maximum 90<sup>th</sup> percentile monthly rainfall approximates 201.7 mm and occurred in the month of March. A maximum daily rainfall of 321 mm was recorded.

# 4.1.4 Hydrology

Seven small un-named dams or reservoirs are located within a one kilometre radius of the quarry. In addition the following surface water receptors were noted in close proximity to the site:

- Ropes Creek, approximately 1.5 km to the west of the quarry;
- Eastern Creek, approximately 3 km east of the quarry; and
- Prospect Reservoir, approximately 6 km east of the quarry.

The catchment area for the pit void is larger than the pit itself and approximates an area of 376,611 m<sup>2</sup> (refer *Figure 2* of *Annex A*). Prior to operation of the landfill, to minimise the amount of surface runoff entering the landfill void, the site drainage system will be constructed to divert surface runoff from operational areas surrounding the quarry pit, to storages outside of the pit. Site grading will also ensure clean runoff from non operational areas of the site is diverted around the pit. This will reduce the landfill catchment to the same size as the pit void, which is estimated at 265,000 m<sup>2</sup>.

# 4.1.5 Geology

Reference to the Clark and Jones (1991) Penrith 1:100,000 Geological Sheet indicates that the natural soils and fill material at the site are underlain by Bringelly Shales of the Wianamatta Group. This consists of shale, carbonaceous claystone, laminite, occasional interbedded units of fine to medium grained lithic sandstone and rare coal and tuff.

The quarry itself was developed to extract an (igneous) plug/diatreme of dolerite and volcanic breccia which has intruded through the shales and may have caused localised metamorphism of the shale rocks. The diatreme, referred to as 'Minchinbury Diatreme', is about 850 m long and 350 m wide and is typified by a sub-vertical 'ring fault', which defines the perimeter of the diatreme (Jeffery and Katauskas, 2007).

The Wianamatta Group is expected to extend to depths of -80 m AHD in the area of the site and is underlain by the Hawkesbury Sandstone (IGGC, 2007). The base of the quarry is expected to be approximately 20 m above the Hawkesbury Sandstone strata.

A search of the DECC Web Atlas indicates that there is one deep registered bore, GW018361, located approximately 2 km to the northeast of the site. The bore was installed to 217.93 m bgl for waste disposal purposes at an aquaculture facility. The geology encountered in this bore is summarised in *Table 4.1* and indicated shales with occasional interbedded sandstone.

At depths greater than 150 m bgl, white sandstone predominates, and is interpreted to be the Hawkesbury Sandstone.

Depth (m bgl)	Geology
0 - 14.02	topsoil/clay
14.02 - 16.45	Basalt
16.45 - 61.56	grey and light grey shale
61.56 - 64	Basalt
64 - 92.04	black and grey shale
92.04 - 99.06	Sandstone
99.06 - 150.87	grey shale
150.87 - 194.46	white sandstone
194.46 - 195.68	grey shale
195.68 - 217.62	white sandstone

## Table 4.1Borelog for well GW018361 located 2 km north east of the Site.

# 4.1.6 Hydrogeology

A review of the groundwater assessment previously conducted at the site by Ian Grey Groundwater Consulting (IGGC, 2007) suggests that the hydrology at the site is controlled by the surrounding Wianamatta Shale, which has a low permeability and hence a limited ability to transmit groundwater. Typical porosities for shales range from <1-10 % and hydraulic conductivity for shale typically ranges from 1 x 10<sup>-8</sup> to 2 x 10<sup>-6</sup> m/day (Weight and Sonderegger, 2001). A shallow perched groundwater system was identified within the weathered shales and clays. This is underlain by discrete layered aquifer systems within the shales, with the majority of flow occurring via fractures and bedding planes.

IGGC (2007) suggests that the intrusion of the igneous diatreme and historical quarrying activities may have led to an increase in the fracturing of the surrounding shale geology and therefore resulted in an increase in the permeability of the quarry. This is discussed further in *Sections 4.2, 4.4* and *4.5*.

As discussed above, the geology surrounding the site may be characterised as shales with occasional interbedded sandstones. Although no water strike was reported in GW018361, the sandstone strata, identified at depths of 92.04-99.06 m bgl, 150.87-194.46 m bgl and 195.68-217.62 m bgl (*Table 4.1*) are more likely to be associated with groundwater flow, due to the higher permeability of this material by comparison to shale.

## 4.1.7 Groundwater Elevations

A search of the DECC Web Atlas indicates that there are 20 registered bores located within approximately 5 km of the site. The bores range in depth from 6 m bgl to 218 m bgl. The groundwater elevation has been recorded for seven of the 20 wells and ranged from 3.9 to 17 m bgl within bores at depths between 6 and 78 m bgl.

Based on the elevation of the nearest discharge zone (Ropes Creek), IGGC (2007) suggested that the groundwater elevation at the site should be approximately 50 m AHD. However, the presence of the quarry (-57 m AHD deep) has resulted in a depressurisation of the local groundwater which may extend a kilometre or more from the quarry in the deep aquifer.

## 4.1.8 Groundwater Usage

There are 20 registered bores located within approximately 5 km of the site, as reported on the DECC NSW Web Atlas. Groundwater usage within 5 km of the site is limited, with only two (GW028414 located 1.5 km from the site and GW028415 located 3 km from the site) of the 20 wells utilised for abstraction purposes. These wells are installed to a maximum depth of 8 m bgl within the shallow perched water table. The remaining wells were utilised for monitoring purposes and one well (GW018361) was installed to a depth of 217 m bgl for waste disposal purposes.

IGGC (2007) indicated that groundwater associated with igneous bodies such as a diatreme can be highly alkaline, with high levels of inorganic nitrogen. In addition, the surrounding groundwater could also be characterised by high salinity levels due to connate salts within the formation.

The paucity of wells identified within the area reflects the low yields of the aquifers, indicating the poor resource potential of the aquifers in this area.

## 4.1.9 Groundwater Quality

Only three of the registered bores located within approximately 5 km of the site (DECC NSW Web Atlas) have available salinity data. Of these, two wells (GW102673 and GW102674) are screened within the Bringelly Shale deposits. The total dissolved solids data from these two wells approximates 4,500 mg/L, which is above the ANZECC (2000) threshold criteria for domestic and stock use, suggesting that the aquifer system is of limited use.

Shallow groundwater within five unregistered monitoring wells located within the adjacent Hanson<sup>1</sup> site had Electrical Conductivity (EC) measurements ranging from 937 to 30,000  $\mu$ S/cm (IGGC, 2007), with an average of 10,592  $\mu$ S/cm (7,096 mg/L TDS). This data also suggests that local shallow groundwater quality is poor and of limited human and environmental value.

IGGC (2007) took EC measurements from the quarry pond and from a seepage point along the quarry wall in 2005 after a period of significant rainfall. Conductivities of 1,288  $\mu$ S/cm (867 mg/L TDS) were measured in the pond and 1,973  $\mu$ S/cm (1,321 mg/L TDS) in waters from the seepage face. Due to variable EC data within surrounding wells screened within the Bringelly Shale, the relative contributions of rainfall and groundwater to the quarry pit cannot be estimated using salinity data.

A water sample from the quarry sump was scheduled by IGGC (2007) for cation and anion analysis. The analysis results are presented in *Table 4* of *Annex H* and are discussed in more detail in *Section 4.3*.

## 4.1.10 Pit Seepage

Anecdotal information supplied in the IGGC (2007) report indicates that water is pumped from the quarry pit sump at a rate of 40 L/min for on average two hours every two to three days. More frequent pumping is conducted during wet conditions and less frequent pumping is conducted during dry conditions. Based on this information a maximum groundwater seepage rate (including the influence of rainwater) was estimated to be 125 m<sup>3</sup>/day. IGGC (2007) indicated that this rate of seepage was very low for the large size of the quarry. This was supported by observations of very little seepage through the walls of the quarry, although some isolated locations of seepage from the pit walls were noted after rainfall by IGGC (2007), during water sampling events in 2005.

<sup>&</sup>lt;sup>1</sup> The Hanson site is located to the South East of the quarry pit and operations on this land include processing, stockpiling and transport of materials for the building and construction industry.

## 4.2 FIELD OBSERVATIONS

## 4.2.1 Geological and Hydrogeological Observations

The locations of the bores installed on the site are shown in *Figure 2* of *Annex A*.

The geological logs recorded at each location at the site are presented in *Annex C* and photographs of the exposed faces along the quarry pit wall are presented in *Annex B*. Details of the borehole and well installations are summarised in *Table 4.2* below.

Well	TOC	Depth	Depth of screen	Depth	Lithology of
Name	(mAHD)	(m bTOC)	(m bTOC)	Classification	Screen
BH01	69.217	133.8	127.8-133.8	Deep	Shale
BH02	69.192	49.7	43.7-49.7	Intermediate	Shale
BH03	80.347	140.8	134.8-140.8	Deep	Shale
BH04	80.486	49.6	43.6-49.6	Intermediate	Shale
BH05	80.554	20.7	14.7-20.7	Shallow	Clay/shale interface
BH06	85.187	147.9	141.9-147.9	Deep	Shale
BH07	85.123	50.8	44.8-50.8	Intermediate	Shale
BH08	85.018	20.8	14.8-20.8	Shallow	Clay/shale interface
BH09	69.233	20.0	14.0-20.0	Shallow	Clay/shale interface

#### Table 4.2Well Details

2. m bTOC - metres below the top of the well casing

3. m AHD – metres above Australian Height Datum

The geological and hydrogeological observations made by ERM scientists during the fieldwork are summarised as follows:

- the bore logs suggest that the subsurface geology consist of brown silty clay or fill material (0 to 18 m bgl), underlain by a weathered bedrock zone characterised by grey clay and shale (18 to 32 m bgl). This is underlain by soft, followed by hard shale with some siltstone noted (32 to 146 m bgl). This generally concurs with the geology observed in the exposed quarry faces;
- sandstone units, which are more likely to be water bearing were not encountered during the drilling. This also concurs with the geology observed in the exposed quarry faces;
- depths at which lithological changes were identified are generally only accurate to 2 metres due to the water flush rotary drilling method that was used;

- *photographs* 9 to 17 of *Annex B* present profiles of the pit walls. The photos suggest that faulting and volcanically impacted/deformed country rock is apparent along the eastern and southern walls of the pit. The western edge of the pit is more uniform suggesting that either intact breccia intrusion or intact shales extend out from the western wall;
- in general, the intact shales/siltstones appeared to be relatively impermeable, with little water lost from the boreholes during the drilling at depth. At borehole BH01, fracturing in the shale was potentially encountered between 120 and 121 m during drilling works and significant water loss was noted from 123 m bgl to 134 m bgl;
- the silty clays and fill material at the surface of the boreholes appeared to be relatively permeable. Significant loss of water was noted when drilling through the fill material (0 to 15 m bgl) at boreholes BH03, BH04 and BH05 (located along the northern perimeter of the quarry);
- *photographs 12 to 17* of *Annex B* present the locations of seepage within the pit. Seepage was observed to be very isolated from the exposed unconsolidated clay and weathered shale faces. Seepage from the deeper shale units was more substantial but was generally observed to be isolated and insufficient to induce flow or surface ponding at the bottom of each of the seepage faces. However, seepage from the fractured zone on the southern wall did initiate ponding and minimal surface flow. Overall the seepage was observed to be very low and likely to be less than 10 m<sup>3</sup>/day; and
- the different lithologies observed within the pit were not observed to coincide with increased seepage suggesting that any remaining volcanic breccia units have a similar permeability to the surrounding shales and do not impact overall seepage into the pit.

# 4.3 WATER SAMPLING RESULTS

# 4.3.1 Field Chemical Parameters

*Table 3* of *Annex H* presents the field parameters obtained after purging the wells for sampling. The results are summarised as follows:

- EC ranged between 693  $\mu$ S/cm and 8,300  $\mu$ S/cm for the shallow wells and 630  $\mu$ S/cm and 8,710  $\mu$ S/cm for the deeper wells (i.e. intermediate and deep) in the Bringelly Shale. It is noted that the results of the initial sampling event completed in November 2007 may be impacted by residual water used for drilling;
- EC results are generally higher than the human health and ecological investigation levels;

- while EC results from the wells are generally higher than the concentrations measured within the quarry pond the results are generally too variable to draw a significant conclusion about the potential dilution of groundwater within the quarry sump/pond by surface water;
- EC results from BH02 and BH09 sampled in November 2007, located on the western perimeter of the site near the weighbridge shed, were lower (630 μS/cm and 693 μS/cm respectively) than those reported for the remaining wells. During groundwater sampling in November 2007 it was noted that pooled water on the surrounding ground surface was potentially seeping into BH02 and BH09, which may have resulted in dilution of the groundwater and hence resulted in a lower EC value. This conclusion is consistent with the variability in EC results recorded between the sampling events;
- pH ranged between 6.99 and 8.54 for shallow wells and 7.05 and 11.59 for deeper wells screened within the shale (i.e. intermediate and deep wells). The pH is generally within suitable ranges to prevent significant corrosion to piping and fitting systems, suggesting that background water quality is unlikely to result in corrosion of the leachate collection system infrastructure. Some of the pH data are above the investigation level for the protection of human health and ecosystems;
- temperature ranged between 18.7 °C and 21.3 °C for shallow wells and 18.2 °C and 23 °C for deeper wells;
- redox potential ranged between -7 mV and 139 mV for shallow wells and -210 mV and 153 mV for deeper wells;
- dissolved oxygen ranged between 1.44 ppm and 2.41 ppm for shallow wells and 0.15 ppm and 3.79 ppm for deeper wells. This is below the minimum investigation level for lowland river systems and human health. The quarry pond had acceptable concentrations of dissolved oxygen (9.5 ppm); and
- Overall the field chemical parameter data suggests that background groundwater quality is of limited human and environmental value.

# 4.3.2 Laboratory Results

The analytical results for water samples taken at the site are presented in *Table* 4 of *Annex H*.

BH02 and BH08 generally have higher reported concentrations of cations and anions from the second sampling event than concentrations reported for the initial sampling event. This suggests that the initial sampling within BH02 and BH08 may have been impacted by freshwater introduced during slug testing and drilling.

The concentrations presented in the *Table 4* of *Annex H* were compared against the adopted investigation levels.

The laboratory results suggest that the background concentrations within the shallow perched groundwater are in excess of the human health aesthetic investigation level for sodium and chloride. Concentrations of ammonia in two of the three shallow groundwater wells also exceed the Human Health Investigation Level.

Isolated concentrations of nitrate and ammonia in excess of Ecological Investigations Levels were also observed within the shallow perched groundwater aquifer.

Concentrations of ammonia in excess of Human Health and Ecological Investigation Levels are present in the deeper regional aquifer system. Chloride and sodium concentrations in excess of the aesthetic investigation levels are also apparent in samples obtained from the deeper regional aquifer system.

The quarry pond also has concentrations of nitrate in excess of the Ecological Investigation Level.

The results suggest that the background shallow and regional groundwater quality is of limited human and environmental value.

## 4.3.3 Chemical Characterisation

*Figure 4* of *Annex A* presents piper plots of the cations and anions reported in groundwater. The data presented are summarised as follows:

- shallow groundwater quality is variable and generally ranges between Na-HCO<sub>3</sub>-SO<sub>4</sub> dominated water within BH05 (which may be screened within fill material) and Na-Cl-HCO<sub>3</sub> dominated water screened within the clay and weathered shale;
- deeper regional groundwater can generally be characterised as Na-Cl-HCO<sub>3</sub> dominated water. However, the piper plot suggests distinct variations relative concentrations of HCO<sub>3</sub> within the deeper water samples. The results from BH02 are slightly variable in characterisation between sampling events, which is likely to be due to interference from surface run-off and poor sample recovery from this well;
- the samples from the quarry pond, collected as part of the groundwater assessment by IGGC (2007), can be characterised as Na-HCO<sub>3</sub>-SO<sub>4</sub> dominated water; and
- a clear relationship between shallow groundwater, deep groundwater and surface water within the quarry pit is not apparent within the piper diagram (*Figure 4* of *Annex A*). As such, a relationship between the quarry pit surface water<sup>2</sup> samples and groundwater contributions cannot be established using the water chemistry results. However, the absence of a relationship between the deep regional aquifer system and the quarry pit water supports the presence of relatively small volumes of groundwater seepage into the pit relative to surface water flows.

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<sup>&</sup>lt;sup>2</sup> The quarry pit surface water sample was obtained by IGGC in 2005 and reported in IGGC (2007).

## 4.3.4 QA/QC

The field and laboratory QA/QC results for the water samples obtained are outlined below.

All water sampling was conducted in accordance with ERM's SOP, by an experienced sampler.

While standard sampling procedures were adopted, including allowing at least seven days after development for the wells to settle before sampling, and abstraction of at least three well volumes before sampling, it is recognised that the results may still be impacted by water introduced into the quarry during drilling. This is particularly likely for samples obtained from the deeper wells (>40 m deep), which were generally pumped dry and had very low recovery rates, preventing effective sample retrieval of the recovered natural groundwater.

In recognition of this, a second groundwater sampling event was completed in February/March 2008 with the aim of obtaining groundwater samples at a suitable time after previous drilling and hydraulic testing to have allowed water quality within the wells to equilibrate with in situ groundwater quality. The sampling event was conducted by ERM environmental scientists in accordance with the ERM SOP for groundwater sampling. Despite this, recovery in BH02, BH04 and BH08 was insufficient to provide confidence that the water sampled was indicative of in situ groundwater quality surrounding the well. This is not due to the sampling methodology used but rather due to a lack of groundwater recovery, which suggests the potential absence of a groundwater system in this area.

The water quality meter used to monitor field chemical parameters was supplied by Enviroequip Rentals, with a calibration certificate indicating that it had been calibrated for use at this site. The water quality meter was also calibrated at the start of each day. Wells were purged of the recommended three well volumes or pumped dry, and all field chemistry parameters monitored had stabilised to within acceptable limits prior to samples being obtained. This suggests that the water samples obtained were indicative of the water quality at the location being sampled.

A QA/QC procedure was also undertaken to review the validity of the reported laboratory data against guidance documents, including NATA (1995), NEPM (1999) and USEPA (1994). The QA/QC checks were completed on the final laboratory report E0715646 from ALS Laboratories and reports E036376, E036442, E036715 and E036886 from LABMARK laboratories.

The QA/QC review included:

- determining that appropriate handling (chain of custody) of the samples was undertaken between the site and the laboratory;
- that laboratory analysis had been completed inside recommended holding times of the analytes being tested; and
- evaluating the accuracy of the laboratory analytical methods, which is measured as percent recovery (%R). These tests were performed on matrix spikes (specifically to test the interactive effects of the sample matrix on the analyte being measured) and laboratory surrogates (specifically to test the performance of the method extraction process).

The results of the laboratory QA/QC review are summarised as follows:

- all samples were intact and within recommended temperature ranges when received by the laboratory;
- all samples were analysed within the recommended holding times for each analyte with the exception of nitrate analysis which exceeded the recommended holding time of 24 hours by one to two days during the first sampling event. All nitrate analysis from the second sampling event was completed within acceptable holding times. Therefore the variability in the nitrate results between the sampling events presented in *Table 4* of *Annex H* may potentially be due to laboratory holding times. The results of second round of analysis should, therefore, be considered in preference to the initial nitrate analysis;
- concentrations reported for laboratory method blanks were below the laboratory detection limits for all samples and are therefore considered to be acceptable;
- laboratory matrix spike percent recovery results were found to be within the expected control limits of 70% to 130%; and
- laboratory recoveries of surrogate compounds added to water samples, as reported in the final certificates of analysis, were within USEPA documented limits and considered acceptable.

The QA/QC summary of this review is provided in the laboratory reports (*Annex G*).

Based on the assessment of laboratory QA/QC data, the field investigation procedures and reported analytical results are considered to have produced valid and representative concentrations of the analytes tested. In particular, the second sampling event is considered to have produced results indicative of the in-situ groundwater quality. However, due to the absence of a consistent recovery in groundwater at BH02, BH04, and BH08 it cannot be assumed with certainty that a groundwater system is present at these locations. Therefore, the groundwater results for these wells should be considered with caution.

#### 4.4 GROUNDWATER ELEVATIONS

*Annex F* presents the groundwater elevations for the wells installed around the site. The data presented are summarised below:

groundwater elevations in the deeper wells (BH01, BH03 and BH06) appear to have recharged by 30 to 35 m between the groundwater sampling event and slug testing completed in November 07 and the groundwater sampling event completed in February/March 08. This increase in groundwater elevations cannot be attributed to residual water introduced during hydraulic testing. The groundwater elevations within these wells ranged between approximately 14.3 and 24.2 m AHD prior to sampling in February/March 08 but had not stabilised. The rising groundwater elevations in these wells approximate 70 to 80 m above the base of the quarry pit (approx. -58 mAHD) suggesting that a steep regional groundwater gradient is present around, and is directed into, the pit. Variability in the relative groundwater elevations within these wells is likely to be due to the relative distance of each well from the pit walls. The groundwater elevation gradients around the pit support the presence of very low permeability geology and suggest that fracturing is unlikely to exert a significant control on groundwater movement in this area or that fracturing in this area is also of low permeability;

- groundwater elevations in the intermediate wells (BH02, BH04 and BH07) also appear to have recharged between the groundwater sampling event and slug testing completed in November 07 and the groundwater sampling event completed in February/March 08. BH02 has recharged by approximately 12 metres, which may be partially attributed to impacts from surface run-off in this area. BH04 and BH07 have recharged by approximately 4 metres during this period. The slow recovery rate and low total recovery within BH02 and BH04 after purging during the February/March sampling raises uncertainty that the potential recharge observed between sampling events is reflective of the regional water table elevations and suggests that water within these wells may be residual water from drilling and hydraulic testing. However, there are sufficient observation data from BH07 after the February/March sampling round to suggest approximately 6 m of recharge in this well, which is likely to be indicative of the regional groundwater table or a perched water table. The groundwater elevations within the intermediate wells ranged between approximately 42 and 54 m AHD immediately prior to the February/March 08 sampling event, which is higher than the rising water elevations observed within the deeper wells; and
- groundwater elevations within the shallow wells at the site generally ranged between 59 and 69 m AHD prior to the sampling event completed in February/March 08, which is above the groundwater elevations present within the intermediate and deep wells. However, stabilisation of the deeper wells has not presently occurred. The recovery in BH09 back to a relatively constant water elevation after sampling events suggests the presence of a shallow groundwater system at this location. The groundwater elevation within BH08 gradually declines after hydraulic testing and has minimal recovery after the second sampling event in February/March 08. This suggests that water in this well may be attributed to drilling and slug testing and suggests the absence of a shallow groundwater system at this location. The groundwater elevation within BH05 has trended back to a constant water elevation after hydraulic testing and groundwater sampling events, which suggests the presence of a shallow groundwater system in this area. A gradually rising water elevation between sampling events also supports this conclusion. Overall, the groundwater elevations in shallow wells suggest the presence of a discontinuous shallow groundwater system within the weathered shale and clay overburden at the site. This is supported by the absence of a continual seepage face at shallow depths around the pit.

#### 4.5 AQUIFER TESTING

Slug tests were conducted on all wells at the site on 9 November 2007. Monitoring of groundwater elevations continued throughout the day, with three groundwater monitoring rounds (in which all wells were included) completed after initial recovery of the wells. Due to very slow dissipation of the introduced slug of water in the deeper wells, a fourth monitoring round was completed the following day to further quantify falls in water levels. Due to the negligible responses over the monitoring period within the intermediate and deeper wells further analysis was completed using long term water elevation monitoring data. This analysis used long term groundwater recovery data from wells BH01 (deep), BH03 (deep), BH06 (deep) and BH07 (intermediate).

The observed data and analytical results for each well are provided in *Annex E. Table 5* of *Annex H* also presents the calculated hydraulic parameters for the slug tests completed. The data are summarised as follows:

- the hydraulic conductivities (Ks) estimated for the shallow wells (BH05, BH08 and BH09) ranged between 0.21 m/day and 0.25 m/day at BH05 and 1.46 x 10<sup>-3</sup> m/day and 3.82 x 10<sup>-3</sup> m/day at BH08. These Ks are indicative of the permeabilities of the fill (BH05) and the weathered clay and shale (BH08 and BH09), which the shallow bores were screened within;
- the K calculated from slug testing for BH04, which was the only well screened within the deeper shale strata to have an observed fall in water elevations after a slug of water was introduced, ranged between 6.37 x 10<sup>-6</sup> m/day and 7.90 x 10<sup>-6</sup> m/day. This is consistent with typical hydraulic conductivities of un-fractured shales which range from 1 x 10<sup>-8</sup> to 1 x 10<sup>-6</sup> m/day (Weight and Sonderegger, 2000);
- hydraulic analysis of the long term water elevation data for deep wells BH01, BH03 and BH06 and intermediate well BH07 ranged between 1.75 x 10<sup>-6</sup> and 8.7 x 10<sup>-6</sup>, which is consistent with the hydraulic testing result for BH04, which is also screened within shale;
- It was anticipated that the hydraulic testing results would have been higher for BH01 due to the potential for the gravel pack in this well to be contacting a fracture. The estimated top of the gravel pack is at, or about, the estimated location of fracturing (*Annex C*). Given the drilling and installation methods used, an accuracy of +/- 2 m can be expected and therefore, it may be that the gravel pack did not extend to the depth of fracturing;
- based on the permeabilities of the geology around the quarry, it is unlikely that groundwater yields would be suitable for water supply purposes; and

the design permeabilites of clay liners generally approximate 8.64 x 10<sup>-5</sup> m/day (1 x 10<sup>-9</sup> m/s), which is the benchmark technique outlined in the NSW Solid Waste Landfill Guidelines (EPA, 1996). The very low permeabilities calculated for the shales surrounding the quarry are below this, suggesting that a clay liner is unlikely to further impede leachate migration through the base of the landfill once in operation. While it is noted that fracturing may result in localised zones of higher permeability, it is evident from the steep regional groundwater gradients around the pit that the fracture network does not exert a significant control on regional groundwater flow and bulk formation permeability in this area and therefore that any fracture network is likely to be intermittent and localised.

#### 4.6 ESTIMATED PIT SEEPAGE

#### Groundwater Influx

The primary factor determining the rate of groundwater flux is the hydraulic conductivity of the surrounding geology. The estimated seepage into the pit via this process is outlined below.

Based on the hydraulic conductivity calculated at the site the potential seepage into the quarry pit can be conservatively estimated using Darcy's law which states that:

Q = k i a eqn 1 (Weight *et al*, 2001).

Where:

Q = discharge ( $m^3/day$ );

- k = hydraulic conductivity (m/day). The hydraulic conductivity values calculated for the site from the current investigation range between 3.18 x 10<sup>-3</sup> m/day and 0.25 m /day in the weathered shale and clay zone and a maximum hydraulic conductivity of 8.7 x 10<sup>-6</sup> m/day in the shale zone (BH01);
- i = the hydraulic gradient (dimensionless). The hydraulic gradient can be expressed as:

*d*h/*d*L

where:

dh = the change in groundwater elevation (m) between point a and point b; and

dL = the distance (m) between point a and b.

For the shallow aquifer system, dh is interpreted to be the height of the water level in well BH09 above the interface between the weathered shale/clay and intact shale, which gives an approximate value of 8 m. dL is interpreted to be the distance from the surrounding wells to the edge of the pit, which is estimated to approximate 50 m. This gives a hydraulic gradient of 0.16 for the shallow aquifer system.

For the deeper aquifer system within the shale, dh is interpreted to be the fall in groundwater surface between the deep wells (24 mAHD) and the pit base (-58 m AHD), which gives an approximate value of 82 m. dL is interpreted to be the distance from the surrounding wells to the edge of the pit, which is estimated to approximate 50 m. This gives a hydraulic gradient of 1.64 for the deep aquifer system around the pit, which is likely to be conservative; and

a = the cross section area of discharge (m<sup>2</sup>). For the shallow aquifer, the cross-sectional area is calculated to be the depth of the aquifer system (8 m) x the perimeter of the quarry (estimated to be 1,700 m). This gives a discharge zone of 13,600 m<sup>2</sup>. For the deeper aquifer, the cross-sectional area is calculated to be the depth of the aquifer system (82 m) x the perimeter of the quarry (estimated to be 1,700 m). In this instance the cross-sectional area is calculated to be the area of the exposed quarry face (quarry walls estimated at 139,400 m<sup>2</sup>).

Based in the input parameters listed above, the estimated groundwater influx through the walls of the quarry is estimated as follows:

- The shallow groundwater system has the potential to contribute 257 m<sup>3</sup>/day. This is considered to be a high end conservative value and is unlikely to be real as observed seepage from the exposed pit faces at the interface of the weathered shale/clay and shale was observed to be negligible; and
- The deeper groundwater system has the potential to contribute 2 m<sup>3</sup>/day. This seepage rate concurs with seepage observed within the pit, which was estimated to be less than 10 m<sup>3</sup>/day.

As discussed in *Section 4.1.10*, seepage of groundwater into the quarry was estimated by IGGC (2007) using anecdotal information on pumping rates from the quarry pit sump to approximate 125 m<sup>3</sup>/day. This estimate was considered to include a component of rainfall run-off. Given that the contribution of shallow groundwater into the pit was observed to be negligible and that seepage from the deeper aquifer system is likely to approximate 2 m<sup>3</sup>/day, it is considered that the estimated 125 m<sup>3</sup>/day of flow into the pit primarily originates from surface water run-off.

## Surface Water Influx

A surface water management plan was completed for the site by Storm Consulting Pty Ltd (STORM) in February 2008. The report suggests that the likely stormwater inflow to the quarry will approximate:

- 107 m<sup>3</sup>/day for a dry year this was based on the 10<sup>th</sup> percentile annual rainfall of 562 mm/yr recorded at the BoM weather station at Prospect Reservoir;
- 195 m<sup>3</sup>/day for a median year this was based on the 50<sup>th</sup> percentile annual rainfall of 831 mm/yr recorded at the BoM weather station at Prospect Reservoir; and
- 342 m<sup>3</sup>/day for a wet year this was based on the 90<sup>th</sup> percentile annual rainfall of 1,183 mm/yr recorded at the BoM weather station at Prospect Reservoir.

The calculations were based on a quarry open area of 265,000 m<sup>2</sup> and the assumption that 15 mm of initial daily rainfall is lost to evaporation and/or infiltration. The results listed above are sensitive to the initial rainfall loss adopted. As such, there is potential for the surface inflow to the pit to approximate between 238 m<sup>3</sup>/day (dry year) and 560 m<sup>3</sup>/day (wet year) when reducing the initial rainfall loss within an acceptable range (i.e., to 5 mm).

Further details of how these values were derived are provided in the surface water report, included in volume 2 of the EAR.

The surface water inflow rate of  $125 \text{ m}^3/\text{day}$ , documented in IGGC (2007), approximates the lower limit of the range calculated by STORM.

A potential worst case rainfall for a 1 in 25 year 24 hour annual return interval (ARI) rainfall event was also calculated using the methodology outlined within the Australian rainfall and runoff guidelines (IEA, 1998). The value calculated was 156 mm/day, which equates to a quarry inflow of 41,340 m<sup>3</sup>.

The maximum daily rainfall recorded at Prospect Dam weather station approximates 321 mm and was recorded on 6 August 1986. The run-off into the pit generated from this rainfall event would approximate 85,065 m<sup>3</sup>.

#### CONCEPTUAL SITE MODEL

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Based on the findings of this investigation, a conceptual model has been developed for the site, which is presented in *Figure 5* of *Annex A*. The figure presents the following key data:

- the surficial geology comprises clay and weathered shales to depths approximating 32 m bgl. Some fill material was identified in wells located on bunded areas to depths approximating 6 m. Intact shales predominate below the weathered shales down to depths approximating 146 m bgl. A survey of the pit wall suggests some geological changes and fracturing along the eastern and southern walls of the pit. The Hawkesbury Sandstone) is likely to be located approximately 20 m below the base of the quarry;
- background groundwater is generally of a poor quality relative to human health and ecological investigation levels. The groundwater resource is therefore considered to be of limited water use potential and of low ecological value. This is supported by the presence of a waste disposal well located within 2 km of the Site;
- there is an intermittent shallow perched groundwater system located around the quarry within the fill, clay and weathered shale. Permeabilities of these deposits range from 1.46E<sup>-3</sup> m/day to 0.25 m/day. Based on the very isolated seepage observed from the clay and weathered shales exposed on the pit walls, this system is not in significant hydraulic contact with the quarry. This suggests that, provided leachate levels within the pit are kept below the base of the shallow aquifer system, leachate migration into this system is unlikely to occur;
- there is a deeper regional groundwater system located within the shale deposits. The permeability of this shale has been calculated to be very low (1.75E<sup>-6</sup> m/day to 8.7E<sup>-6</sup> m/day). These permeabilities are below specified criteria for clay liners. The elevation of this water table is likely to be in excess of 24 m AHD, which approximates 82 m above the pit base. This indicates a strong inward hydraulic gradient and suggests that the bulk formation hydraulic properties (including fracturing) of the surrounding geology are low. Given the low permeabilities of the geology surrounding the pit there is unlikely to be significant hydraulic contact between the quarry pit and the underlying Hawkesbury Sandstone. These factors negate the need for the landfill to be lined;
- flow of groundwater into the pit is likely to be low and approximate 2 m<sup>3</sup>/day. This generally coincides with seepage observed within the pit; and
- surface water inflow into the landfill, once operational is likely to vary between 39 and 204 m<sup>3</sup>/day annually. This suggests that groundwater represents a small proportion of total water inflow to the quarry pit.
#### LEACHATE STORAGE AND DISCHARGE

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The entire volume of surface water draining into the pit is unlikely to become leachate as it is proposed that the landfill design will include a surface water run-off system, which will capture surface run-off from the pit sides before it mixes with landfill waste and becomes leachate. This will serve to significantly reduce the volumes of leachate generated within the landfill.

The pit surface water drainage system will comprise a suitably engineered drain running along the periphery of the entry road down to the base of the landfill pit. This will drain into a temporary stormwater retention pond developed on the surface of a capped section of the landfill waste, which will then be pumped back to the surface as surface water run-off. The stormwater retention pond will be transient and will be moved across the landfill capping surface as infilling progresses. As the landfill fills over time, the storm retention dam and drainage system will move up and remain at the surface of the landfill, thus preventing stormwater run-off from contacting the waste.

In addition to the capture of the surface run-off, the infilling procedure adopted at the landfill will also impact the amount of rainfall potentially contacting waste and becoming leachate. The landfill procedure will include infilling successive layers with each layer progressing in a singular direction across the landfill surface. Each layer will be temporarily capped with compacted soil to limit rainfall infiltration. It is conservatively estimated that approximately 50% of the rainfall falling onto this surface will migrate into the landfill waste to become leachate, while the remaining volume will either be trapped within the surface soil cap or run off to the stormwater capture system. This capping process will result in a 450 m<sup>2</sup> continual open (uncapped) area of waste.

As each layer is finished and a new layer is begun, the capping layer will be progressively removed from the lower layer or perforated such that water infiltrating into the waste can flow unimpeded to a basal leachate collection system.

At the start of land filling at the base of the pit, sufficient operational area may not be available to cap the waste effectively. As such leachate generated from the waste will mix with rain falling directly onto the landfill base. While leachate generated during this time is likely to be diluted by rain falling on uncontaminated areas of the pit base, it will all become trapped within the landfill leachate system. A separate stormwater retention pond will still be available to capture run-off from the sides of the open pit.

Figure 3.5 of the main Environmental Assessment (EA) report presents a graphical summary of the infilling process.

It is anticipated that the 'best case' infilling rate of the landfill will approximate 400,000 tonnes/year (estimated to be 235,000 m<sup>3</sup>/year), however under 'worst case' conditions the infilling rate is likely to approximate 1,000,000 tonnes/year (estimated to be 588,000 m<sup>3</sup>/year). Under best case

conditions it is anticipated that the pit cavity will be infilled within 65 years, this will shorten to approximately 26 years under worst case infilling conditions.

DECC requested that a spreadsheet based model be developed to assess the required discharge rates for leachate; the likely leachate water elevations in the landfill; the required leachate surface storage; and the anticipated discharge rate to sewer.

The spreadsheet based model was developed in accordance with the DECC recommendations and included the following parameters:

- monthly time steps over a period of 100 years;
- the incorporation of 90<sup>th</sup> percentile wet years at year 1 and at 10 year intervals. Average rainfall conditions were used for the remaining years;
- groundwater inflow to the pit of 2 m<sup>3</sup>/day;
- a surface area of the landfill base of 12,000 m<sup>2</sup> and a maximum surface area of 265,000 m<sup>2</sup>;
- in accordance with the Draft Environmental Guidelines, Landfilling (DECC, 2008) there has been an assumption that 50% of rain falling on the temporary capping at the surface of the landfill becomes leachate while the remaining rainfall runs off as surface water. Following this it is assumed that 10% of rain falling on the landfill cap after closure becomes leachate; and
- the spreadsheet model is also designed to incorporate the infilling procedure outlined above.

*Table 6.1* presents the results of the spreadsheet modelling. The spreadsheet water balance model results are summarised below:

# Table 6.1Surface water and Leachate Generation Estimates (Spreadsheet Water<br/>Balance Model)

	Surface Water Inflow (m³/day)	Leachate Generation (m³/day)	Total Inflow (m³/day)						
Minimum	209	45	254						
10th Percentile	238	119	357						
Average	385	241	626						
90th Percentile	507	374	881						
Maximum	1,003	872	1,875						
1. Values are based on monthly rainfall data.									

- leachate generated by the landfill waste can be expected to vary between 45 m<sup>3</sup>/day and 872 m<sup>3</sup>/day;
- surface run-off requiring removal from the pit can be expected to range between 209 and 1,003 m $^3$ /day; and
- the results suggest a much higher total inflow (254 m<sup>3</sup>/day to 1,919 m<sup>3</sup>/day) than the estimates reported by STORM (39 m<sup>3</sup>/day to 204 m<sup>3</sup>/day). This is due to inherent conservatism in the spreadsheet based model developed to meet the DECC requirements and the methodology outlined in the Draft Environmental Guidelines, Landfilling (DECC, 2008). It is also due to the presentation of monthly data in *Table 6.1* above rather than annual values reported by STORM.

The results presented in Table 6.1 represent the results for a 'best case' landfill filling rate. These results were found not to change significantly under worst case conditions (Refer to *Annex I* for the spreadsheet of the Water Balance Modelling).

*Figure 6* of *Annex A* presents the likely variations in leachate water elevations with variations in leachate pumping rates. The proposed capacity of the leachate collection treatment system on site will be 500 m<sup>3</sup>/day. Pumping at this rate, the leachate water elevation within the landfill is estimated to fluctuate up to 3 m above the pit base.

The DECC have suggested that provided leachate elevations are maintained below the base of regional groundwater elevations (to maintain an inward head gradient) leachate may be stored within the landfill. Based on the regional groundwater elevations observed at the site, this would give a potential leachate water elevation approximating 70 to 80 m above the pit base, which suggests that there is potential from time to time to operate at lower pumping rates. However, average pumping rates above 250 m<sup>3</sup>/day are likely required to conservatively ensure a suitable hydraulic gradient into the landfill.

Correspondence with the DECC has indicated that leachate extracted from the landfill must be stored within a contained storage dam with enough freeboard to accept direct rainfall from a 1:25 year ARI 24 hour rainfall event. The rain falling under these conditions was estimated using the methodology outlined in the Australian rainfall runoff guidelines (IAE, 1998) to approximate 156 mm/day.

Based on the above and using the methodology outlined in the Solid Waste Guidance (EPA, 1996) that states that 50% of rainfall becomes leachate, while conservatively assuming no evaporation, it is estimated that this rainfall will generate 20,670 m<sup>3</sup> of leachate. This suggests that an on-site leachate storage capacity of at least 20,670 m<sup>3</sup> plus any additional storage for leachate generated from green waste stockpiles and free board will be required on site, which is significantly in excess of the 2,200 m<sup>3</sup> proposed to store leachate at the site.

However, the DECC have also stated that, "leachate may be stored within the landfill waste provided the saturated levels of the waste is not greater than the height to be able to maintain the flow of groundwater into the void from each of the fracture water bearing zones".

The proposed 20,670 m<sup>3</sup> of potential leachate generated is likely to result in a worst case instantaneous increase in potential leachate water elevations of 8.6 m (17 m for the highest rainfall event on record). This estimated increase in leachate levels in the landfill above those predicted in *Figure 6* of *Annex A* is unlikely to impact the groundwater gradient into the pit at pumping rates greater than 250 m<sup>3</sup>/day. As such, it is considered that the landfill itself can be used as the primary means of storage during high rainfall events, thus reducing the need for significant volumes of surface storage. Based on this the proposed leachate storage capacity of 2,200 m<sup>3</sup> is considered to be acceptable.

The treatment system will also be required to store and treat run-off from the green waste area (approximating a proposed area of 5,000 m<sup>2</sup>) as well as the leachate from the pit. The expected range in leachate generated from the green waste area is estimate to range between 0  $m^3/day$  and 22  $m^3/day$ . Given that the capacity of the proposed treatment system will treat 500  $m^3/day$  and the pumping rates from the landfill may fall as low as 250  $m^{3}/day$ , this is not considered to represent a potential treatment issue. The storage required to hold run-off for a 1 in 25 year ARI 24 hour duration rainfall event from the green waste area will approximate 780 m<sup>3</sup>. The proposed infrastructure is suitable to handle this volume. An assessment has also been made to assess the cumulative storage in green waste over the lifetime of the landfill using the spreadsheet based model. This suggests that to prevent exceedence of the proposed leachate storage capacity prior to treatment (i.e.,  $1,100 \text{ m}^3$ ), a pumping rate of >  $10 \text{ m}^3/\text{day}$  will be required at anytime when there is green waste leachate in storage. It is anticipated that some the  $10 \text{ m}^3/\text{day}$  from the green waste area will be irrigated back onto the green waste to aid in decomposition of the waste, however, some of this may need to be directed through the treatment system.

*Figure* 7 of *Annex A* presents a graphical summary of leachate movement through the collection and treatment systems at the site.

The leachate volume generated post landfill capping is estimated to average 72 m<sup>3</sup>/day, which is based on Draft Environmental Guidelines, Landfilling (DECC, 2008) of 10% rainfall infiltration through the landfill cap. This is in excess of the current groundwater inflow to the pit suggesting that the regional groundwater system may not be able to dissipate the leachate generated. Therefore, after the cessation of leachate dewatering, leachate elevations could eventually rise above the regional groundwater elevations and begin recharging the shallow perched groundwater system, which is potentially capable of handling this recharge volume. Given that it will take in excess of 40 years for the landfill waste to reach this depth time is available to further characterise and investigate options to mitigate leachate generation. However, subject to these findings a liner at shallow depths of the landfill maybe required. However other options, such as higher specification landfill capping and ongoing pump and treatment may also be valid options to mitigate these potential impacts. It is anticipated that it will take approximately 67 years after landfill closure and the cessation of dewatering for leachate levels to approximate elevations within the shallow aquifer system.

#### CONCLUSIONS

7

The main aim of this investigation was to develop a conceptual site model based on credible geological, hydrogeological and hydrochemical data, such that an understanding of the likely water influx to the landfill area and interactions with the surrounding groundwater systems could be adequately characterised. Subsequently the investigation has been completed to provide the background data to allow the preliminary design of an appropriate leachate collection system for the landfill.

The key findings of the investigation are provided below:

- the pit geology comprises shallow fill and clay layers to 18 m bgl, clay and weathered shale to depths of 32 m bgl and Bringelly Shale to depths up to 5 m below the base of the quarry (approximately 140 m bgl). The eastern and southern edges of the pits are fractured and deformed, while the eastern and north eastern edges of the pit are relatively uniform. The fractures are generally sparse and localised. It is estimated from surrounding borehole information that the Hawkesbury Sandstone underlies the Bringelly shale approximately 20 m below the base of the quarry pit;
- a shallow perched and intermittent groundwater system is located within the shallow fill and weathered shale and clay up to depths approximating 32 m bgl. This was observed to have little connection with the open pit (i.e., very little seepage was observed from the clay and weathered shale deposits). Impacts to this intermittent perched aquifer system from leachate are likely to be minimal provided that the leachate levels remain below the depth of this aquifer. Current estimates of fluctuations of the leachate levels during operation suggest leachate levels will be maintained well below this aquifer system. In addition, the potential yield and water quality of this aquifer system suggest that the system is of low human and environmental value;
- a deeper regional aquifer system is present within the shale and volcanic sediments. The permeability of this aquifer system is very low and generally below the recommended permeability of clay liners. Fracture zones are unlikely to significantly impact flow into the pit, as evident in the very low seepage and very steep regional groundwater gradients into the pit. Overall groundwater seepage into the pit was observed to be isolated and low, which supports a calculated seepage of 2 m<sup>3</sup>/day into the quarry pit. The potential yield and water quality of this aquifer system suggest that the system is of low human and environmental value;

- surface water input into the quarry pit void is conservatively estimated to range between 254 m<sup>3</sup>/day and 1,875 m<sup>3</sup>/day, of which between 45 and 872  $m^3/day$  will become leachate (averaging 241  $m^3/day$ ). The pumping rates required to dewater this leachate, while meeting DECC requirements to maintain an inward head gradient, will range between 250 m<sup>3</sup>/day and 500 This pumping rate is within the design specification of the  $m^3/day$ . proposed leachate collection system. Pumping at the proposed design capacity of 500 m<sup>3</sup>/day will result in a 3 metre variation in leachate elevations above the base of the landfill. This will maintain an inward head gradient to the landfill and prevent leachate from migrating into the surrounding regional aquifer system. Pumping at this rate will also provide enough capacity to allow an instantaneous rainfall event from a 1 in 25 year 24 hour event (and the highest rainfall event on record) to be effectively stored within the landfill without impacting on the inward groundwater gradient to the landfill. As such the proposed leachate storage capacity of 2,200 m<sup>3</sup> is considered to be acceptable; and
- After cessation of landfilling and capping of the landfill, leachate generated is likely to average 72 m<sup>3</sup>/day. After the cessation of pumping there is potential for groundwater elevations to eventually rise above the regional groundwater system and recharge the shallow system. However, given the low human and environmental value of surrounding groundwater systems monitoring should be used as a first step to quantify potential adverse impacts, with continued leachate dewatering instigated as required.

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Annex A

## Figures















Annex B

## Photographs



0071234 Light Horse Landfill



Photographs

0071234 Light Horse Landfill









Annex C

## Borelogs

#### Client: Dial a Dump Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Western Side of Quarry, Near Weigh Bridge Site Address: Archbold Road, Eastern Creek, NSW

### ID: BH01



Drill Start Date: **3 October 2007** Drill Finish Date: **6 October 2007** Drill Co: **McDermott Drilling** Driller: **Shaun Taylor** Drill Method: **Auger/Water Flush Rotary** Hole Type: **Monitoring Well**  Total Depth (m): **134.2 m bgl** Hole Diam. / Width (mm): **99 mm** Casing Type: **Class 15 Threaded PVC** Casing Diam. (mm): **50 mm ID** Surface Completion: **Flush Gatic Cover** Water Elevation: **96.02 m bTOC**  Water Level (Final): N/A RL Ground: N/A RL Case: N/A East MGA: N/A North MGA: N/A

Lithology	Symbol	Well		Depth (m)	Sample Type	Sample Details	Remarks
Ground Surface				0			
Concrete Silty Clay Light brown, dry, stiff, low to medium plasticity, silt content increased from 0.3 to 6 m bgl then decreased with depth trace siltstone fragments. Siltstone				-	-		Solid flight auger used between 0.2 and 6 m bgl.
fragments increasing from 5 m bgl.				-	-		Water flush rotary used between 6 and 134.2 m bgl.
Clay Grey, some siltstone fragments, increasing with depth.				10— - - - -	- - - -		Well Construction 0-128 m bgl Class 15 PVC threaded, 128-134 m bgl Class 15 slotted PVCscreen (1 mm slots), 0-128 m bgl cement/bentonite grout, 128-129 m bgl washed fine
Sillatora				- - - - - - - - - - - - - - - - - - -			sand, 129-134 m bgl washed 2-5 mm gravel
Grey, trace clay.				- 30- - -			
				40			Drilling was easy between 40 and 85 m bgl.

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

Log By: E.W. Checked By: S.C.

Client: <b>Dial a Dump</b> Project No: <b>0071234</b>								ID: BH01	
Project Name: Lighthorse Landfill									
Site Name: Eastern Creek Quarry: Western	n Side of Qua	arry, Near Wei	gh Bridge						
Site Address: Archbold Road, Eastern Creek, NSW									
Drill Start Date: 3 October 2007	Total Depth (m): <b>134.2 m bgl</b> Water Level (Final): <b>N/A</b>								
Drill Finish Date: 6 October 2007	Hole Diam. / Width (mm): 99 mm RL Ground: N/A								
Drill Co: McDermott Drilling	Drilling Casing Type: Class 15 Threaded PVC RL Case: N/A								
Driller: Shaun Taylor	ylor Casing Diam. (mm): 50 mm ID East MGA: N/A								
Drill Method: Auger/Water Flush Rotary	Surface C								
Hole Type: Monitoring Well	Water Elevation: 96.02 m bTOC							ERM Australia Pty Ltd	
Lithology		ō		very	(L)	Sample	Sample	Domarko	

Lithology	Symbol	Well	Recoven	Depth (m	Sample Type	Sample Details	Remarks
		N		-			
		N.		-			
		8		-			
		N.		-			
				-			
				60— -			
		N.		-			
		N.		-			
		8		-			
				-			
				70—			
		N		-			
		N		-			
		N.		-			
		8		-			
		8		- 80			
		N.		-			
				-			
				-			Drilling became harder between 85 and 100 m bgl.
				-			
				- 90 —			
Some siltstone fragments at 91 m bgl.		N.		-			
		Ň		-			
		$\mathbb{N}_{\mathbf{v}}$		-			Water level measured at
		<u> </u>		-			96.02 m bTOC on 29/10/07
				- 100			
		89		100-			

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

Log By: **E.W.** Checked By: **S.C.** Page **2** of 3

Client: <b>Dial a Dump</b> Project No: <b>0071234</b>			ID: BH01
Project Name: Lighthorse Landfill			
Site Name: Eastern Creek Quarry: Western	i Side of Quarry, Near Weigh Bridge		
Site Address: Archbold Road, Eastern Cree	ek, NSW		
Drill Start Date: 3 October 2007	Total Donth (m): <b>134.2 m hal</b>	Water Loval (Final): N/A	
Drill Finish Date: 6 October 2007	Hole Diam. / Width (mm): 99 mm	RL Ground: N/A	
Drill Co: McDermott Drilling	Casing Type: Class 15 Threaded PVC	RL Case: N/A	
Driller: Shaun Taylor	Casing Diam. (mm): 50 mm ID	East MGA: N/A	FBM
Drill Method: Auger/Water Flush Rotary	Surface Completion: Flush Gatic Cover	North MGA: N/A	
Hole Type: Monitoring Well	Water Elevation: 96.02 m bTOC		ERM Australia Pty Ltd

Lithology	Symbol	Well	Recovery	Depth (m)	Sample Type	Sample Details	Remarks
End of hole at 134.2 m bgl							A fracture was potentially encountered between 120 and 121 m bgl. Significant water loss was noted during drilling from 123 m bgl.
End of Log				- - -			
				- - - - - - - - -			
				- - 150 _			

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump **ID: BH02** Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Western Side of Quarry, Near Weigh Bridge Site Address: Archbold Road, Eastern Creek, NSW Drill Start Date: 26 October 2007 Total Depth (m): 50 m bgl Water Level (Final): N/A Drill Finish Date: 29 October 2007 Hole Diam. / Width (mm): 99 mm RL Ground: N/A Drill Co: McDermott Drilling Casing Type: Class 15 Threaded PVC RL Case: N/A Casing Diam. (mm): 50 mm I.D. East MGA: N/A Driller: Shaun Taylor E Ł Drill Method: Auger/Water Flush Rotary Surface Completion: Flush Gatic Cover North MGA: N/A Hole Type: Monitoring Well Water Elevation: N/A ERM Australia Pty Ltd Depth (m) Recovery Sample Sample Symbol Lithology Remarks Туре Details Well Ground Surface Concrete Silty Clay Solid flight auger was used Brown, dry, stiff, low plasticity. between 0 and 6.0 m bgl. Clay Water flush rotary was used Grey, some shale fragments, shale fragments between 6.0 and 50 m bgl. increasing with depth. 10 Well Construction 20 0-44 m bgl Class 15 PVC threaded, 44-50 m bgl Class 15 slotted PVC screen (1 mm slots), 0-41 m bgl cement/bentonite grout, 41-42.5 m bgl washed fine sand, 42.5-50 m bgl washed 2-5 mm gravel. 30 Shale Grey. 40 End of hole at 50 m bgl. 50 End of Log

NOTE: This bore log is for environmental purposes only and is not intended to provide geotechnical information.

Log By: E.W. Checked By: S.C. Page 1 of 1

#### Client: Dial a Dump Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Northern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW

Drill Start Date: 9 October 2007 Drill Finish Date: 12 October 2007 Drill Co: McDermott Drilling Driller: Shaun Taylor Drill Method: Auger/Water Flush Rotary Hole Type: Monitoring Well Total Depth (m): **140 m bgl** Hole Diam. / Width (mm): **99 mm** Casing Type: **Class 15 Threaded PVC** Casing Diam. (mm): **50 mm I.D.** Surface Completion: **Monument Gatic** Water Elevation: **102.795 m bTOC**  Water Level (Final): N/A RL Ground: N/A RL Case: N/A East MGA: N/A North MGA: N/A

### ID: BH03



Lithology	Symbol	Well	Recovery	Depth (m)	Sample Type	Sample Details	Remarks
Ground Surface				0			
Fill Silt, grey, dry, dense, trace shale fragments, trace organic matter.				- - - -	-		Solid flight auger was used between 0 and 7.0 m bgl.
Fill Silty clay, mottled dark brown and reddish brown, dry, soft, high plasticity.				- - - 10—	-		Water flush rotary was used between 7.0 and 140 m bgl.
Silty Clay Light brown, soft, trace shale fragments, shale increasing from 13 m bgl.				-	-		Significant water loss between 10 and 15 m bgl (approximately 5000L).
Clay Grey, trace shale fragments.				- - 20 -	-		Continued water loss during remainder of drilling.
Shale Grey.					-		
				30— - - - -	-		Well Construction 0-134 m bgl Class 15 PVC threaded, 134-140 m bgl Class 15 slotted PVC screen (1 mm slots), 0-125 m bgl cement/bentonite grout, 125-125.5 m bgl washed fine
				- - - 40	-		sand, 125.5-140 m bgl washed 2-5 mm gravel.
				- - - - - - 50 —			

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

Log By: E.W. Checked By: S.C. Page 1 of 3

#### Client: Dial a Dump ID: BH03 Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Northern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW Drill Start Date: 9 October 2007 Total Depth (m): 140 m bgl Water Level (Final): N/A Drill Finish Date: 12 October 2007 Hole Diam. / Width (mm): 99 mm RL Ground: N/A Drill Co: McDermott Drilling Casing Type: Class 15 Threaded PVC RL Case: N/A Casing Diam. (mm): 50 mm I.D. East MGA: N/A Driller: Shaun Taylor EI RI Drill Method: Auger/Water Flush Rotary Surface Completion: Monument Gatic North MGA: N/A Hole Type: Monitoring Well Water Elevation: 102.795 m bTOC ERM Australia Pty Ltd Depth (m) Recovery Sample Sample Symbol Lithology Remarks Details Well Туре 60 Drilling considered easy throughout profile. 70

80

90

100

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.
### Client: Dial a Dump ID: BH03 Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Northern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW Drill Start Date: 9 October 2007 Total Depth (m): 140 m bgl Water Level (Final): N/A Drill Finish Date: 12 October 2007 Hole Diam. / Width (mm): 99 mm RL Ground: N/A Drill Co: McDermott Drilling Casing Type: Class 15 Threaded PVC RL Case: N/A Casing Diam. (mm): 50 mm I.D. East MGA: N/A Driller: Shaun Taylor E Z Drill Method: Auger/Water Flush Rotary Surface Completion: Monument Gatic North MGA: N/A Hole Type: Monitoring Well Water Elevation: 102.795 m bTOC ERM Australia Pty Ltd Depth (m) Recovery Sample Sample Symbol Lithology Remarks Details Well Туре Water level measured at 102.795 m bTOC on 29/10/07. 110 120 130 End of hole at 140 m bgl 140 End of Log 150

NOTE: This bore log is for environmental purposes only and is not intended to provide geotechnical information.

Page 3 of 3

#### Client: Dial a Dump Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Landfill: Northern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW

Drill Start Date: 15 October 2007 Drill Finish Date: 16 October 2007 Drill Co: McDermott Drilling Driller: Shaun Taylor Drill Method: Auger/Water Flush Rotary Hole Type: Monitoring Well Total Depth (m): **49.5 m bgl** Hole Diam. / Width (mm): **99 mm** Casing Type: **Class 15 Threaded PVC** Casing Diam. (mm): **50 mm I.D.** Surface Completion: **Monument Gatic** Water Elevation: **46.22 m bTOC**  Water Level (Final): N/A RL Ground: N/A RL Case: N/A East MGA: N/A North MGA: N/A

## ID: BH04



Lithology	Symbol	Well	Recovery	Depth (m)	Sample Type	Sample Details	Remarks
Ground Surface	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			0-			
Fill Silt and gravel, grey, dry, loose, gravel sub rounded to sub angular, maximum 3 cm in diameter.				-	-		Solid flight auger was used between 0 and 6.0 m bgl.
Fill Concrete and blue metal gravel, grey, dense.				-	-		Water flush rotary was used between 6.0 and 50 m bgl.
Fill Clay, reddish brown, soft, high plasticity, trace shale gravel, sub angular.				- 	-		Water loss noted while drilling through fill material. Steady water loss noted during remainder of drilling.
<b>Clay</b> Greyish brown, soft, high plastcity, some shale fragments, shale increasing with depth.				-	-		
Shale Grey, trace clay, clay decreasing with depth			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	20_ - - - - - -	-		Well Construction 0-43.5 m bgl Class 15 PVC threaded, 43.5-49.5 m bgl Class 15 slotted PVC screen (1 mm slots), 0-39.4 m bgl cement/bentonite grout, 39.4-40.9 m bgl washed fine
Shale Grey				- - - 30 –	-		sand, 40.9-49.5 m bgl washed 2-5 mm gravel.
				- - - - - - - - - - - - - - - - - - -			
End of hole at 49.5 m bgl.			•••••				Water level measured at 46.22 m bTOC on 29/10/07.
End of Log				50 — -	-		

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Northern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW

Drill Start Date: 22 October 2007 Drill Finish Date: 22 October 2007 Drill Co: McDermott Drilling Driller: Shaun Taylor Drill Method: Auger/Water Flush Rotary Hole Type: Monitoring Well Total Depth (m): 20.68 m bgl Hole Diam. / Width (mm): 99 mm Casing Type: Class 15 Threaded PVC Casing Diam. (mm): 50 mm I.D. Surface Completion: Monument Gatic Water Elevation: 12.705 m bTOC Water Level (Final): N/A RL Ground: N/A RL Case: N/A East MGA: N/A North MGA: N/A

### ID: BH05



Lithology	Symbol	Well	Recovery	Depth (m)	Sample Type	Sample Details	Remarks
Ground Surface							
Fill Silt and shale gravel, grey, dry, loose, gravel sub rounded to sub angular, maximum diameter 2 cm.							Solid flight auger used between 0 and 6.0 m bgl. Water flush rotary used between 6.0 and 20.68 m bgl.
Shale Grey. No sample return due to significant water loss.				- - - 10			Significant water loss from 6 m bgl. No sample return from 9.0 to 20.0 m bgl due to water loss.
				-			Water level measured at 12.705 m bTOC on 23/10/07. Well Construction 0-14.68 m bgl Class 15 PVC threaded, 14.68-20.68 m bgl
End of hole at 20.68 m bgl. End of Log				- - - 20— -			Class 15 slotted PVC screen (1 mm slots), 0-10.0 m bgl cement/bentonite grout, 10.0-12.0 m bgl washed fine sand, 12.0-20.68 m bgl washed 2-5 mm gravel.

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Eastern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW

Drill Start Date: 22 October 2007 Drill Finish Date: 24 October 2007 Drill Co: McDermott Drilling Driller: Shaun Taylor Drill Method: Auger/Water Flush Rotary Hole Type: Monitoring Well Total Depth (m): **146 m bgl** Hole Diam. / Width (mm): **99 mm** Casing Type: **Class 15 Threaded PVC** Casing Diam. (mm): **50 mm I.D.** Surface Completion: **Monument Gatic** Water Elevation: **128.98 m bTOC**  Water Level (Final): N/A RL Ground: N/A RL Case: N/A East MGA: N/A North MGA: N/A

### ID: BH06



Lithology	Symbol	Well	Recovery	Depth (m)	Sample Sampl Type Details		Remarks
Ground Surface				0			
Fill Silty clay, black to dark brown, moist, stiff, high plasticity, trace blue metal gravel. Colour changes to reddish brown from 1.0 m bgl.					-		Solid flight auger was used between 0 and 6.0 m bgl.
Silty clay, brown, dry, stiff, medium plasticity, trace gravel. Clay Greyish brown, trace shale fragments, shale					-		Water flush rotary was used between 6.0 and 146 m bgl.
fragments increasing with depth.				-10 - - -	•		
Shale Grey, siltstone lenses at 16, 20 and 38 m bgl.				-	-		
				20— - - -			Well Construction 0-140 m bgl Class 15 PVC threaded, 140-146 m bgl Class 15 slotted PVC screen (1 mm slots), 0-130.5 m bgl cement/bentonite grout,
				- - - 30- -	- - - - -		sand, 131-146 m bgl washed 2-5 mm gravel.
				- - - - -			
Shale				40— - -			No significant water loss noted during drilling.
Grey.				- - - - 50-	-		

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump ID: BH06 Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Eastern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW Drill Start Date: 22 October 2007 Total Depth (m): 146 m bgl Water Level (Final): N/A Drill Finish Date: 24 October 2007 Hole Diam. / Width (mm): 99 mm RL Ground: N/A Drill Co: McDermott Drilling Casing Type: Class 15 Threaded PVC RL Case: N/A Driller: Shaun Taylor Casing Diam. (mm): 50 mm I.D. East MGA: N/A F. Drill Method: Auger/Water Flush Rotary Surface Completion: Monument Gatic North MGA: N/A Hole Type: Monitoring Well Water Elevation: 128.98 m bTOC ERM Australia Pty Ltd

Lithology	Symbol	Well	Recovery	Depth (m)	Sample Type	Sample Details	Remarks
				-			
				-			
				- - 60—			
				-			
				-			
				- 70— -			
				-			
				-			
				- 80 - -			
				-			
				- - - 90			
				-			
				- - 100—			

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump **ID: BH06** Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Eastern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW Drill Start Date: 22 October 2007 Total Depth (m): 146 m bgl Water Level (Final): N/A Drill Finish Date: 24 October 2007 Hole Diam. / Width (mm): 99 mm RL Ground: N/A Drill Co: McDermott Drilling Casing Type: Class 15 Threaded PVC RL Case: N/A Driller: Shaun Taylor Casing Diam. (mm): 50 mm I.D. East MGA: N/A E 21 Drill Method: Auger/Water Flush Rotary Surface Completion: Monument Gatic North MGA: N/A Hole Type: Monitoring Well Water Elevation: 128.98 m bTOC **ERM Australia Pty Ltd** Recovery Depth (m) Sample Sample Symbol Lithology Remarks Details Туре Well 110 120 Water level measured at 128.985 m bTOC on 29/10/07. 130

 End of hole at 146 m bgl.
 Image: Constraint of Log
 Image: Constraint of Log
 Image: Constraint of Log
 Image: Constraint of Log

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Eastern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW

Drill Start Date: 25 October 2007 Drill Finish Date: 26 October 2007 Drill Co: McDermott Drilling Driller: Shaun Taylor Drill Method: Auger/Water Flush Rotary Hole Type: Monitoring Well Total Depth (m): **50 m bgl** Hole Diam. / Width (mm): **99 mm** Casing Type: **Class 15 Threaded PVC** Casing Diam. (mm): **50 mm I.D.** Surface Completion: **Monument Gatic** Water Elevation: **42.74 m bTOC**  Water Level (Final): N/A RL Ground: N/A RL Case: N/A East MGA: N/A North MGA: N/A

### ID: BH07



Lithology	Symbol	Well	Recovery	Depth (m)	Sample Type	Sample Details	Remarks
Ground Surface				0			
Fill Silty clay, reddish brown, dry, hard, non plastic.				-			Solid flight auger was used between 0 and 3.0 m bgl.
Clay Brown, trace shale fragments, colour changed to greyish brown from 6.0 m bgl, shale fragments increase with depth.							Water flush rotary was used between 3.0 and 50 m bgl.
				- 10 - - - - - -	· · ·		
Shale Grey.				- 20— - -			Significant water loss from 18.0 m bgl.
							Well Construction 0-44 m bgl Class 15 PVC threaded, 44-50 m bgl Class 15 slotted PVC screen (1 mm slots), 0-40 m bgl cement/bentonite grout, 40-41 m bgl washed fine sand, 41-50 m bgl washed 2-5 mm gravel.
Siltstone Grey.				- - - 40			
Shale Grey.			•				Water level measured at 42.74 m bTOC on 30/10/07.
End of hole at 50 m bgl.				50			
End of Log					·		

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Eastern Side of Quarry Site Address: Archbold Road, Eastern Creek, NSW

Drill Start Date: 25 October 2007 Drill Finish Date: 25 October 2007 Drill Co: McDermott Drilling Driller: Shaun Taylor Drill Method: Auger/Water Flush Rotary Hole Type: Monitoring Well Total Depth (m): 20.78 m bgl Hole Diam. / Width (mm): 99 mm Casing Type: Class 15 Threaded PVC Casing Diam. (mm): 50 mm I.D. Surface Completion: Monument Gatic Water Elevation: N/A Water Level (Final): N/A RL Ground: N/A RL Case: N/A East MGA: N/A North MGA: N/A

### ID: BH08



Lithology	Symbol	Well		Depth (m)	Sample Type	Sample Details	Remarks
Ground Surface				٥			
Fill Silty clay, reddish brown, moist, soft, high plasticity, trace gravel.				-	-		Solid flight auger was used between 0 and 3.0 m bgl.
Clay Yellowish brown, trace shale fragments, shale increasing with depth.				-			Water flush rotary was used between 3.0 and 20 m bgl.
				- - - 10 -			Well Construction 0-14.78 m bgl Class 15 PVC threaded, 14.78-20.78 m bgl Class 15 slotted PVC screen (1 mm slots), 0-10.9 m bgl cement/bentonite grout, 10.9-11.5 m bgl washed fine sand, 11.5-20.78 m bgl washed 2-5 mm gravel.
<b>Shale</b> Grey, trace clay. End of hole at 20.78 m bgl.				- - - - - - - - - - 20			Water level measured at 17.165 m bTOC on 30/10/07.
End of Log			]	-	-		

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

#### Client: Dial a Dump **ID: BH09** Project No: 0071234 Project Name: Lighthorse Landfill Site Name: Eastern Creek Quarry: Western Side of Quarry, Near Weigh Bridge Site Address: Archbold Road, Eastern Creek, NSW Drill Start Date: 29 October 2007 Total Depth (m): 20 m bgl Water Level (Final): N/A Drill Finish Date: 30 October 2007 Hole Diam. / Width (mm): 99 mm RL Ground: N/A Drill Co: McDermott Drilling Casing Type: Class 15 Threaded PVC RL Case: N/A East MGA: N/A Driller: Shaun Taylor Casing Diam. (mm): 50 mm I.D. H. Ł Drill Method: Auger/Water Flush Rotary North MGA: N/A Surface Completion: Flush Gatic Cover Water Elevation: N/A Hole Type: Monitoring Well ERM Australia Pty Ltd Depth (m) Recovery Sample Sample Symbol Lithology Remarks Туре Details Well Ground Surface Concrete Silty Clay Yellowish brown, dry, stiff, medium plasticity. Solid flight auger used between 0 and 6.0 m bgl Water flush rotary used between 6.0 and 20.0 m bgl. Clay Grey, trace shale fragments, shale increasing with 0-14 m bgl Class 15 PVC depth. threaded, 14-20 m bgl Type 15 slotted screen (1 mm slots), 0-10.3 m bal cement/bentonite groute, 10.3-11.1 m bgl washed fine sand, 11.1-20 m bgl washed 10. coarse sand. No significant water loss noted during drilling. Shale Grey, trace clay. Ξ End of hole at 20 m bgl. 20 End of Log

**NOTE:** This bore log is for environmental purposes only and is not intended to provide geotechnical information.

Annex D

# Water Sampling Records

GROUNDWATER MONITORING REPORT												
Client: Di	ial A Du	np					Job	No:	00	071234		
Project: Li	ghthorse	Landfill					We	ll ID:	В	H01		
Location: Ea	astern Cro	eek					Tot	al Depth (m):	1.	35.640		
WELL FINISH:												
Monument	D P	VC Stand P	lipe	<b>√</b> G	atic Co	ver		□ Other:				
WELL DEVELOPMENT	:											
		Stage	e 1	Stage	2				S	Stage 1	Sta	nge 2
Sampler:						Befo	ore	SWL (m):				
Date:								Time:				
Well Atmosphere (pp	m):					Afte	er	SWL (m):				
Method:								Time:				
<b>Total Volume Remov</b>	ed (L):					Dep	oth to	Product (m)	:			
Total Depth to Bottor	n of Well – Before & After Development (m):											
Comments (Before an	d After	Developing	g):									
Appearance and Odo	urs:											
Other: Well was deve	loped by	air lift usin	g a petro	ol air compre	essor in	Octo	ber 2	007.				
WELL PURGING:		[										
Sampler:		C. Agnew	, H. Can	npbell		Befo	ore	SWL (m):	49.18	37		
Date:		21/2/08 <b>Time:</b> 11:40										
Well Atmosphere (pp	m):	-				Afte	er	SWL (m):				
Method:		Bennet Pu	imp					Time:				
Total Volume Remov	ed (L):	130				Dep	oth to	Product (m)	: -			
WELL PURGING – FIE	LD PARA	METER DAT	ГА									1
Vol. Removed (L):	5	10	20	30	40	4	50	60	80	100	128	
Time:	11:51	11:52	11:56	12:00	12:03	]	12:06	12:09	12:17	12:24	12:31	
Temp: (°C)	21.5	21.2	21.2	21.3	21.2	2	-6.15 -0.16			21.2	21.3	
DO (mg/L):	4.68	1.41	0.01	-0.09	-0.17	-	-6.15	-0.16	-0.18	-0.21	-0.22	
EC (μS):	5690	5240	5100	5020	4790		3980	3660	3340	2990	2680	
pH:	6.95	6.71	6.74	6.79	6.86		/.03	7.11	7.15	7.11	7.05	
En (mv):	-135 daun hia	-219 h. avenue de	-230	-230	-229	-	-224	-219	-210	-205	-205	
Appearance and Ode	dour, nig	n suspende	u 10au.									
Appearance and Out	ter gas ra	n out at 12:	<u>п25 оц</u> 15	Jui								
Durged well dry	tel gas la	11 Out at 12.4	+5									
WELL SAMPLING:												
WELL SAMPLING: Samplar:						Ton	n ·					
Data:							<u></u> (%	r nnm).				
Method:						FC	(1)S a	n ppinj. nr mS)•				
Refore SWL (m)						nH·		n msj.				
Time						Eh (	(mV)	•				
Comments: Pump bec	<b>rents:</b> Pump became lodged and could not be retrieved during removal preventing a sample from being obtained											
Appearance and Odo	urs:						ai pi e	, enong a sam	p. <b>.</b> nom	001180014		
Other:	ui și											
Containers Used:												
										□ Field	Filtration P	erformed
Notes: 1. SWL – Stan	ding water	level (m)				Ch	ecked	By:				
2. SWL measure 3 For calibrati	red from th	e top of the ca	sing, highe	st point t Calibration P	ecord'	Da	ite:					
3. FOI CANDFALL	on records,	Terer to Field	Бquipinen	i Canulation K	acoiu							



		GF	ROUND	WATER MO	NITO	RIN	G REPORT			
Client: Di	ial A Dur	np				Job	No:	0071234		
Project: Li	ghthorse	Landfill				We	ll ID:	BH01		
Location: Ea	astern Cre	eek				Tot	al Depth (m):	135.640		
WELL FINISH:										
Monument	<b>D</b> P	VC Stand P	Pipe	✓ Gatic (	Cover		□ Other:			
WELL DEVELOPMENT	•									
		Stage	e 1	Stage 2				Stage 1	Sta	age 2
Sampler:					Bef	ore	SWL (m):			
Date:							Time:			
Well Atmosphere (pp	m):				Aft	er	SWL (m):			
Method:							Time:			
Total Volume Remov	ed (L):				Dep	oth to	Product (m):			
Total Depth to Bottor	n of Wel	l - Before &	& After ]	Development (m	):					
Comments (Before an	d After	Developing	g):							
Appearance and Odo	urs:									
Other:										
WELL PURGING:										
Sampler:		Purging d	etails on	previous page	Bef	ore	SWL (m):			
Date:							Time:			
Well Atmosphere (pp	m):				Aft	er	SWL (m):			
Method:							Time:			
Total Volume Remov	ed (L):				Dep	oth to	Product (m):			
WELL PURGING - FIE	LD PARA	METER DA	ГА				· · ·			
Vol. Removed (L):	160	200	230							
Time:	16:20	16:32	16:43							
Temp: (°C)	21.8	21.5	21.6							
DO (mg/L):	-0.07	-0.19	-0.23							
EC (µS):	5750	4880	3260							
pH:	6.40	6.61	6.68							
Eh (mV):	-180	-206	-189							
<b>Comments:</b> Dry at 23	0 L 16:43	3								
Appearance and Odo	urs: Org	anic odour.	Water i	s clear to transluc	ent					
Other:										
WELL SAMPLING:										
Sampler:					Ten	np. :				
Date:					DO	(% (	or ppm):			
Method:					EC	(µS o	or mS):			
Before SWL (m):					pH	:				
Time:					Eh	(mV)	):			
Comments:										
Appearance and Odo	urs:									
Other:										
<b>Containers Used:</b>										
								🗖 Field F	Filtration F	Performed
Notes: 1. SWL – Stand	Notes: 1. SWL – Standing water level (m) Checked By:									
2. SWL measur 3. For calibrati	red from the on records,	e top of the ca refer to 'Field	sıng, highe Equipmer	est point <u> nt Calibration Record</u> ?	Da	nte:				



		GF	ROUND	WATER ]	Mon	ITORIN	G REPORT					
Client: Dial a Dump							į	lob No: 0	071234			
Project: Light Horse	Landfill						V	Vell ID:	BH02			
Location: Western Loc	ation ne	ar weighbr	idge				Г	otal Dep	th (m):	49.65 mbT	ĨOC	
WELL FINISH:												
Monument	<b>P</b>	VC Stand P	ipe	Gatic	Cover		□ Other:					
WELL DEVELOPMENT	:											
		Stage	: 1	Stage	2		1	St	tage 1	Sta	ige 2	
Sampler:		ļ				Before	SWL (m):					
Date:							Time:					
Well Atmosphere (pp	m):					After	SWL (m):	-				
Method:							Time:	_		_		
Total Volume Remove	ed (L):					Depth to	Product (m)	N/A				
Total Depth to Botton	n of Wel	f Well - Before & After Development (m):										
Comments (Before an	d After	Developing	;):									
Appearance and Odo	urs:											
Other:												
WELL PURGING:												
Sampler:		S.C.				Before	SWL (m):	39.62				
Date:		09/11/200	7				Time:	11.54				
Well Atmosphere (pp	m):	N/A				After	SWL (m)					
Method:		Micropurg	ge				Time:					
Total Volume Remove	ed (L):	130L				Depth to	Product (m)	N/A				
WELL PURGING - FIEL	LD PARA	METER DA	ГА									
Vol. Removed (L):	1L	5L	10L	15L	20L							
Time:	12.26		13.10		_					Τ		
Temp:	17.8	17.1	18.7	18.9	18.4							
DO (pm):	11.42	1.75	1.88	4.39	3.79						<u> </u>	
EC (µS):	3.35	9.27	7.25	6.16	6.35				<u> </u>	Τ	<u> </u>	
pH:	7.84	9.26	9.52	10.05	9.72							
Eh (mV):	177	132	108	84	71							
Comments:						•						
Appearance and Odo	urs <u>:</u>											
Other:												
WELL SAMPLING:												
Sampler:	S.C					Temp. :		18.4				
Date:	09/11/2	2007				DO (ppr	<b>n):</b> 3.7	'9 ppm				
Method:	Bailer					EC (µS):	63	35 us				
Before SWL (m):	Unknov	wn				pH:		9.72				
Time:	_					Eh(mV)	:	71				
Comments:								-				
Appearance and Odo	urs:											
Other:												
Containers Used: 1 x	1L unpr	eserved, 1	x 250mLl	NaO prese	rved							
		`							Gamma Field J	Filtration P	erformed	
Notes: 1. SWL – Stand	ding water	level (m)				Checked	By: E.Watson					
<ol> <li>SWL measure</li> <li>For calibration</li> </ol>	red from the	e top of the cas refer to 'Field	sing, highest Equipment	: point Calibration R	ecord'	Date: 13	/12/07					



		Gi	ROUNDV	WATER ]	Mon	ITORI	NG	REPOR	Т					
Client: Di	ial a Dun	np							Jo	ob No:	00712	234		
Project: Li	ight Hors	e Landfill							W	ell ID:	BH02	2		
Location: W	estern lo	cation, near	r Weighbri	dge					Т	otal Dep	oth (m):		_	
												49.875m	bTOC	
WELL FINISH:														
Monument	<b>D</b> P	VC Stand I	Pipe	☑ Gatic	Cover			Other:						
WELL DEVELOPMENT	•	1								1				
		Stage	e 1	Stage	2					St	tage 1	St	age 2	
Sampler:						Before	;	SWL (m):						
Date:							_	Time:						
Well Atmosphere (pp	m):					After	_	<u>SWL (m):</u> T:						
Method:	. <b>J</b> ( <b>T</b> ).					D4	4.1	Time:	<u>)</u> .					
Total Volume Remov	ea (L): n of Wol	Depth to Product (m):												
Comments (Before an	d After	<u>I - Delore c</u> Developing		evelopmen	nt (m).									
Appearance and Odo	urs:	Developing	5)•											
Other:	ui 51													
WELL PURGING:														
Sampler:		E.W.				Before	,	SWL (m):		1.165r	nbTOC			
Date:		07/11/200	)7					Time:		7:37				
Well Atmosphere (pp	m):	N/A				After		SWL (m):		44.5mbTOC				
Method:		Micropur	ge					Time:		17:00				
<b>Total Volume Remov</b>	ed (L):	110L				Depth	to I	Product (m	):	43mb7	ГОС			
WELL PURGING - FIE	LD PARA	METER DA	ТА	T	1				-		1	1	1	
Vol. Removed (L):	1L	15L	30L	40L	50L	601	Ĺ	70L	8	30L	90L	100L	110L	
Time:	10:00	10:52	11:25	11:48	12:46	13:	24	14:16	1	5	15:42	16:00	16:51	
Temp:	14.7	15.3	17.6	18.3	16.7	18.	0	19.7	]	8.4	17.9	18.2	18.8	
DO (% or ppm):	4.79	2.82	0.58	0.18	0.09	0.2	5	0.28		.33	0.07	2.16	4.35	
EC (µS or mS):	552 001	496	556	512	386	41	0	5.11	:	3.42	456	525	4/0	
рн: Fh (mV);	901	9.51	02	8.93	8.80 75	9.0	0	53	4	7./1 51	9.1	9.02	8.90	
Comments: Plug of cl	$\frac{175}{2}$	of well pu	shed out w	ith screwd	15 Iriver	01		55	•	)1	20	51	49	
Appearance and Odo	urs: Wel	ll full of wa	ter verv si	lty light g	rev clo	udv								
Other: Water very silt	v grevish	brown afte	er water lev	vel below 2	20mbT(	DC/Furt	her	purging rec	juir	ed.				
y .									1					
WELL SAMPLING:														
Sampler:						Temp.	:							
Date:						DO (p	pm)	):						
Method:						EC (µ	S):							
Before SWL (m):						pH:								
Time:						Eh (m	V):							
Comments:														
Appearance and Odo	urs:													
Other:														
Containers Used:														
											Given Field	Filtration I	Performed	
Notes: 1. SWL – Stand	Notes:     1.     SWL – Standing water level (m)       2     SWL – Standing water level (m)													
2. SWL measur 3. For calibration	on records,	refer to 'Field	ising, nighest l Equipment (	point Calibration R	ecord'	Date:		13/	/12/(	)7				



GROUNDWATER MONITORING REPORT												
Client: Di	ial A Dur	np				J	Job	No:	00	71234		
Project: Li	ghthorse	Landfill				V	Wel	l ID:	BH	102		
Location: Ea	astern Cre	eek				ſ	Tota	al Depth (m):	50.	.440		
WELL FINISH:												
Monument	🗖 P	VC Stand P	lipe	<b>√</b> G	atic Cov	ver		□ Other:				
WELL DEVELOPMENT	•											
		Stage	e 1	Stage	2				St	age 1	Sta	age 2
Sampler:						Befor	·e	SWL (m):				
Date:								Time:				
Well Atmosphere (pp	m):					After		SWL (m):				
Method:								Time:				
Total Volume Remov	ed (L):					Depth	h to	Product (m):				
Total Depth to Bottor	n of Wel	l - Before <b>é</b>	& After I	Developmer	nt (m):							
Comments (Before an	d After	Developing	g):								-	
Appearance and Odo	urs:											
Other: Well was devel	loped by	air lift using	g a petrol	air compre	ssor in (	October	er 20	007.				
WELL PURGING:												
Sampler:		H. Campb	ell			Befor	·e	SWL (m):	26.685	5		
Date:	20/2/08 <b>Time:</b> 10:40											
Well Atmosphere (pp	m):	-				After		SWL (m):	Well p	ourged dry		
Method:		Bennet Pu	imp					Time:	14:50			
Total Volume Remov	ed (L):	60L	•			Depth	h to	Product (m):	-			
WELL PURGING – FIE	LD PARA	METER DAT	ГА									
Vol. Removed (L):	5	10	15	30	40	54	1					
Time:	14:10	14:10	14:25	1440	1442	14	4:46					
Temp: (°C)	24.7	22.6	25.2	22.5	22.4	22	2.2					
DO (mg/L):	1.64	0.54	0.23	-0.12	-0.13	-0.	.15					
EC (µS):	1830	1779	1760	1793	1592	15	554					
pH:	7.81	7.86	8.00	8.02	8.12	8.1	14					
Eh (mV):	-37	-148	-202	-224	-231	-2	10					
Comments: Dry after	60 L ren	noved.										
Appearance and Odo	urs: Purg	ge water init	tially clea	ar ( at 5 L) b	pecomin	g grey	wit	h silt.				
Other: Increasing silt	content w	ith purging	, opaque									
WELL SAMPLING:												
Sampler:	C. Agn	ew, S. Mass	son			Temp	).:		22.2°C	2		
Date:	22/2/08					DO (%	% 0	r ppm):	-0.15p	pm		
Method:	Bailer					EC (µ	JS 0	or mS):	1554µ	S		
Before SWL (m):	46.66					pH:			8.14			
Time:	8:45					Eh (m	nV):		-210			
Comments: 1 L unpres	served bo	ottle only <sup>3</sup> / <sub>4</sub>	full									
Appearance and Odo	urs:											
Other:												
<b>Containers Used:</b> 1L	plastic un	preserved b	ottle for	unfiltered s	ample,	125 mL	LH	NO <sub>3</sub> preserved	plastic b	ottle for fil	tered sam	ple
										✓ Field F	iltration P	erformed
Notes: 1. SWL – Standing water level (m) Checked By:												
<ol> <li>SWL measure</li> <li>For calibration</li> </ol>	red from th on records	e top of the cas refer to 'Field	sing, highes Equinment	st point t Calibration R	lecord'	Date:	:					
5. For currorati												



		GI	ROUND	WATER	Mon	ΙΤΟ	RIN	G REPORT				
Client: Di	ial A Dur	np					Job	No:	00	71234		
Project: Li	ghthorse	Landfill					We	ll ID:	BI	H03		
Location: Ea	astern Cre	eek					Tot	al Depth (m):	14	3.33		
WELL FINISH:												
✓ Monument	🗖 P	VC Stand P	Pipe	□G	atic Co	ver		□ Other:				
WELL DEVELOPMENT	:											
		Stage	e 1	Stage	2				S	tage 1	Sta	age 2
Sampler:				0		Bef	ore	SWL (m):		0		0
Date:								Time:				
Well Atmosphere (pp	m):					Afte	er	SWL (m):				
Method:								Time:				
Total Volume Remov	ed (L):					Dep	oth to	Product (m)	:			
Total Depth to Bottor	n of Wel	l - Before &	& After I	Developmei	nt (m):							
Comments (Before an	d After	Developing	g):									
Appearance and Odo	urs:											
Other: Well was devel	loped by	air lift using	g a petrol	l air compre	ssor in	Octol	ber 20	007.				
WELL PURGING:												
Sampler:		J. Lawren	ce			Bef	ore	SWL (m):	56.18	9		
Date:		12/3/08-2	6/3/08					Time:	8:46 1	2/3/08		
Well Atmosphere (pp	m):	_				Afte	er	SWL (m):	140.0	09		
Method:		Bailer						Time:	15:40	26/3/08		
Total Volume Remov	ed (L):	215				Den	oth to	Product (m)	-			
WELL PURGING – FIE	LD PARA	METER DA'	ГА			- 1						
Vol. Removed (L):	15	42	63	77	97		117	132	152	167	177	187
Time:	13:02	14:32	15:13	16:15	14:43		15:26		14:47	15:36	10:33	10:47
Temp: (°C)	22.5	23.4	23.3	22.9	24.0		22.6	24.1	25.8	23.3	22.4	22.2
DO (mg/L):	2.62	3.15	2.43	2.55	3.40		3.0	1.80	2.34	1.97	2.54	2.40
EC (µS):	5180	4600	4910	4150	3440	,	3.13	2264	2005	1843	3240	2990
pH:	12.20	9.92	12.30	12.23	7.94	,	7.98	11.94	11.73	11.49	12.09	12.03
Eh (mV):	-35	-2	-62	-182	42		33	-7	-15	-189	-31	-26
Comments:					•							
Appearance and Odo	urs:											
Other:												
WELL SAMPLING:												
Sampler:	Sampli	ng details o	n next pa	ge		Ten	np. :					
Date:						DO	(% 0	or ppm):				
Method:						EC	(µS o	or mS):				
Before SWL (m):						pH:	:					
Time:						Eh (	(mV)	:				
Comments:												
Appearance and Odo	urs:											
Other:												
Containers Used:												
										✓ Field I	Filtration F	Performed
Notes: 1. SWL – Stand	ding water	level (m)				Ch	necked	By:				
Yotes:       1.       SWL - standing water rever (iii)       Circenced by:         2.       SWL measured from the top of the casing, highest point       Date:         3.       For calibration records, refer to 'Field Equipment Calibration Record'       Date:												



		GI	ROUND	WATER MO	NITO	RIN	G REPORT				
Client: Di	ial A Dur	np				Job	No:	0071234	ŀ		
Project: Li	ghthorse	Landfill				We	ll ID:	BH03			
Location: Ea	astern Cre	eek				Tot	al Depth (m):	143.33			
WELL FINISH:											
✓ Monument	D P	VC Stand F	Pipe	Gatic C	Cover		□ Other:				
WELL DEVELOPMENT	:										
		Stage	e 1	Stage 2				Stage 1	-	Stage 2	
Sampler:					Befe	ore	SWL (m):				
Date:							Time:				
Well Atmosphere (pp	m):				Afte	er	SWL (m):				
Method:							Time:				
Total Volume Remov	ed (L):				Dep	oth to	Product (m):				
Total Depth to Bottor	n of Wel	l - Before &	& After ]	Development (m)	):						
Comments (Before an	d After	Developing	g):								
Appearance and Odo	urs:										
Other:											
WELL PURGING:											
Sampler:		Purging d	etails on	previous page	Befe	ore	SWL (m):				
Sampler:     Purging details on previous page     Before     SwL (m):       Date:     Time:											
Well Atmosphere (pp	m):				Afte	er	SWL (m):				
Method:							Time:				
Total Volume Remov	ed (L):				Dep	oth to	Product (m):				
WELL PURGING – FIE	LD PARA	METER DA'	ГА		A			I			
Vol. Removed (L):	197	207	215								
Time:	11:35	12:19	15:40								
Temp: (°C)	22.5	23.4	25.4								
DO (mg/L):	2.49	2.61	2.81								
EC (µS):	2490	2210	1964								
pH:	11.84	11.66	11.59								
Eh (mV):	-48	6	-1								
Comments:	•							•	<b>i</b>		
Appearance and Odo	urs:										
Other:											
WELL SAMPLING:											
Sampler:	N. Coor	ney, J.Lawr	ence		Ten	np. :		25.4°C			
Date:	27/3/08				DO	(% c	or ppm):	2.81			
Method:	Bailer				EC	(µS o	or mS):	1964 µS			
Before SWL (m):	140.009	)			pH:		,	11.59			
Time:	15:40				Eh (	(mV)	:	-1			
Comments:	1					· /		I			
Appearance and Odo	urs: Wat	er initially	verv clea	r, becoming very	silty.						
Other: duplicate taken	DUP02	<u> </u>	<u> </u>	<u> </u>	).						
<b>Containers Used:</b> 2x 1	L plastic	unpreserve	ed bottles	s for unfiltered sa	mples.	2x 12	25mL HNO <sub>3</sub> pres	served plastic	bottle for fi	ltered	
samples	1	1			1, '			✓ Fi	eld Filtratio	n Performed	
Notes: 1. SWL – Stan	ding water	level (m)			Ch	ecked	By:				
<ol> <li>SWL measurement</li> <li>For calibration</li> </ol>	red from the	e top of the ca refer to 'Field	sing, highe Equipmen	est point at Calibration Record'	Da	ite:	•				



		Gi	ROUND	WATER ]	Mon	ITORIN	G REPOR	Т				
Client: Dial a Dimp								Job N	No:			
Project: Light Horse	Landfill							Well	ID:	BH04	Ļ	
Location: Northern L	ocation							Total	Dept	h (m):	49.96mb7	TOC
WELL FINISH:												
Monument	🗆 P	VC Stand I	Pipe	Gatic	Cover		□ Other:					
WELL DEVELOPMENT	:											
		Stage	e 1	Stage	2				St	age 1	St	age 2
Sampler:						Before	SWL (m):					
Date:							Time:					
Well Atmosphere (pp	m):					After	SWL (m):					
Method:							Time:					
<b>Total Volume Remov</b>	ed (L):					Depth to	) Product (m	ı):				
<b>Total Depth to Botton</b>	n of Wel	l - Before &	& After I	Developmen	ıt (m):							
Comments (Before an	d After	Developing	g):									
Appearance and Odo	urs:											
Other:												
WELL PURGING:		[					Г					
Sampler:		E.W.				Before	SWL (m):	4	5.95n	nbTOC		
Date:		08/11/200	)7				Time:	1	2:05			
Well Atmosphere (pp	m):	N/A				After	SWL (m):	4	8.84n	nbTOC		
Method:		Micropur	ge				Time:	1	5.37			
Total Volume Remov	ed (L):	15L				Depth to	) Product (m	i): N	[/A			
WELL PURGING – FIE	LD PARA	METER DA	ТА									
Vol. Removed (L):	1L	5L	10L									
Time:	12:54	13:15	13:28									
Temp:	20.1	20.3	19.5									
DO (ppm):	6.60	0.19	0.18									
EC (μδ):	2077	2.13	3.3/									
рн: Fh (mV):	7.90	1.52	07									
En (mv):	270	100	9/ omo cilt i	n bottom of	buokot							
Appearance and Ode		numped d	one shi i	mpled	Ducket	•						
Appearance and Odd	urs. wen 270mb T	$\frac{1}{100} = \frac{13}{13}$	19, 1101 Sa <b>15 1.oft</b> or	151 DFM	OVED	A + 1/ 20	water level	racava	arad t	o 18 68m	hTOC	
Other: water level 46		UC @ 13.	45 Tallel	IJL KEW	OVED.	At 14.27	water lever	ICLOVE		0 40.0011		
WELL SAMPLINC:												
Sampler:						Temn ·						
Date:						DO (ppr	n):					
Method:						EC (µS)	:					
Before SWL (m):						<u>р</u> Н:	•					
Time:						Eh (mV)	):					
Comments:								1				
Appearance and Odo	urs:											
Other:												
Containers Used:										Gamma Field	Filtration	Performed
Notes: 1. SWL – Stand	ding water	level (m)				Checked	l By:E.Watson					
<ol> <li>SWL measure</li> <li>For calibration</li> </ol>	red from th on records,	e top of the ca refer to 'Field	sing, highe I Equipmen	st point t Calibration R	ecord'	Date:13/	/12/07					



		GF	ROUND	WATER ]	Moni	ΤΟΙ	RIN	G REPORT				
Client: Di	ial A Dur	np					Job	No:	00	71234		
Project: Li	ghthorse	Landfill					We	ll ID:	BI	104		
Location: Ea	astern Cre	eek					Tot	al Depth (m):	49	.5		
WELL FINISH:								• • •				
<ul> <li>Monument</li> </ul>	🗖 P	VC Stand P	ipe	□G	atic Cov	ver		□ Other:				
WELL DEVELOPMENT	•		+									
	-	Stage	1	Stage	2				S	tage 1	Sta	ige 2
Sampler:				0		Befo	ore	SWL (m):		8		0
Date:								Time:				
Well Atmosphere (pp	m):					Afte	er	SWL (m):				
Method:								Time:				
Total Volume Remov	ed (L):					Dep	th to	Product (m):				
Total Depth to Bottor	n of Wel	l - Before &	k After I	Developmen	nt (m):							
Comments (Before an	d After	Developing	:									
Appearance and Odo	urs:		/									
Other: Well was devel	loped by	air lift using	g a petrol	air compre	ssor in C	Octob	per 20	)07.				
	1 2			1								
WELL PURGING:												
Sampler:		S. Charter	is			Bef	ore	SWL (m):	36.819	9		
Date:		25/2/08	10			DUR	010	Time:	14.15	25/2/08		
Well Atmosphere (nn	m):	-				Afte	er	SWL (m):	49.3			
Method:		Bailer						Time:	11.15	26/2/08		
Total Volume Remov	ed (L):	35				Den	th to	Product (m):	-	20/2/00		
WELL PURGING – FIE	LD PARA	METER DA'	ГА			Dep		Trouver (iii)				
Vol. Removed (L):	5	10	15	20	25	3	30	32	35			
Time:	15.17	15.35	14:03	14:17	16:38	1	16:59	17:18	10:05			
Temp: (°C)	20.4	20.4	20.6	21.4	23.5	2	20.8	21.5	21.9			
DO (mg/L):	1.7	1.58	1.73	1.53	1.85	1	1.75	1.80	2.74			
EC (µS):	3460	3760	4780	5800	6530	4	4350	4660	4830			
pH:	7.52	7.57	7.84	7.81	7.86	7	7.73	7.77	7.62			
Eh (mV):	-195	-198	-183	-174	-95	-	-133	-84	70			
Comments: Checked	pH on 26	5/2/08 9:50.	3.92 in a	pH solution	n of 4.0					11		1
Appearance and Odo	urs: Wat	er initially	verv clear	r, starting to	o turn bro	own	with	sediment after	23 L.			
<b>Other:</b> . Purged 32 L or	n 25/2/08	3, SWL 48.7	7 at 17:1	6. Continue	ed purgin	ng or	n 26/2	2/08, Well dry	after 35 I	L. SWL 49.3	3 at 11:15	. Water
very silty at base of we	ell.	,			1 0	0						
WELL SAMPLING:												
Sampler:	S. Char	teris. J. Lav	vrence			Tem	1D. :		21.9°C	2		
Date:	27/2/08					DO	(% 0	or ppm):	2.74p	om		
Method:	Bailer					EC	(µS o	or mS):	4830	iS		
Before SWL (m):	49.043					pH:	<u> </u>		7.62			
Time:	12:25					Eh (	(mV)	:	70			
Comments:	1						()		1			
Appearance and Odo	urs:											
Other:												
<b>Containers Used:</b> 1L	plastic un	preserved b	ottle for	unfiltered s	ample, 1	l25 n	nL H	NO <sub>3</sub> preserved	plastic b	ottle for filt	ered sam	ple
		1			r •, •			J	1	✓ Field Fi	ltration P	erformed
Notes: 1. SWL – Stan	ding water	level (m)				Ch	ecked	By:				
2. SWL measu	red from th	e top of the ca	sing, highes	st point		Da	te:	•				
3. For calibrati	on records,	reter to Field	Equipment	t Calibration R	ecord	54						



		GF	ROUND	WATER ]	Mon	ITORIN	G REP	ORT				
Client: Dial a Dump								J	ob No:00	71234		
Project: Light Horse	Landfill							W	ell ID:	BH05		
Location:								Г	<b>Total Dep</b>	oth (m):	20.685ml	oTOC
WELL FINISH:												
Monument	<b>D</b> P	VC Stand P	ipe	Gatic Gatic	Cover		Othe	er:				
WELL DEVELOPMENT	:	<del></del>										
		Stage	: 1	Stage	2		1		St	tage 1	Sta	ige 2
Sampler:						Before	SWL (	m):			_	
Date:							Time:					
Well Atmosphere (pp	m):					After	SWL (	m):				
Method:	<u> </u>	 				-	Time:					
Total Volume Remove	ed (L):					Depth to	) Produc	t (m):				
Total Depth to Botton	n of Wel	I - Before ð	<u>x After De</u>	evelopmer	nt (m):							
Comments (Before an	a After	Developing	<b>):</b>									
Appearance and Odo	urs:											
otilei.												
WELL PURCING.												
Sampler:		E.W.				Before	SWL (	m):	12.81r	nb TOC		
Date:		08/11/200	7				Time:	)*	13:00			
Well Atmosphere (pp	m):	N/A				After	SWL (	m):	12:94	mbTOC		
Method:		Bailer					Time:		15:00			
Total Volume Remov	ed (L):	80L				Depth to	Produc	t (m):	N/A			
WELL PURGING - FIE	ld Para	METER DAT	ГА									
Vol. Removed (L):	3L	10L	20L	36L	40L	60L	70L	,	80L			
Time:	13:06	13:15	13:25	13:48	14:05	5 14:22	2 14:4	41	14:51			
Temp:	20.0	20.1	19.6	19.15	19.18	20.4	20.7	7	20.7		ļ	
DO (ppm):	1.79	2.13	1.00	1.84	1.42	2.27	2.59		2.28		ļ	
EC (μS):	18.56	23.20	38.50	38.00	3.560	2.640	) 48.3	30	28.70			
pH:	6.96	7.00	7.00	6.94	6.93	7.00	7.04	1	6.99			
Eh (mV):	226	164	111	117	124	130	135		139		<u> </u>	
Comments: brown, ve	ry silty (	clear initiall	y)									
Appearance and Odo	urs:											
Other:												
WELL SAMPLING.												
WELL SAMPLING:	F W					Tomn ·			20.07			
Date:	$\frac{1}{08/11/2}$	2007				DO (nni	m).		20.07			
Method:	Bailer	.007				EC (µS)			28.70			
Before SWL (m):	Build					<u>не (де)</u> nH:	•		6.99			
Time:	15:05					Eh (mV	):		139			
Comments: brown, ve	ry silty						-					
Appearance and Odo	urs:											
Other:												
<b>Containers Used:</b> 1 x	1L unpre	eserved, 1 x	250ml (su	ılphide) Νε	aOH pro	eserve.						
										Gill Field F	iltration P	erformed
Notes: 1. SWL – Stand	ding water	level (m)				Checkee	l By:E.Wa	tson				
<ol> <li>SWL measure</li> <li>For calibrative</li> </ol>	on records,	e top of the cas refer to 'Field	Equipment	point Calibration R	lecord'	Date:13	/12/07					



		Gr	ROUND	WATER ]	Moni	TORIN	G REP	ORT				
Client: Di	ial A Dur	np				Jo	b No:		00	71234		
Project: Li	ghthorse	Landfill				W	ell ID:		BH	106		
Location: Ea	astern Cre	eek				То	tal Depth	ı (m):	14	5.43		
WELL FINISH:												
✓ Monument	🗖 P	VC Stand P	ipe	□G	atic Cov	/er	□ Othe	er:				
WELL DEVELOPMENT	•											
		Stage	1	Stage	2				St	tage 1	Sta	nge 2
Sampler:						Before	SWL (	m):				
Date:							Time:					
Well Atmosphere (pp	m):					After	SWL (	m):				
Method:							Time:					
Total Volume Remov	ed (L):					Depth t	o Produc	t (m):				
Total Depth to Bottor	n of Wel	l - Before &	k After I	Developmer	nt (m):							
Comments (Before an	d After	Developing	):									
Appearance and Odo	urs:											
Other: Well was devel	oped by	air lift using	g a petrol	air compre	ssor in (	October 2	2007					
WELL PURGING:												
Sampler:		J. Lawrend	ce, S. Ch	arteris		Before	SWL (	m):	70.925	5		
Date:		27/2/08-12	2/3/08				Time:		14:23	27/2/08		
Well Atmosphere (pp	m):	-				After	SWL (	m):	Wellp	ourged dry		
Method:		Bailer					Time:		12:10	12/3/08		
Total Volume Remov	ed (L):	115				Depth t	o Produc	t (m):	-			
WELL PURGING - FIE	LD PARA	METER DAT	ГА									
Vol. Removed (L):	15	31	45	62	67	71	79	9	95	101	105	115
Time:	16:12	14:06	15:30	12:45	12:53	13:0	0 14:5	50	15:48	16:10	14:43	10:32
Temp: (°C)	22.4	20.7	20.4	22.7	21.7	22.3	22.1	1 2	21.92	21.7	21.4	21.0
DO (mg/L):	2.00	2.32	3.35	1.79	1.20	1.12	1.65	5	1.40	1.34	1.76	0.48
EC (µS):	898	930	914	974	976	975	970	8	863	888	789	2015
рН:	10.99	10.4	10.4	10.39	10.21	10.1	6 10.1	12	10.32	10.31	10.09	10.53
Eh (mV):	-226	-285	-238	123	-290	-293	-258	8 -	-2.78	-207	-259	82
Comments: pH calibra	ation chee	cked: 3.92 in	n pH solı	ution of 4.0	28/2/08							
Appearance and Odo	urs: Wat	er is genera	lly frothy	at surface.	Water	is grey, tı	anslucent	to opa	que.			
Other:												
WELL SAMPLING:												
Sampler:	P. McD	ougall				Temp. :			12.0°C	2		
Date:	13/3/08					DO (%	or ppm):		0.48pp	om		
Method:	Bailer					EC (µS	or mS):		2015µ	S		
Before SWL (m):	142.708	3				pH:			10.53			
Time:	10:17					Eh (mV	):		82			
Comments:												
Appearance and Odo	urs:											
Other: duplicate taken	DUP01											
Containers Used: 2x 1	L plastic	unpreserve	d bottles	for unfilter	ed samp	ples, 2x 1	25 mL Hì	NO <sub>3</sub> pr	eserved	plastic bot	tles for filt	ered
samples.										✓ Field F	Filtration P	erformed
Notes: 1. SWL – Stand	ding water	level (m)				Checke	d By:					
<ol> <li>SWL measure</li> <li>For calibration</li> </ol>	red from th on records,	e top of the cas refer to 'Field	sing, highe: Equipmen	st point t Calibration R	lecord'	Date:						



		GF	ROUND	WATER ]	Mon	ITORI	NG	<b>REPORT</b>				
Client: Dial a Dump								J	lob No: 0	071234		
Project: Light Horse	Landfill							V	Vell ID:	BH07		
Location: Eastern Lo	cation							Т	otal Dep	th (m):	51.29mbT	OC
									09/	11/2007 5	0.763MB1	ГОС
WELL FINISH:												
□ Monument	<b>D</b> P	VC Stand F	Pipe	Gatic Gatic	Cover			Other: Mc	nument			
WELL DEVELOPMENT	:								- [		1	
		Stage	e 1	Stage	2				St	tage 1	St	age 2
Sampler:						Before	•	SWL (m):				
Date:								Time:				
Well Atmosphere (pp	m):					After		SWL (m):	_			
Method:								Time:				
Total Volume Remov	ed (L):			•		Depth	to	Product (m):	:			
Total Depth to Botton	n of Wel	I - Before d	& After D	evelopmer	nt (m):							
Comments (Before an	d After	Developing	<u>():</u>									
Appearance and Odo	urs:											
Other:												
WELL DUD ODVO:												
WELL PURGING:		EW				Dofone		SWI (m)	45 202	mhTOC	10 796m	hTOC
Data:		E.W.	7 00	0/11/2007		Delore	;	<u>SWL (III):</u>	7.41		49.70011	biot
Wall Atmosphere (nn	m).	N/A	0	9/11/2007		Aftor		SWI (m):	/.41			
Method:		Micropure	Te			Alter		Time	11.00	0.100		
Total Volume Remov	ed (L)•		50			Denth	to P	Product (m).	11.00			
WELL PURGING – FIE	LD PARA	METER DA'	ГА			Depti	101	Touuet (III).				
Vol. Removed (L):	1L	AMETER DATA 51. 101. 151. 171. 20				201	Ĺ					
Time:	8:10	8:23	8:40	8:58	9:14	9:3	0					
Temp:	17.6	18.6	18.7	18.8	17.8	18.	2					
DO (ppm):	11.96	1.16	0.68	0.36	0.38	0.6	3					
EC (μS):	311	8.68	6.06	9.62	6.4	6.0	69					
pH:	9.34	8.37	8.30	8.38	8.6	8.9	8					
Eh (mV):	243	206	175	147	130	107	7					
Comments: light grey,	, cloudy -	– pumped d	ry at 10:0	0amwall 11	ır							
Appearance and Odo	urs: and	sample if re	ecovered,	Pumped dr	у							
Other: well pumped dr	ry, not sa	mpled.										
WELL SAMPLING:	[											
Sampler:						Temp.	:					
Date:						DO (p	pm	):				
Method:						EC (µ	S):					
Before SWL (m):						pH:						
Time:						Eh (m	V):					
Comments:												
Appearance and Odo	urs:											
Other:												
Containars Used.												
Containers Used:										Field I	Filtration T	Derformed
Notes: 1 SWI - Stand	ting water	level (m)				Check	ked 1	By:E.Watson			manon	enomeu
2. SWL measure	red from th	e top of the ca	sing, highes	t point		Dotor	13/1	2/07				
<ol><li>For calibration</li></ol>	on records,	reter to 'Field	Equipment	Calibration R	ecord'	Dates						



		GF	ROUND	WATER 1	Moni	TOF	RINO	G REPORT	I			
Client: Di	ial A Dur	np					Job	No:	0	071234		
Project: Li	ghthorse	Landfill					Wel	ll ID:	Е	H07		
Location: Ea	astern Cre	eek					Tot	al Depth (m):	5	0.45		
WELL FINISH:												
✓ Monument	🗖 P	VC Stand P	ipe	□Ga	atic Cov	ver		□ Other:				
WELL DEVELOPMENT	:											
		Stage	1	Stage	2					Stage 1	Sta	age 2
Sampler:						Befo	ore	SWL (m):				
Date:								Time:				
Well Atmosphere (pp	m):					Afte	er	SWL (m):				
Method:								Time:				
<b>Total Volume Remov</b>	ed (L):					Dept	th to	Product (m)	:			
<b>Total Depth to Bottor</b>	n of Wel	l - Before &	k After I	Developmen	nt (m):							
Comments (Before an	d After	Developing	):									
Appearance and Odo	urs:											
Other: Well was devel	loped by	air lift using	g a petrol	air compres	ssor in C	Octob	er 20	007				
WELL PURGING:												
Sampler:		J. Lawren	ce			Befo	ore	SWL (m):	31.32	2		
Date:		26/2/08, 2	7/2/08,					Time:	13:1	6 26/2/08		
Well Atmosphere (pp	m):	-				Afte	er	SWL (m):	50.1	8		
Method:		Bailer						Time:	13:0	1 27/2/08		
Total Volume Remov	ed (L):	53				Dept	th to	Product (m)	-			
WELL PURGING – FIE	LD PARA	METER DAT	ГА		1							1
Vol. Removed (L):	5	10	15	20	25	3	30	35	40	46	50	53
Time:	13:54	14:17	14:54	15:20	15:38	1	15:49	16:00	16:13	16:27	12:05	13:01
Temp: (°C)	23.7	25.0	24.3	24.1	22.5	2	22.0	22.4	22.3	22.4	21.1	22.1
DO (mg/L):	1.85	1.35	1.62	1.65	1.30	2	2.40	1.83	2.32	2.41	2.41	3.62
EC (µS):	1179	2239	2660	4500	6420	6	5500	7000	7170	7490	8100	8710
pH:	7.75	7.85	7.85	8.00	8.06	8	3.07	8.13	8.13	8.06	7.69	8.26
Eh (mV):	116	172	170	168	153	1	61	180	181	142	131	153
Comments: Calibratio	on checke	ed 27/2/08,	3.91 in p	H solution c	of 4.0							
Appearance and Odo	urs: Wa	ter becomin	g turbid	after 24 L, v	very silty	y afte	er 451	L.				
Other: Purged 46 L or	n 26/2/08	, SWL 48.3	14 at 16:	24. Continue	ed purgi	ing or	n 27/.	2/08. Before S	SWL 47.	53, after (w	ell dry afte	er 53 L)
SWL 50.18 at 13:01.												
WELL SAMPLING:												
Sampler:	Sample	taken 27/3/	08. Deta	ils on next p	bage.	Tem	<u>ір. :</u>					
Date:						DO (	(% 0	or ppm):				
Method:						<u>ЕС (</u>	(µS o	or mS):				
Before SWL (m):						<u>рн:</u>	10					
lime:						<b>Eh (</b> 1	mv)	•				
Comments:												
Appearance and Odo	urs:											
Other:												
Containers Used:												
										✔ Field I	Filtration F	erformed
Notes: 1. SWL – Stand	ding water	level (m)				Che	ecked	By:				
2. SWL measur 3. For calibration	red from th on records,	e top of the cas refer to 'Field	sing, highes Equipment	st point <u>t Cali</u> bration R	ecord'	Dat	te:					



		GF	ROUND	WATER N	<b>Aon</b> t	ΓORIN	G REPORT				
Client: D	ial A Dur	np				Joł	o No:	00	71234		
Project: Li	ghthorse	Landfill				We	ell ID:	BF	107		
Location: Ea	astern Cre	eek				Tot	tal Depth (m):	50	.45		
WELL FINISH:											
✓ Monument	D P	VC Stand P	ipe	□Ga	tic Cove	er	□ Other:				
WELL DEVELOPMENT	:										
		Stage	-1	Stage 2	2			St	tage 1	Sta	age 2
Sampler:					]	Before	SWL (m):				
Date:							Time:				
Well Atmosphere (pp	m):					After	SWL (m):				
Method:							Time:				
<b>Total Volume Remov</b>	ed (L):				]	Depth to	o Product (m):				
Total Depth to Bottor	n of Wel	l - Before &	<b>&amp; After</b> ]	Development	t (m):						
Comments (Before an	d After	Developing	;):					-			
Appearance and Odo	urs:										
Other:											
WELL PURGING:											
Sampler:		N. Cooney	y, J. Law	rence	]	Before	SWL (m):	39.130	)		
Date:		27/3/08					Time:	8:26 2	7/3/08		
Well Atmosphere (pp	m):	_				After	SWL (m):	50.335	5		
Method:		Bailer					Time:	10:48	27/3/08		
Total Volume Remov	ed (L):	35			]	Depth to	• Product (m):	-			
WELL PURGING – FIE	LD PARA	METER DAT	ГА			-		1			
Vol. Removed (L):	10	20	30	35							
Time:	9:04	9:32	9:55	10:32							
Temp: (°C)	20.6	21.4	20.0	19.7							
DO (mg/L):	2.80	2.36	2.50	3.93							
EC (µS):	17510	18020	18000	17590							
pH:	7.49	7.62	7.71	7.98							
Eh (mV):	72	112	11	67							
Comments: pH calibra	ation chee	cked 4.03 in	n pH solu	ution of 4.0		•			•		
Appearance and Odo	urs:										
Other:											
WELL SAMPLING:											
Sampler:	N. Coor	nev. J. Law	rence		,	Temp. :		19.7			
Date:	27/3/08				]	DO (%)	or ppm):	3.93 p	pm		
Method:	Bailer				]	EC (US	or mS):	17.59	mS		
Before SWL (m):						pH:		7.98			
Time:	]	Eh (mV	):	67							
Comments:					I						
Appearance and Odo	urs:										
Other:											
<b>Containers Used:</b> 1L	plastic un	preserved b	ottle for	unfiltered sa	mple, 1	25 mL H	INO <sub>3</sub> preserved	plastic b	ottle for fil	tered sam	ple
					1 ,				✓ Field Fi	iltration F	· erformed
Notes: 1. SWL – Stan	ding water	level (m)				Checkee	d By:				
2. SWL measu	red from the	e top of the ca	sing, highe	est point	cord'	Date:					
5. For canorati	on records,	relet to Field	Equipmer	n Canoration Re	coru						



		G	ROUND	WATER N	Ionitorin	G REPOR	T					
Client: Dial a Dump							Job No:	0071234				
Project: Light Horse	Landfill						Well ID:	BH08	3			
Location: Eastern Lo	cation						9/11/200	20.71	mbTOC			
WELL FINISH:												
Monument	🗆 P	VC Stand I	Pipe	Gatic C	lover	D Other: N	Monument					
WELL DEVELOPMENT	` <b>.</b>											
		Stag	e 1	Stage 2			5	Stage 1	Sta	age 2		
Sampler:				8	Before	SWL (m)				8		
Date:						Time:						
Well Atmosphere (pp	m):				After	SWL (m)						
Method:						Time:						
Total Volume Remov	ed (L):				Depth t	o Product (n	n):					
Total Depth to Bottor	n of Wel	ll - Before d	& After I	Development	(m):							
Comments (Before an	nd After	Developing	g):		× <i>t</i>							
Appearance and Odo	urs:											
Other:												
WELL PURGING:												
Sampler:		E.W.			Before	SWL (m):	16.22	28mbTOC	(19.892r	nbTOC)		
Sampler:         E.W.         Before         SWL (m):         16.228mbTOC         (19.892mbTOC)           Date:         8/11/2007         9/11/2007         Time:         8:20         (9:30 9/11/2007)												
Date:         8/11/2007         Time:         8:20         (9:30 9/11/2007)           Well Atmosphere (ppm):         N/A         After         SWL (m):         20 12mbTOC         19 95mbTOC												
Method:	)*	Bailer				Time:	11.37	7	16.52			
Total Volume Remov	ed (L):	15L			Depth to	Product (m	):		10.02			
WELL PURGING - FIE	LD PARA	METER DA	ТА			(						
Vol. Removed (L):	11	51.	10L	15L								
Time:	8:29	8:47	9:00	9:30								
Temp:	194	19.2	19.1	190								
DO (nnm):	2.39	2.53	3 16	1 71								
EC (uS):	2.19	3.09	3.13	2.51								
nH:	8.17	8.26	8 33	8.54								
Eh (mV)	189	162	148	119								
<b>Comments:</b> light grey	ish brow	n cloudy (y	verv brow	n silty in one	e pull) verv silt	v/cloudy						
Appearance and Odo	urs: afte	r 10L remo	ved Pum	ned dry at 10	·00	.y/eloudy						
<b>Other:</b> Wait 1hr and st	ample if	recovery	vou. i uni	peu ury ur ro	.00							
		leeovery										
WELL SAMPLINC:												
Sampler:	SC				Temn ·		Not e	nough sam	nle			
Date:	09/11/2	2007			DO (nn	m).	to me	asure wate	r			
Method:	Bailer	2007			EC (µS)		qualit	v naramete	rs			
Before SWL (m):	19 8921	mbTOC			nH·		quant	y paramete				
Time	9.30				Eh (mV	)•						
Comments:	7.50				En (m v	)•						
Annearance and Odo												
<b>Other:</b> 1 x 11 unprese	$\frac{u}{v} = 1$	250mL Na	OH prese	rved								
	ivcu. † i	230mL Ma	on prese	ivcu.								
Containars Usad.												
Containers Useu:								D Field	Filtration I	Derformed		
Notes: 1 SW/I Ston	ding water	level (m)			Chaolza	d Bv·F Wateon			1 111111111111	enomeu		
2. SWL – Stan 2. SWL measu	red from th	ie top of the ca	sing, highes	st point	Direcke	u Dy.E. waison						
<ol><li>For calibrati</li></ol>	on records,	refer to 'Field	d Equipment	Calibration Rec	cord' Date:13	/12/07						



	GROUNDWATER MONITORING REPORT												
Client: Di	ial A Dur	np				Job	o No:	007	1234				
Project: Li	ghthorse	Landfill				We	ell ID:	BHO	)8				
Location: Ea	astern Cre	eek				Tot	tal Depth (m):	20.6	68				
WELL FINISH:													
✓ Monument	🗖 P	VC Stand I	Pipe	□Gat	tic Cover		□ Other:						
WELL DEVELOPMENT	•												
		Stag	e 1	Stage 2				Sta	ge 1	Sta	ige 2		
Sampler:					В	efore	SWL (m):						
Date:							Time:						
Well Atmosphere (pp	m):				Α	fter	SWL (m):						
Method:							Time:						
Total Volume Remov	ed (L):				D	epth to	• Product (m):						
Total Depth to Bottor	n of Wel	l - Before d	& After I	Development	(m):								
Comments (Before an	d After	Developing	g):										
Appearance and Odo	urs:												
Other: Well was devel	loped by	air lift usin	g a petrol	air compress	sor in Oc	tober 2	007.						
WELL PURGING:													
Sampler:		C. Agnew	7		В	efore	SWL (m):	15.555					
Date:		21/2/08					Time:	13:40					
Well Atmosphere (pp	m):	-			Α	fter	SWL (m):	20.439					
Method:		Bailer					Time:	14:10					
Total Volume Remov	ed (L):	22			D	epth to	• Product (m):	-					
WELL PURGING - FIE	LD PARA	METER DA	ТА										
Vol. Removed (L):	5	10	15	20									
Time:	13:43	13:47	13:52	14:08									
Temp: (°C)	21.4	21.1	21.1	21.0									
DO (mg/L):	2.05	1.85	1.55	1.44									
EC (µS):	4010	4120	4110	4090									
pH:	7.13	7.61	7.61	7.61									
Eh (mV):	30	15	13	11									
Comments:													
Appearance and Odo	urs: Wa	ter cloudy a	and brown	n.									
Other:													
WELL SAMPLING:								1					
Sampler:	C. Agn	ew			Т	emp. :		21.0°C					
Date:	22/2/08				D	0 (%	or ppm):	1.44ppn	n				
Method:	Bailer				Е	C (µS (	or mS):	4090µS					
Before SWL (m):	19.94				<b>p</b> ]	H:		7.61					
Time:	8:10				E	h (mV)	):	11					
Comments:													
Appearance and Odo	urs:												
Other:													
Containers Used: 1L	plastic un	preserved	bottle for	unfiltered sar	mple, 12:	5 mL H	INO <sub>3</sub> preserved	plastic bo	ttle for filt	tered sam	ple		
								•	<ul> <li>Field Fi</li> </ul>	ltration P	erformed		
Notes: 1. SWL – Stan	ding water	level (m)	sing highs	st point	Ļ	Checked	l By:						
<ol> <li>SwL measure</li> <li>For calibration</li> </ol>	on records,	refer to 'Field	l Equipmen	t Calibration Rec	cord'	Date:							

			GROU	NDWATI	ER MON	ITORIN	G REPOI	RT				
Client: Dial a Dump								Jo	b <u>No</u> :	: 0071234		
Project: Light Horse	Landfil	ī						We	ell ID	: BH09		
Location: Western lo	ocation n	lear We	ighbridge	;				Т	otal D	epth (m):	20mbTC	C
WELL FINISH:												
Monument	[ <b>D</b>	PVC Sta	and Pipe	<b>G</b>	atic Cover		Other:					
WELL DEVELOPMENT	г:											
		5	Stage 1	St	age 2					Stage 1	St	age 2
Sampler:		$\square$				Before	SWL (m)	:				
Date:							Time:					
Well Atmosphere (pp	pm):					After	SWL (m)	:				
Method:				_			Time:					
Total Volume Remov	ved (L):					Depth to	) Product (1	m):				
Total Depth to Botton	<u>m of We</u>	<u>:ll - Bef</u>	ore & Afte	er Develop	ment (m)	:						
Comments (Before an	nd After	Develo	ping):									
Appearance and Odo	ours:											
Other:												
WELL PURGING:							<u> </u>					
Sampler:		EW				Before	SWL (m)	:	9.24	5mbTOC		
Date:		07/11	/2007				Time:		11:0	)0		
Well Atmosphere (pp	pm):	N/A				After	SWL (m)	:	15.5	54	16.73mb	oTOC
Method:		Baile	r				Time:		17:0	)0	16.35pm	1
<b>Total Volume Remov</b>	ved (L):	90L				Depth to	) Product (1	m):	N/A	L		
WELL PURGING - FIE	ELD PAR/	AMETEF	R DATA	15.39	мвтос	17.5мвТ	OC 17	.40м	вТОС	2	_ 	_
Vol. Removed (L):	5L	13L	20L	40L	50L	60L	70L	80L	,	90L	100	110L
Time:			12:30	13:12	13:34	14:00	15:35	15:5	57	16:04	16:13	16:27
Temp:	17.0	18.4	18.1	18.1	17.8	19.0	17.9	18.6	5	19.4	18.9	18.7
DO (ppm):	4.08	3.77	2.52	2.11	2.14	3.82	4.03	4.33	3	3.09	1.93	2.05
EC (μS):	790	796	1081	15.1	2.39	3.64	37.6	3.82	2	4.55	6.84	6.93
pH:	11.00	11.1	9.52	7.53	8.30	1.66	7.52	7.46	5	7.39	7.37	7.37
Eh (mV):	41	35	59	138	72	99	48	75		109	74	61
Comments: Light gree	y, cloudy	y, cleani	ng slightly	r after 5L re	emove.							
Appearance and Odo	ours: ver	y silty f	rom 14mb	TOB after	20L remov	ved.						
Other: Shale fragmen	its in wat	er after	70L remov	/ed.								
WELL SAMPLING:	<del></del>					•			1			
Sampler:	E.W					Temp. :			18.7	1		
Date:	07/11/	2007				DO (ppr	m):		2.05			
Method:	Bailer					EC (µS)	:		6.93			
Before SWL (m):						pH:			7.37	/		
Time:						Eh (mV)	):		61			
Comments:												
Appearance and Odo	ours:											
Other:												
<b>Containers Used:</b> 1 x	1L unpr	eserved	, 1 X 250n	al NaOH p	reserved.							
						<u> </u>				Give Field	Filtration I	Performed
Notes: 1. SWL – Star	nding water	r level (m)	) d - cosing hi	1 tu aint		Checked	l By: E.Watso	n				
2. SWL measu 3 For calibrat	ured from the	he top of t	the casing, his Field Equipt	ghest point ment Calibrat	ion Record'	Date: 13	3/12/07					



		GI	ROUND	WATER ]	Moni	ITOF	RINO	GROUNDWATER MONITORING REPORT											
Client: D	ial A Du	mp					Job	No:	00	71234									
Project: Li	ghthorse	Landfill					Wel	ll ID:	BI	109									
Location: Ea	astern Cro	eek					Tot	al Depth (m):	20	.087									
WELL FINISH:																			
□Monument	🗖 P	VC Stand F	Pipe	<b>√</b> G	atic Cov	ver		□ Other:											
WELL DEVELOPMENT	:																		
		Stage	e 1	Stage	2				S	tage 1	Sta	age 2							
Sampler:						Befo	ore	SWL (m):											
Date:								Time:											
Well Atmosphere (pp	m):					Afte	r	SWL (m):											
Method:								Time:											
<b>Total Volume Remov</b>	ed (L):					Dept	th to	Product (m):											
Total Depth to Bottor	n of Wel	l - Before &	& After I	Developmer	nt (m):														
Comments (Before an	d After	Developing	g):																
Appearance and Odo	urs:																		
Other: Well was devel	loped by	air lift usin	g a petrol	air compre	essor in (	Octob	er 20	007.											
WELL PURGING:																			
Sampler:		H. Campb	ell			Befo	ore	SWL (m):	8.683										
Date:		20/2/08, 2	1/2/08					Time:	15:00										
Well Atmosphere (pp	m):	-				Afte	r	SWL (m):											
Method:		Bennet Pu	ımp					Time:											
Total Volume Remov	ed (L):	85				Dept	th to	Product (m):	-										
WELL PURGING - FIE	LD PARA	METER DA	ГА																
Vol. Removed (L):	10	35	40	45	50	6	50	70	80	85									
Time:	15:21	15:35	15:39	10:45	10:48	1	0:52	10:55	10:58	11:01									
Temp: (°C)	36.0	23.6	23.8	26	25.6	2	21.5	21.6	21.5	21.3									
DO (mg/L):	0.16	1.14	0.39	4.20	2.83	2	2.02	1.93	2.76	2.80									
EC (µS):	9250	6070	8510	9130	8910	8	3570	8470	8240	8300									
pH:	6.93	7.13	6.98	7.07	6.99	7	7.01	7.03	7.10	7.08									
Eh (mV):	-56	-50	-49	156	110	9	94	84	83	78									
Comments:																			
Appearance and Odo	urs: Init	ially cloudy	and silty	y, becoming	g slightly	y clear	rer o	nce 20 L purge	ed.										
Other: Well dry after	85 L purg	ged																	
WELL SAMPLING:																			
Sampler:	H. Can	pbell				Tem	ıp. :		21.3°C	C									
Date:	22/2/08	3				DO (	(% 0	or ppm):	2.80pj	pm									
Method:	Bailer					EC (	(µS o	or mS):	8300µ	IS									
Before SWL (m):	9.953					pH:			7.08										
Time:	Time:         8:55         Eh (mV):         78																		
Comments:																			
Appearance and Odo	urs: Ver	y clear, no s	suspended	d solids															
Other:																			
Containers Used: 1L	plastic ur	preserved l	pottle for	unfiltered s	ample,	125 m	nL H	NO <sub>3</sub> preserved	l plastic b	ottle for fil	tered sam	ple							
						-				✓ Field F	iltration F	Performed							
Notes: 1. SWL – Stan	ding water	level (m)		·: ·		Che	ecked	By:											
<ol> <li>SWL measu</li> <li>For calibrati</li> </ol>	rea from th on records,	e top of the ca refer to 'Field	sing, highes Equipment	st point t Calibration R	lecord'	Dat	te:												

Annex E

Hydraulic Testing -Groundwater Elevation Plots and Analytical Results









### ERM Australia Ltd.

Pumping Test Analysis Report				
Project:	Eastern Creek			
No:	0071234			
Client:	Dial a Dump Industries			

		В	H03 (Hvorslev)					
0	2122	2452 4	Time [s]	6367356	8489808	10612260	BH03	
ΟΨ/Ψ								
Test name: BH03								
Analysis method: Hvorslev								
Analysis results	<u>::</u>			Conduct	ivity:	2.03E-1	11 [m/s]	
Test parameter	: Test well:		BH03	Aquifer t	Aquifer thickness:		120 [m]	
	Screen radi	ius: (	0.05 [m]					
	Screen leng	gth: 0	6 [m]					
	Casing radi	us: (	0.025 [m]					
Comments:								
						Evaluated by: Date:	17/03/2008	




L		Pu Pro		Pumping Test Analysis Report				
0	EDM Australia L to			Project: 0071234 - Light Horse Landfill				
EDM	ERM AUStralia Lto	No: 0071234						
EINIVI		Client:						
OUY	15424.2	4-50 m w ell (Hvor Time [ 30848.4	Client: rslev) [5] 46272.	Dial a Dump In	8 7712	e1 ■ BH04		
<u>Test name:</u> <u>Analysis method:</u>	BH04-50 m well Hvorslev							
<u>Analysis results:</u>				Conductivity:	9.1	4E-11 [m/s]		
Test parameters:	Test well:	BH04		Aquifer thickness	s: 6 [r	6 [m]		
	Screen radius:	0.05 [m]						
	Screen length:	6 [m]						
	Casing radius:	0.025 [m]						
Comments:								
					Evaluated Date:	by: 12/11/2007		

1			Pumping Test Analysis Report					
0	EDM Australia Ltd		Project: 0071234 - Light Horse Landfill					
EDM	ERIM AUStralia Ltu	•	No:	0071234				
EKIVI		(		Dial a Dump Industrie	es			
Que Test name: Analysis method:	BH04-50 BH04-50 m well Bouwer-Rice	0 m w ell (Bouw e Time [ 30848.4	Client: er-Rice) s] 46272	.6 61696.8	77121 • BH04			
Analysis results:				Conductivity:	7.37E-11 [m/s]			
Test parameters:	Test well:	BH04		Aquifer thickness:	6 [m]			
	Screen radius:	0.05 [m]		Gravel pack Porosity (%	ú) 25			
	Screen length:	6 [m]						
	Casing radius:	0.025 [m]						
	r(eff):	0.033 [m]						
<u>Comments:</u>					Evaluated by: Date: 12/11/2007			





























Annex F

## Long Term Groundwater Elevation Observation Data



















Annex G

## Laboratory Reports





Accredited for compliance with ISO/IEC 17025. The Accretine to compute with aborner measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the APLAC mutual recognition arrangement for the Austanaianation standards (ATA is a signal of the the APLAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

AOIS AUSTRALIAN QUARANTINE AND INSPECTION SERVICE

#### SYDNEY License No. N0356

Quarantine Approved Premises criteria 5.1 for quarantine Quarantine Approved Premises criteria 5.1 for quarantine containment level 1 (QCI) facilities. Class five criteria cover premises utilised for research, analysis and testing of biological material, soil, animal, plant and human products.

**CUSTOMER CENTRIC - ANALYTICAL CHEMISTS** 

#### FINAL CERTIFICATE OF ANALYSIS - ENVIRONMENTAL DIVISION

E036376 Laboratory Report No: ERM Australia Pty Ltd (NSW) **Client Name:** Lighthorse Landfill **Client Reference:** Stefan Charteris **Contact Name:** A08951 **Chain of Custody No:** WATER Sample Matrix:

Cover Page 1 of 4 plus Sample Results

Date Received: 22/02/2008 Date Reported: 28/02/2008

This Final Certificate of Analysis consists of sample results, DQI's, method descriptions, laboratory definitions, and internationally recognised NATA accreditation and endorsement. The DQO compliance relates specifically to QA/QC results as performed as part of the sample analysis, and may provide an indication of sample result quality. Transfer of report ownership from Labmark to the client shall only occur once full & final payment has been settled and verified. All report copies may be retracted where full payment has not occured within the agreed settlement period.

QUALITY CONTROL

#### QUALITY ASSURANCE CRITERIA

			GLOBAL ACCEPTANCE CRITERIA (GAC)				
Accuracy: Precision:	matrix spike: lcs, crm, method: surrogate spike: laboratory duplicate:	<ol> <li>1 in first 5-20, then 1 every 20 samples</li> <li>1 per analytical batch</li> <li>addition per target organic method</li> <li>1 in first 5-10, then 1 every 10 samples</li> </ol>	Accuracy:	spike, lcs, crm surrogate:	general analytes 70% - 130% recovery phenol analytes 50% - 130% recovery organophosphorous pesticide analytes 60% - 130% recovery phenoxy acid herbicides, organotin 50% - 130% recovery		
	laboratory triplicate:	boratory triplicate: re-extracted & reported when duplicate RPD values exceed acceptance criteria		anion/cation bal: +/- 10% (0-3 meq/l), +/- 5% (>3 meq/l) method black:			
Holding Times:	soils, waters:	Refer to LabMark Preservation & THT table VOC's 14 days water / soil VAC's 7 days water or 14 days acidified VAC's 14 days soil SVOC's 7 days water, 14 days soil	r recision.	duplicate lab RPD (metals): duplicate lab RPD:	0-30% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL) 0-50% (>10xEQL), 0-75% (5-10xEQL) 0-50% (<5xEQL)		
		Pesticides 7 days water, 14 days soil Metals 6 months general elements Mercury 28 days	QUALITY CONTROL ANALYTE SPECIFIC ACCEPTANCE CRITERIA (ASAC)				
Confirmation:	target organic analysis:	GC/MS, or confirmatory column	Accuracy:	spike, lcs, crm surrogate:	analyte specific recovery data <3xsd of historical mean		
Sensitivity:	EQL:	Typically 2-5 x Method Detection Limit (MDL)	Uncertainty	y: spike, lcs:	measurement calculated from historical analyte specific control		
RESULT ANNO	DTATION				charts		

Data Quality Objective matrix spike recovery s: Data Quality Indicator d: Estimated Quantitation Limit t: not applicable r:

laboratory duplicate laboratory triplicate RPD relative % difference p: pending laboratory control sample lcs: certified reference material crm: mb: method blank

bcs: batch specific lcs bmb: batch specific mb

David Burns Quality Control (Report signatory) david.burns@labmark.com.au



Ivan Povolny Authorising Chemist (NATA signatory) ivan.povolny@labmark.com.au

math

Simon Mills Authorising Chemist (NATA signatory) simon.mills@labmark.com.au

This document is issued in accordance with NATA's accreditation requirements.

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LabMark PTY LTD ABN 27 079 798 39 \* MELBOURNE: 116 Moray Street, South Melbourne VIC 3205 \* Telephone: (03) 9686 8344 \* Fax: (03) 9686 7344 \* SYDNEY: Unit 1, 8 Leighton Place Asquith NSW 2077 \* Telephone: (02) 9476 6533 \* Fax: (02) 9476 8219

Form QS0144, Rev. 1 : Date Issued 06/02/08



ENVIRONMENTAL LABORATORIES

#### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

#### Laboratory Report: E036376

Cover Page 2 of 4

#### NEPC GUIDELINE COMPLIANCE - DQO

# GENERAL A. Results relate specifically to samples as received. Sample results are not corrected for matrix spike, lcs, or surrogate recovery data. B. EQL's are matrix dependant and may be increased due to sample dilution or matrix interference. C. Laboratory QA/QC samples are specific to this project.

- D. Inter-laboratory proficiency results are available upon request. NATA accreditation details available at www.nata.asn.au.
- E. VOC spikes & surrogates added to samples during extraction, SVOC spikes & surrogates added prior to extraction.
- F. Recovery data outside GAC limits shall be investigated and compared to ASAC (historical mean +/- 3sd). If recovery data <20%, then the relevant results for that compound are considered not reliable.
- G. Recovery data (ms, surrogate, crm, lcs) outside ASAC limits shall initiate an investigative action. Anomolous QC data is examined in conjunction with other QC samples and a final decision whether to accept or reject results is provided by the professional judgement of the senior analyst. The USEPA-CLP National Functional Guidelines are referred to for specific recommendations.
- H. Extraction (preparation) date refers to the date that sample preparation was initiated. Note that certain methods not requiring sample preparation (eg. VOCs in water, etc) may report a common extraction and analysis date.
- I. LabMark shall maintain an official copy of this Certificate of Analysis for all tracable reference purposes.

#### 2. CHAIN OF CUSTODY (COC) & SAMPLE RECEIPT NOTICE (SRN) REQUIREMENTS

- A. SRN issued to client upon sample receipt & login verification.
- B. Preservation & sampling date details specified on COC and SRN, unless noted.
- C. Sample Integrity & Validated Time of Sample Receipt (VTSR) Holding Times verified (preservation may extend holding time, refer to preservation chart).

#### 3. NATA ACCREDITED METHODS

- A. NATA accreditation held for each in-house method and sample matrix type reported, unless noted below (Refer to subcontracted test reports for NATA accreditation status).
- B. NATA accredited in-house laboratory methods are referenced from NEPC, ASTM, modified USEPA / APHA documents. Corporate Accreditation No. 13542.
- C. Subcontracted analyses: Refer to Sample Receipt Notice and additional DQO comments. Reported by Sydney Analytical Laboratories, NATA accreditation No.1884.

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ENVIRONMENTAL LABORATORIES

#### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

#### Laboratory Report: E036376

Cover Page 3 of 4



### 4. QA/QC FREQUENCY COMPLIANCE TABLE SPECIFIC TO THIS REPORT

Matrix:	WATER						
Page:	Method:	Totals:	#d	%d-ratio	#t	#s	%s-ratio
1	Chloride	3	0	0%	0	0	0%
2	Fluoride	3	0	0%	0	0	0%
3	Sulphate	3	0	0%	0	0	0%
4	Nitrate as N	3	0	0%	0	0	0%
4	Nitrite as N	3	0	0%	0	0	0%
5	Ammonia as N	3	0	0%	0	0	0%
6	Major cations	3	0	0%	0	0	0%
7	Alkalinity (CO3, HCO3, OH)	3	0	0%	0	0	0%
8	Sulphide	2	1	50%	0	0	0%

#### GLOSSARY:

#d	number	of disc	rete du	plicate	extractions/	analyses	performed	l.

%d-ratio NEPC guideline for laboratory duplicates is 1 in 10 samples (min 10%).

#t number of triplicate extractions/analyses performed.

#s number of spiked samples analysed.

%s-ratio USEPA guideline for laboratory matrix spikes is 1 in 20 samples (min 5%).

#### 5. ADDITIONAL COMMENTS SPECIFIC TO THIS REPORT

A. All tests were conducted by LabMark Environmental Sydney, NATA accreditation No. 13542, Corporate Site No. 13535, unless indicated below.

B. The following test was conducted by Sydney Analytical Laboratories, NATA accreditation No.1884. :-SAL20364. Results for sulphide issued on 27/02/08.

C. Sample BH08 not analyzed for sulphide due to insufficient sample volume available; client informed on 22/02/08.

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ENVIRONMENTAL LABORATORIES

#### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS



Laboratory Report: E036376

Cover Page 4 of 4

Laboratory QA/QC data shall relate specifically to this report, and may provide an indication of site specific sample result quality. LabMark <u>DOES</u> <u>NOT</u> report <u>NON-RELEVANT BATCH QA/QC</u> data. Acceptance of this self assessment certificate does not preclude any requirement for a QA/QC review by a accredited contaminated site EPA auditor, when and wherever necessary. Laboratory QA/QC self assessment references available upon request.

This document is issued in accordance with NATA's accreditation requirements.

 LabMark PTY LTD
 ABN 27 079 798 397

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 \* Telephone: (02) 9476 6533
 \* Fax: (02) 9476 8219
 \* Telephone: (03) 9686 8344
 \* Fax: (03) 9686 7344
Gi alanania	Labora	tory Report	t No: E	036376			Page	: 1 of 8	H	inal
	Client ]	Vame:	E	RM Australi	a Pty Ltd (N	SW)	plus e	over page	Ŭ	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Š	tefan Charter	is		Date:	: 28/02/08	C	of Analysis
	Client ]	Reference:	Γ	ighthorse La	ndfill 00712	34	This re]	port supercedes reports	issued on: N/A	
Laboratory Identification		142647	142648	142649	lcs	dm				
Sample Identification		BH02	80HB	BH09	QC	QC				
Depth (m)		ł	:	1	ł	ł				
Sampling Date recorded on COC		22/2/08	22/2/08	22/2/08	1	1				
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08				
Laboratory Analysis Date		25/2/08	25/2/08	25/2/08	26/2/08	26/2/08				
Method : E033.1/E045.1/E047.1 Chloride Chloride	EQL 1	534	226	2640	102%	<1				
Results expressed in mg/l unless otherwise spec	cified							-	-	

E033.1/E045.1/E047.1: Determination by colour and/or by Ion Chromatography. Sample filtered through a 0.45um filter prior to analysis.

Git alsonauls	Labora	tory Report	t No: E	036376			Page	: 2 of 8		Final
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (N	SW)	plus e	cover page		Certificate
ENVIRONMENTAL LABORATORIES	Contact	t Name:	Š	tefan Charter	is		Date:	: 28/02/08		of Analysis
	Client ]	Reference:	Г	ighthorse La	ndfill 00712	34	This rej	port supercedes rej	ports issued on: N//	
Laboratory Identification		142647	142648	142649	lcs	qm				
Sample Identification		BH02	BH08	BH09	QC	бc				
Depth (m)		ł	1	ł	1	1				
Sampling Date recorded on COC		22/2/08	22/2/08	22/2/08	!	1				
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08				
Laboratory Analysis Date		25/2/08	25/2/08	25/2/08	26/2/08	26/2/08				
Method : E034.1/E045.1 Fluoride	EQL									
Fluoride	0.1	0.5	0.5	<0.1	77%	<0.1				
Results expressed in mg/l unless otherwise spec	ified									

E034.1/E045.1: Determined by FIA-Ion Selective Electrode and/or by Ion Chromatography. Samples filtered through a 0.45um filter prior to analysis.

Gir als Annuly	Labor	itory Report	t No: E	036376			Page: 3	of 8	Final
	Client	Name:	E	RM Australi	a Pty Ltd (N	SW)	plus cove	r page	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Ś	tefan Charter	is		<b>Date:</b> 28/	02/08	of Analysis
	Client	Reference:	L	ighthorse La	ndfill 00712	34	This report s	percedes reports issued on:	N/A
Laboratory Identification		142647	142648	142649	lcs	qm			
Sample Identification		BH02	BH08	BH09	QC	бс			
Depth (m)		ł	1	1	1	1			
Sampling Date recorded on COC		22/2/08	22/2/08	22/2/08	1	1			
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08			
Laboratory Analysis Date		25/2/08	25/2/08	25/2/08	25/2/08	25/2/08			
Method : E042.1/E045.1/E056.1 Sulphate Sulphate	EQL 2	14	131	$\langle 2$	96%	<2			
Results expressed in mg/l unless otherwise spec	cified								-

1 ò 5

Comments:

E042.1/E045.1/E056.1: Determination by colour and/or by Ion Chromatography. Sample filtered through 0.45um prior to analysis.

Gi abaaal	Labora	tory Report	t No: E	036376			Page:	4 of 8		Final
	Client ]	Name:	E	RM Australi	a Pty Ltd (N	SW)	plus cc	ver page		Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Ś	tefan Chartei	is		Date:	28/02/08		of Analysis
	Client ]	Reference:	L	ighthorse La	ndfill 00712	34	This repo	rt supercedes rel	oorts issued on: N/	Ą
Laboratory Identification		142647	142648	142649	lcs	qm				
Sample Identification		BH02	BH08	BH09	QC	QC				
Depth (m)		ł	1	ł	1	ł				
Sampling Date recorded on COC		22/2/08	22/2/08	22/2/08	1	-				
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08				
Laboratory Analysis Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08				
Method: E037.1/E051.1 Nitrite as N NO2-N	<b>EQL</b> 0.01	0.02	0.34	<0.01	81%	<0.01				
Method : E037.1/E051.1 Nitrate as N NO3-N	<b>EQL</b> 0.01	0.06	0.31	0.01	105%	<0.01				

Results expressed in mg/l unless otherwise specified

Comments:

E037.1/E051.1: Nitrate determined by colour. Sample filtered through 0.45um prior to analysis. E037.1/E051.1: Nitrite determined by colour. Sample filtered through 0.45um prior to analysis.

GI - PARTICI	Labora	tory Report	t No: E	036376			Page: 5 of	8	Final	
	Client ]	Vame:	E	RM Australi	a Pty Ltd (N	SW)	plus cover p	age	Certificate	
ENVIRONMENTAL LABORATORIES	Contact	t Name:	S	tefan Charter	is		<b>Date:</b> 28/02	/08	of Analysis	
	Client ]	Reference:	Ľ	ighthorse La	ndfill 00712	34	This report supe	rcedes reports issued on: N	4/A	
Laboratory Identification		142647	142648	142649	lcs	dm				
Sample Identification		BH02	BH08	BH09	QC	QC				
Depth (m)		ł	1	1	ł	1				
Sampling Date recorded on COC		22/2/08	22/2/08	22/2/08	1	1				
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08				
Laboratory Analysis Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08				
Method:E036.1/E050.1 Ammonia as N Ammonia	<b>EQL</b> 0.01	1.29	0.83	2.89	100%	<0.01				
Results expressed in mg/ nuless otherwise spec	cified									T

na specific 20 ndvo en

Comments:

E036.1/E050.1: Determined by colour. Sample filtered through 0.45um prior to analysis.

Gi abaaal	Labor	atory Report	t No: E	3036376			<b>Page:</b> 6 of 8		Final
	Client	Name:	H	ERM Australi	a Pty Ltd (N	(MS	plus cover page		Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Charter	ris		<b>Date:</b> 28/02/08		of Analysis
	Client	Reference:	Γ	ighthorse La	ndfill 00712	34	This report supercedes repo	rts issued on: N/A	-
Laboratory Identification		142647	142648	142649	lcs	dm			
Sample Identification		BH02	BH08	BH09	QC	QC			
Depth (m)					1	ł			
Sampling Date recorded on COC		22/2/08	22/2/08	22/2/08	1	1			
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08			
Laboratory Analysis Date		26/2/08	26/2/08	26/2/08	26/2/08	26/2/08			
Method:E020.1/E030.1 Major cations	EQL								
Calcium	0.1	13	21.6	118	110%	<0.1			
Magnesium	0.1	4.5	42.7	172	110%	<0.1			
Sodium	0.1	518	880	1440	109%	<0.1			
Potassium	0.1	11.2	10.7	24	107%	<0.1			
							-	_	

Results expressed in mg/l unless otherwise specified

Comments:

E020.1/E030.1: Sample directly analysed by Flame AAS and/or ICP-OES.

Gal all An and	Labora	tory Report	t No: E	036376			Page: 7.	of 8		Final	
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (N	ISW)	plus cove	r page		Certificate	•
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Chartei	is		<b>Date:</b> 28/	02/08		of Analysis	
	Client ]	Reference:	Γ	ighthorse La	ndfill 00712	34	This report su	thercedes reports	issued on: N//	A	
Laboratory Identification		142647	142648	142649	lcs	qm					
Sample Identification		BH02	BH08	BH09	ებ	бC					
Depth (m)		ł	ł	1	1	1					
Sampling Date recorded on COC		22/2/08	22/2/08	22/2/08	1	-					
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08					
Laboratory Analysis Date		22/2/08	22/2/08	22/2/08	22/2/08	22/2/08					
Method : E035.1 Alkalinity (CO3, HCO3, OH)	EQL										
Carbonate	S	Ş	$\delta$	$\Diamond$	1	$\Diamond$					
Bicarbonate	5	433	738	859	108%	$\lesssim$					
Hydroxide	5	Ş	Ş	$\Diamond$	1	$\Diamond$					
Results expressed in mg/l unless otherwise snee	cified										T

wise specified IIII IIIg/I III 2 C C C NCOULD CAPICO

Comments:

E035.1: Determination by colour and/or by titration, followed by calculation. Results expressed as CaCO3.

GI - LA Manula	Labora	tory Report	t No: E	036376			Page	: 8 of 8		Final
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (N	(MS)	plus e	cover page		Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Chartei	ris		Date	: 28/02/08		of Analysis
	Client ]	Reference:	Γ	ighthorse La	ndfill 00712	34	This re	port supercedes re	ports issued on: 1	٨/A
Laboratory Identification		142647	142649	142647d	142647r	qm				
Sample Identification		BH02	60HB	QC	бc	бC				
Depth (m)		ł	ł	1	1	1				
Sampling Date recorded on COC		22/2/08	22/2/08	1	-	-				
Laboratory Extraction (Preparation) Date		22/2/08	22/2/08	22/2/08	1	22/2/08				
Laboratory Analysis Date		26/2/08	26/2/08	26/2/08	:	26/2/08				
Method : DMR Sulphide Sulphide	<b>EQL</b> 0.1	<0.1	<0.1	<0.1	-	<0.1				
Results expressed in mg/l unless otherwise spec	cified			-				+		

4 á 1

Comments:

DMR: Determination by Iodometric Titration



Quality, Service, Support

Sample **Receipt** 



Notice (SRN) for E036376

	Client Detai	ls	Laboratory	Reference Information
Client Name: Client Phone:	ERM Australia Pty 02 8584 8888	Ltd (NSW)	Please hav when	ve this information ready contacting Labmark.
Client Fax: Contact Name:	02 8584 8800 Stefan Charteris		Laboratory Report:	E036376
Contact Email:	Stefan.Charteris@	erm.com	Quotation Number:	- Not provided, standard prices apply
Client Address:	Locked Bag 24 Broadway NSW 20	007	Laboratory Address:	Unit 1, 8 Leighton Pl. Asquith NSW 2077
Project Name:	Lighthorse Landfil		Phone:	61 2 9476 6533
Project Number:	0071234		Fax:	61 2 9476 8219
CoC Serial Number	:A08951		Sample Receipt Contac	t: Jakleen El Galada
Purchase Order:	- Not provided -	ind (manufes by Cr20mm an	Email:	jakleen.galada@labmark.com.au
Surcharge:	due date)	led (results by 6:30pm on	Reporting Contact:	Jyothi Lal
Sample Matrix:	WATER		Email:	jyothi.lal@labmark.com.au
Date Sampled (ear Date Samples Rece Date Sample Rece Date Preliminary R	liest date): eived: ipt Notice issued: eport Due:	22/02/2008 22/02/2008 25/02/2008 28/02/2008	NATA Accreditation: TGA GMP License: APVMA License: AQIS Approval: AQIS Entry Permit:	13542 185-336 (Sydney) 6105 (Sydney) NO356 (Sydney) 200521534 (Sydney)
Reporting Require	ments: Electronic	c Data Download required:Ye	es Ir	voice Number: 30583
Sample Condition:	COC rece Samples Samples Samples Security s Sample c	eived with samples. Report r received in good order . received with cooling media: received chilled. seals not required. Direct Lak ontainer & chemical preserve	number and lab ID's define Crushed ice . omark's custody taken . ation suitable .	ed on COC.
Comments:	S2 subco	ntracted to SAL.		
Holding Times:	Date rece	vived allows for sufficient time	e to meet Technical Holdir	ng Times.
Preservation:	Chemical	preservation of samples sat	isfactory for requested an	alytes.
Important Notes:	anaibly dianage of a	pont oustomor soil and wate		the divintegration of the completed A

LabMark shall responsibly dispose of spent customer soil and water samples which includes the disintegration of the sample label. A sample disposal fee of \$1.00 is applicable on all samples received by the laboratory regardless of whether they have undergone analytical testing. Sample disposal of environmental samples shall be 31 days (water) and 3 months (soil, HN03 preserved samples) after laboratory receipt, unless otherwise requested in writing by the client. Samples requested to be held in non-refrigerated storage shall incur \$5.00/ sample/ 3 months. Additional refrigerated storage shall incur \$30/ sample/ 3 months. Combination prices apply only if requested. Transfer of report ownership from LabMark to the client shall occur once full and final payment has been settled and verified. All report copies may be retracted where full payment does not occur within the agreed settlement period.

Analysis comments:

Subcontracted Analyses:

Reported by Sydney Analytical Laboratories, NATA accreditation No.1884.

Thank you for choosing Labmark to analyse your project samples.

Additional information on www.labmark.com.au



# Quality, Service, Support

The table below represents LabMark's understanding and interpretation of the customer supplied sample COC request (refer to SRN comments section on first page for external subcontracting method details). Please confirm that your COC request has been entered correctly. Due to THT and TAT requirements, testing shall commence immediately as per this table, unless the customer intervenes with a correction prior to testing.

GRID REVIEW TABLE		_		_			_		Re	ques	ted A	nalys	sis				
No. Date Depth Client Sample ID	Major cations	Alkalinity (CO3, HCO3, OH)	Chloride	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	NOX (as N)	PREP Not Reported	Sulphate	External Sulphide						
142647 22/02 BH02	٠	٠	٠	۰	٠	٠	٠	٠	٠	٠	٠						
142648 22/02 BH08	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠						
142649 22/02 BH09	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠						
Totals:	3	3	3	3	3	3	3	3	3	3	3						

'PREP Not Reported' refers to an internal laboratory instruction - client confirmation of this parameter is not required.

Thank you for choosing Labmark to analyse your project samples. Additional information on www.labmark.com.au

**Report Date : 25/02/2008** Report Time: 9:28:08AM

Sample Receipt



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2. Do you wish any	v sediment laye	ts in water	r to ba extu	ided from	extrac	tions?					T	۰ú		38 443	88 			101 / DE	acy 2	S'No	~						ψ,	ontarin	Trits etc.	ctal detectio etc)
4. % of extreneous	to reported white material remov	are sample red from s	e batches a ramples to t	tre < 10 st be reports	ample: 5d as t	S <sup>2</sup> Xer NE	PM5.	1.13				(900-) 08 6 8	нац	390) -	esticion 				as) <sup>5</sup>	x <sup>SL</sup>	พิเท						<u>، ک</u>	Jung	4 Sa)	5 þ.e
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Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the APLAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports. AQIS AUSTRALIAN QUARANTINE AND INSPECTION SERVICE

SYDNEY License No. N0356.

Quarantine Approved Premises criteria 5.1 for quarantine containment level 1 (QCI) facilities. Class five criteria cover premises utilised for research, analysis and testing of biological material, soil, animal, plant and human products.

#### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

# FINAL CERTIFICATE OF ANALYSIS - ENVIRONMENTAL DIVISION

Laboratory Report No:E036442Client Name:ERM Australia Pty Ltd (NSW)Client Reference:0071234Contact Name:Stefan CharterisChain of Custody No:S4203Sample Matrix:WATER

Cover Page 1 of 4 plus Sample Results

Date Received: 27/02/2008 Date Reported: 05/03/2008

This Final Certificate of Analysis consists of sample results, DQI's, method descriptions, laboratory definitions, and internationally recognised NATA accreditation and endorsement. The DQO compliance relates specifically to QA/QC results as performed as part of the sample analysis, and may provide an indication of sample result quality. Transfer of report ownership from Labmark to the client shall only occur once full & final payment has been settled and verified. All report copies may be retracted where full payment has not occured within the agreed settlement period.

QUALITY CONTROL

#### QUALITY ASSURANCE CRITERIA

			GLOBAL A	CCEPTANCE C	CRITERIA (GAC)
Accuracy: Precision:	matrix spike: lcs, crm, method: surrogate spike: laboratory duplicate:	<ol> <li>in first 5-20, then 1 every 20 samples</li> <li>per analytical batch</li> <li>addition per target organic method</li> <li>in first 5-10, then 1 every 10 samples</li> </ol>	Accuracy:	spike, lcs, crm surrogate:	general analytes 70% - 130% recovery phenol analytes 50% - 130% recovery organophosphorous pesticide analytes 60% - 130% recovery phenoxy acid herbicides, organotin 50% - 130% recovery
	laboratory triplicate:	re-extracted & reported when duplicate RPD values exceed acceptance criteria	Precision:	anion/cation bal	: +/- 10% (0-3 meq/l), +/- 5% (>3 meq/l) not detected >95% of the reported EOL
Holding Times:	soils, waters:	Refer to LabMark Preservation & THT table VOC's 14 days water / soil		duplicate lab RPD (metals):	0-30% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)
		VAC's 7 days water or 14 days acidified VAC's 14 days soil SVOC's 7 days water 14 days soil		duplicate lab RPD:	0-50% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)
		Pesticides 7 days water, 14 days soil Metals 6 months general elements Mercury 28 days	QUALITY ANALYTE	Control Specific Ac	CEPTANCE CRITERIA (ASAC)
Confirmation:	target organic analysis:	: GC/MS, or confirmatory column	Accuracy:	spike, lcs, crm surrogate:	analyte specific recovery data <3xsd of historical mean
Sensitivity:	EQL:	Typically 2-5 x Method Detection Limit (MDL)	Uncertaint	y: spike, lcs:	measurement calculated from historical analyte specific control
RESULT ANNO	OTATION				charts
Data Quality Obj	jective s: mat	trix spike recovery p: pending		bcs: bat	ch specific lcs
Data Quality Ind	icator d: labo	oratory duplicate lcs: laborator	y control samp	le bmb: bat	ch specific mb

Estimated Quantitation Limit t:

not applicable

laboratory triplicate

r:

RPD relative % difference

David Burns Quality Control (Report signatory) david.burns@labmark.com.au

crm:

mb:

certified reference material

method blank

Geoff Weir Authorising Chemist (NATA signatory) geoff.weir@labmark.com.au

Small.

Simon Mills Authorising Chemist (NATA signatory) simon.mills@labmark.com.au

This document is issued in accordance with NATA's accreditation requirements.

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Form QS0144, Rev. 1 : Date Issued 06/02/08



# CUSTOMER CENTRIC - ANALYTICAL CHEMISTS



#### Laboratory Report: E036442

Cover Page 2 of 4

# NEPC GUIDELINE COMPLIANCE - DQO

#### 1. GENERAL Results relate specifically to samples as received. Sample results are not corrected for matrix spike, lcs, or A. surrogate recovery data. Β. EQL's are matrix dependant and may be increased due to sample dilution or matrix interference. C. Laboratory QA/QC samples are specific to this project. D. Inter-laboratory proficiency results are available upon request. NATA accreditation details available at www.nata.asn.au. E. VOC spikes & surrogates added to samples during extraction, SVOC spikes & surrogates added prior to extraction. F. Recovery data outside GAC limits shall be investigated and compared to ASAC (historical mean +/- 3sd). If recovery data <20%, then the relevant results for that compound are considered not reliable. G. Recovery data (ms, surrogate, crm, lcs) outside ASAC limits shall initiate an investigative action. Anomolous QC data is examined in conjunction with other QC samples and a final decision whether to accept or reject results is provided by the professional judgement of the senior analyst. The USEPA-CLP National Functional Guidelines are referred to for specific recommendations. H. Extraction (preparation) date refers to the date that sample preparation was initiated. Note that certain methods not requiring sample preparation (eg. VOCs in water, etc) may report a common extraction and analysis date. I. LabMark shall maintain an official copy of this Certificate of Analysis for all tracable reference purposes.

# 2. CHAIN OF CUSTODY (COC) & SAMPLE RECEIPT NOTICE (SRN) REQUIREMENTS

- A. SRN issued to client upon sample receipt & login verification.
- B. Preservation & sampling date details specified on COC and SRN, unless noted.
- C. Sample Integrity & Validated Time of Sample Receipt (VTSR) Holding Times verified (preservation may extend holding time, refer to preservation chart).

# 3. NATA ACCREDITED METHODS

- A. NATA accreditation held for each in-house method and sample matrix type reported, unless noted below (Refer to subcontracted test reports for NATA accreditation status).
- B. NATA accredited in-house laboratory methods are referenced from NEPC, ASTM, modified USEPA / APHA documents. Corporate Accreditation No. 13542.
- C. Subcontracted analyses: Refer to Sample Receipt Notice and additional DQO comments. Reported by Sydney Analytical Laboratories, NATA accreditation No.1884.

This document is issued in accordance with NATA's accreditation requirements.

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# 6) LabMark

ENVIRONMENTAL LABORATORIES

# CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

# Laboratory Report: E036442

Cover Page 3 of 4



# 4. QA/QC FREQUENCY COMPLIANCE TABLE SPECIFIC TO THIS REPORT

Matrix:	WATER						
Page:	Method:	Totals:	#d	%d-ratio	#t	#s	%s-ratio
1	Total alkalinity	2	0	0%	0	0	0%
2	Chloride	2	0	0%	0	0	0%
3	Fluoride	2	0	0%	0	0	0%
4	Sulphate	2	0	0%	0	0	0%
5	Nitrite as N	2	0	0%	0	0	0%
5	Nitrate as N	2	0	0%	0	0	0%
6	Ammonia as N	2	0	0%	0	0	0%
7	Total Nitrogen (as N)	2	0	0%	0	0	0%
8	Major cations	2	0	0%	0	0	0%
9	Alkalinity (CO3, HCO3, OH)	2	0	0%	0	0	0%
10	Sulphide	2	1	50%	0	0	0%

# GLOSSARY:

#d number of discrete duplicate extractions/analyses performed.

%d-ratio NEPC guideline for laboratory duplicates is 1 in 10 samples (min 10%).

#t number of triplicate extractions/analyses performed.

#s number of spiked samples analysed.

%s-ratio USEPA guideline for laboratory matrix spikes is 1 in 20 samples (min 5%).

This document is issued in accordance with NATA's accreditation requirements.



# CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

#### Laboratory Report: E036442

Cover Page 4 of 4



# 5. ADDITIONAL COMMENTS SPECIFIC TO THIS REPORT

A. All tests were conducted by LabMark Environmental Sydney, NATA accreditation No. 13542, Corporate Site No. 13535, unless indicated below.

B. The following test was conducted by Sydney Analytical Laboratories, NATA accreditation No.1884. :-Sulphide, SAL reference SAL20378 issued 04/03/2008.

Laboratory QA/QC data shall relate specifically to this report, and may provide an indication of site specific sample result quality. LabMark <u>DOES</u> <u>NOT</u> report <u>NON-RELEVANT BATCH QA/QC</u> data. Acceptance of this self assessment certificate does not preclude any requirement for a QA/QC review by a accredited contaminated site EPA auditor, when and wherever necessary. Laboratory QA/QC self assessment references available upon request.

This document is issued in accordance with NATA's accreditation requirements.

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	Labora	tory Report	t No: E	036442			Page	: 1 of 10		Final	
	Client ]	Name:	E	RM Australi	a Pty Ltd (NSV	<b>V</b> )	plus	cover page		Certifica	lte
ENVIRONMENTAL LABORATORIES	Contact	t Name:	S	tefan Charter	is		Date	: 05/03/08		of Analysis	
	Client ]	Reference:	ŏ	071234			This re	port supercedes re	ports issued on:	04/03/08	
Laboratory Identification		143287	143288	lcs	mb						
Sample Identification		QP01	BH05	бc	QC						
Depth (m)		ł	12	1							
Sampling Date recorded on COC		26/2/08	26/2/08	+	1						
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08						
Laboratory Analysis Date		28/2/08	28/2/08	28/2/08	28/2/08						
<b>Method : E035.1</b> <b>Total alkalinity</b> Alkalinity	EQL 5	442	1360	114%	€						
Results expressed in mg/l unless otherwise spec	cified				-						

E035.1: Determination by colour and/or by titration. Results expressed as CaCO3.

Gir als An and	Labora	atory Repor	t No: E	036442			<b>Page:</b> 2 of 1	0	Final	
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (NSV	<i>W</i> )	plus cover p	ıge	Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Charter	is		<b>Date:</b> 05/03/	08	of Analysis	
	Client ]	Reference:	0	071234			This report super	cedes reports issued or	r: 04/03/08	
Laboratory Identification		143287	143288	lcs	dm					<b></b>
Sample Identification		QP01	BH05	QC	QC					
Depth (m)		1	12	1	1					
Sampling Date recorded on COC		26/2/08	26/2/08	1	1					
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08					1
Laboratory Analysis Date		27/2/08	27/2/08	27/2/08	27/2/08					
Method: E033.1/E045.1/E047.1 Chloride	EQL									
Chloride	1	54	175	103%	<1					
Results expressed in mg/l unless otherwise spec	cified									1

E033.1/E045.1/E047.1: Determination by colour and/or by Ion Chromatography. Sample filtered through a 0.45um filter prior to analysis.

Gu -lana-ula	Labora	tory Repor	t No: E	036442			<b>Page:</b> 3 of 10		Final	
	Client ]	Name:	Ц	RM Australi	a Pty Ltd (NSW	(/	plus cover page		Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Ś	tefan Charter	is		<b>Date:</b> 05/03/08		of Analysis	
	Client ]	Reference:	0	071234			This report supercedes	reports issued on:	04/03/08	
Laboratory Identification		143287	143288	lcs	dm					
Sample Identification		QP01	BH05	QC	QC					
Depth (m)		1	12	1	1					
Sampling Date recorded on COC		26/2/08	26/2/08	1	1					
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08					
Laboratory Analysis Date		27/2/08	27/2/08	27/2/08	27/2/08					
Method : E034.1/E045.1 Fluoride	EQL									
Fluoride	0.1	0.3	0.2	92%	<0.1					
Results expressed in mg/l unless otherwise spec	sified									

E034.1/E045.1: Determined by FIA-Ion Selective Electrode and/or by Ion Chromatography. Samples filtered through a 0.45um filter prior to analysis.

Gu - LAA	Labora	tory Report	t No: E	036442		<b>Page:</b> 4 of 1(	0	Final
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (NSW)	plus cover pa	ge	Certificate
ENVIRONMENTAL LABORATORIES	Contact	t Name:	Ś	tefan Charter	is	<b>Date:</b> 05/03/(	8	of Analysis
	Client ]	Reference:	õ	071234		This report superce	edes reports issued on	04/03/08
Laboratory Identification		143287	143288	lcs	mb			
Sample Identification		QP01	BH05	бc	QC			
Depth (m)		ł	12	1				
Sampling Date recorded on COC		26/2/08	26/2/08	1	:			
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08			
Laboratory Analysis Date		27/2/08	27/2/08	27/2/08	27/2/08			
Method : E042.1/E045.1/E056.1 Sulphate	EQL							
Sulphate	0	117	395	100%	<2			
Results expressed in mg/l unless otherwise spec	ified							

E042.1/E045.1/E056.1: Determination by colour and/or by Ion Chromatography. Sample filtered through 0.45um prior to analysis.

Git als Analy	Labora	tory Report	t No: E	036442			Page: 5 of	0	Final	
	Client <b>N</b>	Vame:	Ш	RM Australi	a Pty Ltd (NS	(M)	plus cover p	age	Certificate	
ENVIRONMENTAL LABORATORIES	Contact	t Name:	St	tefan Charter	is		<b>Date:</b> 05/03,	80,	of Analysis	
	Client <b>F</b>	Reference:	0	071234			This report super	cedes reports issued on	04/03/08	
Laboratory Identification		143287	143288	lcs	qm					
Sample Identification		QP01	BH05	QC	QC					
Depth (m) Sampling Date recorded on COC		 26/2/08	12 26/2/08	1 1	1 1					
Laboratory Extraction (Preparation) Date Laboratory Analysis Date		27/2/08 28/2/08	27/2/08 28/2/08	27/2/08 28/2/08	27/2/08 28/2/08					
Method : E037.1/E051.1 Nitrite as N NO2-N	<b>EQL</b> 0.01	0.01	<0.01	84%	<0.01					
Method : E037.1/E051.1 Nitrate as N NO3-N	<b>EQL</b> 0.01	2.76	8.29	110%	<0.01					
										ſ

Results expressed in mg/l unless otherwise specified

Comments:

E037.1/E051.1: Nitrate determined by colour. Sample filtered through 0.45um prior to analysis. E037.1/E051.1: Nitrite determined by colour. Sample filtered through 0.45um prior to analysis.

Gu - baarle	Labora	tory Report	t No: E	036442			<b>Page:</b> 6 of 10		Final	
	Client ]	Name:	Ë	RM Australi	a Pty Ltd (NSW	(,	plus cover page		Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Š	tefan Charter	is		<b>Date:</b> 05/03/08		of Analysis	
	Client ]	Reference:	ō	071234			This report supercede	s reports issued on:	04/03/08	
Laboratory Identification		143287	143288	lcs	$\mathbf{mb}$					
Sample Identification		QP01	30HB	QC	QC					
Depth (m)		1	12	1	1					
Sampling Date recorded on COC		26/2/08	26/2/08	1	1					
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08					
Laboratory Analysis Date		28/2/08	28/2/08	28/2/08	28/2/08					
<b>Method:E036.1/E050.1</b> <b>Ammonia as N</b> Ammonia	<b>EQL</b> 0.01	<0.01	<0.01	104%	<0.01					
Results expressed in mg/l unless otherwise spec	cified									Ī

5, à 5

Comments:

E036.1/E050.1: Determined by colour. Sample filtered through 0.45um prior to analysis.

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	Client	Name:	Щ	RM Australi	a Pty Ltd (NSW)	plus cov	er page	Certificate
ENVIRONMENTAL LABORATORIES	Contac	et Name:	S	tefan Chartei	is	<b>Date:</b> 05	//03/08	of Analysis
	Client	Reference:	0	071234		This report	supercedes reports issued on	: 04/03/08
Laboratory Identification		143287	143288	lcs	dm			
Sample Identification		QP01	BH05	бc	QC			
Depth (m)		1	12	1	-			
Sampling Date recorded on COC		26/2/08	26/2/08	1	1			
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08			
Laboratory Analysis Date		28/2/08	28/2/08	28/2/08	28/2/08			
<b>Method : E038.1</b> <b>Total Nitrogen (as N)</b> Total Nitrogen (as N)	<b>EQL</b> 0.1	3.9	8.5	82%	<0.1			
Recults expressed in ma/Lunless otherwise snew	ified							

Kesults expressed in mg/l unless otherwise specified

Comments:

E038.1: Total Nitrogen by calculation.

Gu - La Manula	Labora	tory Report	t No: E(	036442			Page: 8 of	10	Final	
	Client ]	Name:	E	RM Australi	a Pty Ltd (NSW	(/	plus cover p	age	Certificat	(۵
ENVIRONMENTAL LABORATORIES	Contac	t Name:	St	efan Chartei	is		<b>Date:</b> 05/03	/08	of Analysis	
	Client ]	Reference:	00	171234			This report super	cedes reports issued or	: 04/03/08	
Laboratory Identification		143287	143288	lcs	dm					
Sample Identification		QP01	BH05	QC	QC					
Depth (m)		ł	12	1	1					
Sampling Date recorded on COC		26/2/08	26/2/08	-						
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08					
Laboratory Analysis Date		3/3/08	3/3/08	29/2/08	29/2/08					
Method: E020.1/E030.1 Meior options	FOI									
Calcium	0.1	4.1	66.1	105%	<0.1					
Magnesium	0.1	2.6	85.9	103%	<0.1					
Sodium	0.1	280	702	105%	<0.1					
Potassium	0.1	2.5	1.7	105%	<0.1					
						_			-	Ī

Results expressed in mg/l unless otherwise specified

Comments:

E020.1/E030.1: Sample directly analysed by Flame AAS and/or ICP-OES.

Gal all An and	Labora	tory Report	t No: E	3036442			Page	: 9 of 10		Final	
	Client <b>N</b>	Vame:	Ц	ERM Australi	a Pty Ltd (NS	(M)	plus e	cover page		Certific	ate
ENVIRONMENTAL LABORATORIES	Contact	t Name:	S	tefan Chartei	ris		Date	: 05/03/08		of Analysis	
	Client I	Reference:	0	071234			This rej	port supercedes	reports issued on	: 04/03/08	
Laboratory Identification		143287	143288	lcs	qm						
Sample Identification		QP01	BH05	QC	QC						
Depth (m)		1	12	1	1						
Sampling Date recorded on COC		26/2/08	26/2/08	1	1						
Laboratory Extraction (Preparation) Date		27/2/08	27/2/08	27/2/08	27/2/08						
Laboratory Analysis Date		28/2/08	28/2/08	28/2/08	28/2/08						
Method : E035.1 Alkalinity (CO3, HCO3, OH)	EQL										
Carbonate	5	ŝ	Ş	ł	ŝ						
Bicarbonate	5	442	1360	114%	$\Diamond$						
Hydroxide	S	$\Diamond$	$\Diamond$	1	Ş						
Results expressed in mg/l unless otherwise spec	cified										Ī

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Comments:

E035.1: Determination by colour and/or by titration, followed by calculation. Results expressed as CaCO3.

Gu - La Manula	Labora	itory Repor	t No: E	036442			Page: 1(	) of 10	Final	
	Client ]	Name:	Щ	IRM Australi	a Pty Ltd (N	(MS)	plus cove	r page	Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Chartei	ris		<b>Date:</b> 05,	03/08	of Analysis	
	Client ]	Reference:	0	071234			This report s	upercedes reports issued	on: 04/03/08	
Laboratory Identification		143287	143288	143287d	143287r	qm				
Sample Identification		QP01	BH05	QC	QC	бc				
Depth (m)		1	12	1	ł	1				
Sampling Date recorded on COC		26/2/08	26/2/08	1	1	+				
Laboratory Extraction (Preparation) Date		28/2/08	28/2/08	28/2/08	1	28/2/08				T
Laboratory Analysis Date		3/3/08	3/3/08	3/3/08	-	3/3/08				
Method : DMR Sulphide Sulphide	<b>EQL</b> 0.1	<0.1	<0.1	<0.1	-	<0.1				
Results expressed in mg/l unless otherwise spec	cified									T

DMR: Determination by Iodometric Titration



Quality, Service, Support



Receipt



Notice (SRN) for E036442

	Clie	nt Detai	S	Laborat	tory Reference Information	
Client Name: Client Phone:	ERM Au 02 8584	stralia Pty 8888	Ltd (NSW)	Please w	e have this information ready hen contacting Labmark.	
Client Fax:	02 8584	8800				
Contact Name:	Stefan C	Charteris		Laboratory Report:	EU36442	
Contact Email:	Stefan.C	Charteris@	erm.com	Quotation Number	Not provided, standard prices apply	
Client Address:	Locked Broadwa	Bag 24 ay NSW 20	007	Laboratory Addres	SS: Unit 1, 8 Leighton Pl. Asquith NSW 2077	
Project Name:	0071234	1		Phone:	61 2 9476 6533	
Project Number:	- Not pro	ovided -		Fax:	61 2 9476 8219	
CoC Serial Number	:S4203			Sample Receipt Co	ntact: lakleen El Galada	
Purchase Order:	- Not pro	ovided -		Fmail.	iakleen galada@labmark.com au	
Surcharge:	No surcl	harge appli	ied (results by 6:30pm on	Reporting Contact:	: .lvothi l al	
	due date	e)		Email:	ivothi.lal@labmark.com.au	
Sample Matrix:	WATER				10540	
Date Sampled (earl Date Samples Rece Date Sample Recei Date Preliminary R	liest date eived: pt Notice eport Du	e): e issued: e:	26/02/2008 27/02/2008 27/02/2008 04/03/2008	NATA Accreditation:         13542           5/02/2008         TGA GMP License:         185-336 (Sydney)           7/02/2008         APVMA License:         6105 (Sydney)           4/03/2008         AQIS Approval:         NO356 (Sydney)		
<b>Reporting Require</b>	ments:	Electronic	Data Download required: Ye	es	Invoice Number: 30654	
Sample Condition:		COC rece Samples Samples Samples Security s Sample c	eived with samples. Report r received in good order . received with cooling media: received chilled. seals not required. Direct Lat ontainer & chemical preserva	number and lab ID's d Crushed ice . omark's custody taken ation suitable .	lefined on COC.	
Comments:		Sulphide	analysis subcontracted to SA	AL.		
Holding Times:		Date rece	ived allows for sufficient time	e to meet Technical H	lolding Times.	
Preservation:		Chemical	preservation of samples sat	isfactory for requeste	d analytes.	
Important Notes: LabMark shall respo	onsibly dis	spose of sp	pent customer soil and water	samples which includ	des the disintegration of the sample label. A	

Labidark shall responsibly dispose of spent customer soil and water samples which includes the disintegration of the sample label. A sample disposal fee of \$1.00 is applicable on all samples received by the laboratory regardless of whether they have undergone analytical testing. Sample disposal of environmental samples shall be 31 days (water) and 3 months (soil, HN03 preserved samples) after laboratory receipt, unless otherwise requested in writing by the client. Samples requested to be held in non-refrigerated storage shall incur \$5.00/ sample/ 3 months. Additional refrigerated storage shall incur \$5.00/ sample/ 3 months. Additional refrigerated storage shall occur once full and final payment has been settled and verified. All report copies may be retracted where full payment does not occur within the agreed settlement period.

Analysis comments:

Subcontracted Analyses:

Reported by Sydney Analytical Laboratories, NATA accreditation No.1884.

Thank you for choosing Labmark to analyse your project samples. Additional information on www.labmark.com.au



# Quality, Service, Support

Report Time : 1:31:25PM Sample

Receipt



Notice (SRN) for E036442

**Report Date : 27/02/2008** 

The table below represents LabMark's understanding and interpretation of the customer supplied sample COC request (refer to SRN comments section on first page for external subcontracting method details). Please confirm that your COC request has been entered correctly. Due to THT and TAT requirements, testing shall commence immediately as per this table, unless the customer intervenes with a correction prior to testing.

GRID REVI	EW TABLE									Re	ques	ted A	naly	sis				
No. Date Depth Cl	ient Sample ID	Major cations	Alkalinity (CO3, HCO3, OH)	Chloride	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	NOX (as N)	PREP Not Reported	Sulphate	TKN (as N)	Total alkalinity	Total Nitrogen (as N)	External Sulphide			
143287 26/02 QI	201	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠			
143288 26/02 12 BH	H05	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠			
То	otals:	2	2	2	2	2	2	2	2	2	2	2	2	2	2			

'PREP Not Reported' refers to an internal laboratory instruction - client confirmation of this parameter is not required.

Thank you for choosing Labmark to analyse your project samples. Additional information on www.labmark.com.au





Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the APLAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports. AQIS AUSTRALIAN QUARANTINE AND INSPECTION SERVICE

SYDNEY License No. N0356.

Quarantine Approved Premises criteria 5.1 for quarantine containment level 1 (QCI) facilities. Class five criteria cover premises utilised for research, analysis and testing of biological material, soil, animal, plant and human products.

#### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

# FINAL CERTIFICATE OF ANALYSIS - ENVIRONMENTAL DIVISION

Laboratory Report No:E0Client Name:ERClient Reference:EasContact Name:SteChain of Custody No:S42Sample Matrix:W/

E036715 ERM Australia Pty Ltd (NSW) Eastern Creek Stefan Charteris S4204 WATER Cover Page 1 of 4 plus Sample Results

Date Received: 14/03/2008 Date Reported: 26/03/2008

This Final Certificate of Analysis consists of sample results, DQI's, method descriptions, laboratory definitions, and internationally recognised NATA accreditation and endorsement. The DQO compliance relates specifically to QA/QC results as performed as part of the sample analysis, and may provide an indication of sample result quality. Transfer of report ownership from Labmark to the client shall only occur once full & final payment has been settled and verified. All report copies may be retracted where full payment has not occured within the agreed settlement period.

QUALITY CONTROL

#### QUALITY ASSURANCE CRITERIA

			GLOBAL A	CCEPTANCE (	CRITERIA (GAC)
Accuracy: Precision:	matrix spike: lcs, crm, method: surrogate spike: laboratory duplicate:	<ol> <li>1 in first 5-20, then 1 every 20 samples</li> <li>1 per analytical batch</li> <li>addition per target organic method</li> <li>1 in first 5-10, then 1 every 10 samples</li> </ol>	Accuracy:	spike, lcs, crm surrogate:	general analytes 70% - 130% recovery phenol analytes 50% - 130% recovery organophosphorous pesticide analytes 60% - 130% recovery phenoxy acid herbicides, organotin 50% - 130% recovery
	laboratory triplicate:	re-extracted & reported when duplicate RPD values exceed acceptance criteria		anion/cation bal	: +/- 10% (0-3 meq/l), +/- 5% (>3 meq/l)
		-	Precision:	method blank:	not detected >95% of the reported EQL
Holding Times:	soils, waters:	Refer to LabMark Preservation & THT table VOC's 14 days water / soil		duplicate lab RPD (metals):	0-30% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)
		VAC's 7 days water or 14 days acidified VAC's 14 days soil		duplicate lab RPD:	0-50% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)
		SVOC's 7 days water, 14 days soil Pesticides 7 days water, 14 days soil Metals 6 months general elements Mercury 28 days	QUALITY ANALYTE	CONTROL SPECIFIC ACC	CEPTANCE CRITERIA (ASAC)
Confirmation:	target organic analysis:	GC/MS, or confirmatory column	Accuracy:	spike, lcs, crm surrogate:	analyte specific recovery data <3xsd of historical mean
Sensitivity:	EQL:	Typically 2-5 x Method Detection Limit (MDL)	Uncertaint	y: spike, lcs:	measurement calculated from historical analyte specific control charts

#### **RESULT ANNOTATION**

- Data Quality Objectives:Data Quality Indicatord:Estimated Quantitation Limitt:not applicabler:
- matrix spike recovery laboratory duplicate laboratory triplicate RPD relative % difference
- p: pending
   lcs: laboratory control sample
   crm: certified reference material
   mb: method blank

bcs: batch specific lcs bmb: batch specific mb

Geoff Weir Quality Control (Report signatory) geoff.weir@labmark.com.au



Ivan Povolny Authorising Chemist (NATA signatory) ivan.povolny@labmark.com.au

math

Simon Mills Authorising Chemist (NATA signatory) simon.mills@labmark.com.au

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# CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

# Laboratory Report: E036715

Cover Page 2 of 4

# NEPC GUIDELINE COMPLIANCE - DQO

# 1. GENERAL A. Results relate specifically to samples as received. Sample results are not corrected for matrix spike, lcs, or surrogate recovery data. B. EQL's are matrix dependant and may be increased due to sample dilution or matrix interference. C. Laboratory QA/QC samples are specific to this project.

- D. Inter-laboratory proficiency results are available upon request. NATA accreditation details available at www.nata.asn.au.
- E. VOC spikes & surrogates added to samples during extraction, SVOC spikes & surrogates added prior to extraction.
- F. Recovery data outside GAC limits shall be investigated and compared to ASAC (historical mean +/- 3sd). If recovery data <20%, then the relevant results for that compound are considered not reliable.
- G. Recovery data (ms, surrogate, crm, lcs) outside ASAC limits shall initiate an investigative action. Anomolous QC data is examined in conjunction with other QC samples and a final decision whether to accept or reject results is provided by the professional judgement of the senior analyst. The USEPA-CLP National Functional Guidelines are referred to for specific recommendations.
- H. Extraction (preparation) date refers to the date that sample preparation was initiated. Note that certain methods not requiring sample preparation (eg. VOCs in water, etc) may report a common extraction and analysis date.
- I. LabMark shall maintain an official copy of this Certificate of Analysis for all tracable reference purposes.

# 2. CHAIN OF CUSTODY (COC) & SAMPLE RECEIPT NOTICE (SRN) REQUIREMENTS

- A. SRN issued to client upon sample receipt & login verification.
- B. Preservation & sampling date details specified on COC and SRN, unless noted.
- C. Sample Integrity & Validated Time of Sample Receipt (VTSR) Holding Times verified (preservation may extend holding time, refer to preservation chart).

# 3. NATA ACCREDITED METHODS

- A. NATA accreditation held for each in-house method and sample matrix type reported, unless noted below (Refer to subcontracted test reports for NATA accreditation status).
- B. NATA accredited in-house laboratory methods are referenced from NEPC, ASTM, modified USEPA / APHA documents. Corporate Accreditation No. 13542.
- C. Subcontracted analyses: Refer to Sample Receipt Notice and additional DQO comments. Reported by Amdel Limited, NATA accreditation No.1526.

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# CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

# Laboratory Report: E036715

Cover Page 3 of 4



# 4. QA/QC FREQUENCY COMPLIANCE TABLE SPECIFIC TO THIS REPORT

Matrix:	WATER						
Page:	Method:	Totals:	#d	%d-ratio	#t	#s	%s-ratio
1	pH in water	2	0	0%	0	0	0%
2	Total alkalinity	2	0	0%	0	0	0%
3	Chloride	2	0	0%	0	0	0%
4	Fluoride	2	0	0%	0	0	0%
5	Sulphate	2	0	0%	0	0	0%
6	Nitrate as N	2	0	0%	0	0	0%
6	Nitrite as N	2	0	0%	0	0	0%
7	Ammonia as N	2	0	0%	0	0	0%
8	Total Nitrogen (as N)	2	0	0%	0	0	0%
9	Major cations	2	0	0%	0	0	0%
10	Alkalinity (CO3, HCO3, OH)	2	0	0%	0	0	0%

# GLOSSARY:

#d number of discrete duplicate extractions/analyses performed.
%d-ratio NEPC guideline for laboratory duplicates is 1 in 10 samples (min 10%).

#t number of triplicate extractions/analyses performed.

#s number of spiked samples analysed.

%s-ratio USEPA guideline for laboratory matrix spikes is 1 in 20 samples (min 5%).

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 LabMark PTY LTD
 ABN 27 079 798 397

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 \* MELBOURNE: 116 Moray Street, South Melbourne VIC 3205

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 \* Fax: (02) 9476 8219
 \* Telephone: (03) 9686 8344
 \* Fax: (03) 9686 7344



# CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

# Laboratory Report: E036715

Cover Page 4 of 4



# 5. ADDITIONAL COMMENTS SPECIFIC TO THIS REPORT

A. All tests were conducted by LabMark Environmental Sydney, NATA accreditation No. 13542, Corporate Site No. 13535, unless indicated below.

B. The following test was conducted by Amdel Limited, NATA accreditation No.1526. :- sulphide.

Laboratory QA/QC data shall relate specifically to this report, and may provide an indication of site specific sample result quality. LabMark <u>DOES</u> <u>NOT</u> report <u>NON-RELEVANT BATCH QA/QC</u> data. Acceptance of this self assessment certificate does not preclude any requirement for a QA/QC review by a accredited contaminated site EPA auditor, when and wherever necessary. Laboratory QA/QC self assessment references available upon request.

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Gi abaaal	Labora	tory Report	t No:	E036715	<b>Page:</b> 1 of 10	Final
	Client ]	Name:	[	ERM Australia Pty Ltd (NSW)	plus cover page	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	•1	Stefan Charteris	<b>Date:</b> 26/03/08	of Analysis
	Client ]	Reference:		Eastern Creek 0071234	This report supercedes reports iss	ued on: N/A
Laboratory Identification		146138	146139			
Sample Identification		BH06	Dup01			
Depth (m)		ł	1			
Sampling Date recorded on COC		13/3/08	13/3/08			
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08			
Laboratory Analysis Date		14/3/08	14/3/08			
Method:E018.1 pH in water pH (pH units)	<b>EQL</b> 0.1	<i>T.T</i>	7.6			
Results expressed in pH units unless otherwise	snecified			-	-	-

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Comments:

E018.1: Direct measurement by pH ion selective electrode.

Git allower and	Labora	atory Report	t No: E	036715		<b>Page:</b> 2 (	of 10	Final
	Client	Name:	Ц	RM Australi	a Pty Ltd (NSW)	plus cove	r page	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Ś	tefan Charter	is	<b>Date:</b> 26/	03/08	of Analysis
	Client	Reference:	E	astern Creek	0071234	This report su	upercedes reports issued on:	N/A
Laboratory Identification		146138	146139	lcs	mb			
Sample Identification		90HB	Dup01	бc	бс			
Depth (m)		ł	1	1	1			
Sampling Date recorded on COC		13/3/08	13/3/08	1	-			
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08			
Laboratory Analysis Date		14/3/08	14/3/08	14/3/08	14/3/08			
<b>Method : E035.1</b> <b>Fotal alkalinity</b> Alkalinity	EQL 5	006	800	100%	Ş			
Results expressed in mg/1 mless otherwise spec	ified							

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Comments:

E035.1: Determination by colour and/or by titration. Results expressed as CaCO3.

Git allowers	Labora	tory Report	t No: E	3036715			<b>Page:</b> 3 of 1	0	Final	
	Client ]	Name:	Ц	ERM Australi	a Pty Ltd (NSV	<i>N</i> )	plus cover p	age	Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	stefan Charter	is		<b>Date:</b> 26/03/	08	of Analysis	
	Client ]	Reference:	Ц	Eastern Creek	0071234		This report super	cedes reports issued on:	N/A	
Laboratory Identification		146138	146139	lcs	mb					-
Sample Identification		BH06	Dup01	QC	QC					
Depth (m)		ł	1	1	1					
Sampling Date recorded on COC		13/3/08	13/3/08	1	1					
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08					r
Laboratory Analysis Date		17/3/08	17/3/08	17/3/08	17/3/08					
Method : E033.1/E045.1/E047.1 Chloride	EQL									-
Chloride	1	250	251	99%	<1					
Results expressed in mg/l unless otherwise spec	cified					,	,			

E033.1/E045.1/E047.1: Determination by colour and/or by Ion Chromatography. Sample filtered through a 0.45um filter prior to analysis.

Git alsonauls	Labora	tory Report	t No: E	036715		<b>Page:</b> 4 of 1	0	Final
	Client ]	Vame:	E	RM Australi	a Pty Ltd (NSW)	plus cover pa	ıge	Certificate
ENVIRONMENTAL LABORATORIES	Contact	t Name:	S	tefan Charter	is	<b>Date:</b> 26/03/	08	of Analysis
	Client ]	Reference:	E	astern Creek	0071234	This report super	cedes reports issued on: 1	V/A
Laboratory Identification		146138	146139	lcs	mb			
Sample Identification		BH06	Dup01	QC	QC			
Depth (m)		ł	1	1	1			
Sampling Date recorded on COC		13/3/08	13/3/08	1				
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08			
Laboratory Analysis Date		19/3/08	19/3/08	19/3/08	19/3/08			
Method : E034.1/E045.1 Fluoride	EOL							
Fluoride	0.1	0.3	0.3	89%	<0.1			
Results expressed in mg/l unless otherwise spec-	ified							

E034.1/E045.1: Determined by FIA-Ion Selective Electrode and/or by Ion Chromatography. Samples filtered through a 0.45um filter prior to analysis.
Gill or hand and a	Labora	tory Report	t No: E	036715		Page: 5	of 10	Final
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (NSW)	plus cov	er page	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Ś	tefan Charter	is	Date: 26	;/03/08	of Analysis
	Client ]	Reference:	Щ	astern Creek	0071234	This report	supercedes reports issued on:	N/A
Laboratory Identification		146138	146139	lcs	dm			
Sample Identification		BH06	Dup01	бc	QC			
Depth (m)		ł	1	1	1			
Sampling Date recorded on COC		13/3/08	13/3/08	1	1			
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08			
Laboratory Analysis Date		17/3/08	17/3/08	14/3/08	14/3/08			
<b>Method : E042.1/E045.1/E056.1</b> Sulphate Sulphate	EQL 2	24	26	%86	\$			
Results expressed in mg/l unless otherwise spec	cified				-	-	-	_

Comments:

E042.1/E045.1/E056.1: Determination by colour and/or by Ion Chromatography. Sample filtered through 0.45um prior to analysis.

Gundander 19	Labora	tory Report	t No: E	036715			<b>Page:</b> 6 of 10		Final
	Client <b>]</b>	Vame:	E	RM Australi	a Pty Ltd (NS	(M)	plus cover page		Certificate
ENVIRONMENTAL LABORATORIES	Contact	t Name:	Š	tefan Charter	is		<b>Date:</b> 26/03/08		of Analysis
	Client I	Reference:	Щ	astern Creek	0071234		This report superced	es reports issued on: N	A
Laboratory Identification		146138	146139	lcs	dm				
Sample Identification		BH06	Dup01	QC	QC				
Depth (m)		ł	ł	1	1				
Sampling Date recorded on COC		13/3/08	13/3/08	-	-				
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08				
Laboratory Analysis Date		14/3/08	14/3/08	14/3/08	14/3/08				
Method:E037.1/E051.1 Nitrite as N NO2-N	<b>EQL</b> 0.01	0.06	0.03	%66	<0.01				
Method : E037.1/E051.1 Nitrate as N NO3-N	<b>EQL</b> 0.01	0.04	0.02	86%	<0.01				

Results expressed in mg/l unless otherwise specified

Comments:

E037.1/E051.1: Nitrate determined by colour. Sample filtered through 0.45um prior to analysis. E037.1/E051.1: Nitrite determined by colour. Sample filtered through 0.45um prior to analysis.

Git als Admin	Labora	tory Report	: No: E	036715		Page: 7	of 10	Final
	Client <b>]</b>	Vame:	E	RM Australi	a Pty Ltd (NSW)	plus cove	ır page	Certificate
ENVIRONMENTAL LABORATORIES	Contact	t Name:	S	tefan Charter	IS	<b>Date:</b> 26/	03/08	of Analysis
	Client I	Reference:	Ē	astern Creek	0071234	This report s	upercedes reports issued on: ]	N/A
Laboratory Identification		146138	146139	lcs	mb			
Sample Identification		BH06	Dup01	бC	бс			
Depth (m)		1	1	1				
Sampling Date recorded on COC		13/3/08	13/3/08	-	:			
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08			
Laboratory Analysis Date		14/3/08	14/3/08	14/3/08	14/3/08			
Method:E036.1/E050.1 Ammonia as N Ammonia	<b>EQL</b> 0.01	2.92	2.43	100%	<0.01			
Results expressed in mg/l unless otherwise spec	aified							

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Comments:

E036.1/E050.1: Determined by colour. Sample filtered through 0.45um prior to analysis.

Git allowers	Labor	atory Report	t No: E	036715		<b>Page:</b> 8 of 10		Final
	Client	Name:	н	RM Australi	a Pty Ltd (NSW)	plus cover page		Certificate
ENVIRONMENTAL LABORATORIES	Contac	ct Name:	S	tefan Charter	is	<b>Date:</b> 26/03/08		of Analysis
	Client	<b>Reference:</b>	Щ	lastern Creek	0071234	This report supercede	s reports issued on: N/	A
Laboratory Identification		146138	146139	lcs	mb			
Sample Identification		BH06	Dup01	бс	бс			
Depth (m)		ł	ł	1	1			
Sampling Date recorded on COC		13/3/08	13/3/08	1	-			
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08			
Laboratory Analysis Date		20/3/08	20/3/08	14/3/08	14/3/08			
Method: E038.1 Fotal Nitrogen (as N) Fotal Nitrogen (as N)	<b>EQL</b> 0.1	138	126	119%	<0.1			
Qeculte eveneeed in ma/I unless otherwise snee	hfiad							

Results expressed in mg/l unless otherwise specified

Comments:

E038.1: Total Nitrogen by calculation.

Gu - LAA-	Labor	atory Report	t No: E	3036715			Page:	9 of 10		Final	
	Client	Name:	ц	ERM Australi	a Pty Ltd (N	SW)	plus c	over page		Certifica	te
ENVIRONMENTAL LABORATORIES	Contac	t Name:		tefan Charte	ris		Date:	26/03/08		of Analysis	
	Client	Reference:	H	lastern Creek	0071234		This rep	ort supercedes	eports issued on:	N/A	
Laboratory Identification		146138	146139	lcs	qm						
Sample Identification		BH06	Dup01	QC	QC						
Depth (m) Sampling Date recorded on COC		 13/3/08	 13/3/08	1 1	1 1						
Laboratory Extraction (Preparation) Date Laboratory Analysis Date		14/3/08 25/3/08	14/3/08 25/3/08	14/3/08 18/3/08	14/3/08 18/3/08						
Method : E020.1/E030.1 Major cations Calcium	<b>EQL</b> 0.1	21.6	23.6	103%	<0.1						
Magnesium Sodium Potassium	$\begin{array}{c} 0.1 \\ 0.1 \\ 0.1 \end{array}$	6.1 475 19.4	6.5 484 18.5	100% 101% 100%	<0.1 <0.1 <0.1						
-	۔ بر										Ī

Results expressed in mg/l unless otherwise specified

Comments:

E020.1/E030.1: Sample directly analysed by Flame AAS and/or ICP-OES.

Gar allond and	Labora	tory Report	t No: E	3036715			<b>Page:</b> 10 of	. 10	Final	
	Client ]	Name:	Щ	ERM Australi	a Pty Ltd (NSV	()	plus cover p	age	Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Charter	is		<b>Date:</b> 26/03,	/08	of Analysis	
	Client ]	Reference:	ц	Jastern Creek	0071234		This report super	cedes reports issued on:	N/A	
Laboratory Identification		146138	146139	lcs	qm					_
Sample Identification		BH06	Dup01	бC	бc					
Depth (m)		ł	ł	1	1					
Sampling Date recorded on COC		13/3/08	13/3/08	1	-					_
Laboratory Extraction (Preparation) Date		14/3/08	14/3/08	14/3/08	14/3/08					_
Laboratory Analysis Date		14/3/08	14/3/08	14/3/08	14/3/08					
Method:E035.1 Alkalinity (CO3, HCO3, OH)	EQL									
Carbonate	5	$\dot{\mathcal{O}}$	$\delta$	1	$\delta$					_
Bicarbonate	5	006	800	100%	Ş					_
Hydroxide	5	$\Diamond$	$\delta$	1	Ś					
Results expressed in mg/1 unless otherwise spec	cified									

5 á

Comments:

E035.1: Determination by colour and/or by titration, followed by calculation. Results expressed as CaCO3.



Quality, Service, Support

Sample

Receipt



Notice (SRN) for E036715

	Clie	nt Detai	ls			Laboratory	Reference Information
Client Name: Client Phone:	ERM Au 02 8584	istralia Pty 8888	Ltd (NSW)	r     		Please hav when	ve this information ready contacting Labmark.
Client Fax:	02 8584	8800			Lab	natom Domonto	5000745
Contact Name:	Stefan (	Charteris			Labo	bratory Report:	E036715
Contact Email:	Stefan.0	Charteris@	erm.com		Quo	tation Number:	<ul> <li>Not provided, standard prices apply</li> </ul>
Client Address:	Locked Broadwa	Bag 24 ay NSW 20	007		Labo	oratory Address:	Unit 1, 8 Leighton Pl. Asquith NSW 2077
Project Name:	Eastern	Creek			Pho	ne:	61 2 9476 6533
Project Number:	0071234	1			Fax:		61 2 9476 8219
CoC Serial Number	:S4204				C	nla Dessint Conto	te Jaldaan El Calada
Purchase Order:	- Not pro	ovided -			Sam	ple Receipt Contac	it: Jakieen El Galada
Surcharge:	No surc	harge appl	lied (results by 6:30pm o	on	Ema	II. Arting Contact:	Jakieen.galada@labmark.com.au
	due date	e)			Emo	in Contact:	jyothi lal@labmark.com.ou
Sample Matrix:	WATER				EIIId	11.	Jyothi.lai@labhlaik.com.au
Date Sampled (ear Date Samples Rece Date Sample Rece Date Preliminary R	liest date eived: ipt Notice eport Du	e): e issued: le:	13/03/2008 14/03/2008 17/03/2008 26/03/2008		TGA APV AQIS AQIS	GMP License: MA License: Approval: Entry Permit:	185-336 (Sydney) 6105 (Sydney) NO356 (Sydney) 200521534 (Sydney)
<b>Reporting Require</b>	ments:	Electronic	c Data Download require	ed:Yes	S	Ir	voice Number: 30918
Sample Condition:	:	COC rece Samples Samples Samples Security s Sample c	eived with samples. Represeived in good order a received with cooling marceived chilled. seals not required. Direction transmission of the present the	port nu iedia: I ct Labr eservat	umbe Ice b mark' tion s	r and lab ID's define ricks . s custody taken . suitable .	ed on COC.
Comments:		Samples received bottles. S	received and analysed of for Sulphide in both sam amples sent to Amdel for	on the nples a or ana	last and fo lysis	day of THT for Nutri or Cations in Dup01, of Sulphide.	ents. Incorrect sample container Sample taken from unpreserved
Holding Times:		Date rece Note: The Technica dates det	eived allows for sufficien ere are Samples within t I Holding Times expire. ailed in the sample grid	nt time this ba LabMa for co	to m tch th ark ca nfirm	eet Technical Holdir hat have been receiv annot guarantee TH ation.	ng Times. /ed by the laboratory 0 day(s) after T compliance, refer to the extraction
Preservation:		Chemical	preservation of sample	s unsa	atista	ctory for requested	analytes.
Important Notes: LabMark shall respo	onsibly di	spose of s	pent customer soil and v	waters	samp	les which includes t	he disintegration of the sample label. A

LabMark shall responsibly dispose of spent customer soil and water samples which includes the disintegration of the sample label. A sample disposal fee of \$1.00 is applicable on all samples received by the laboratory regardless of whether they have undergone analytical testing. Sample disposal of environmental samples shall be 31 days (water) and 3 months (soil, HN03 preserved samples) after laboratory receipt, unless otherwise requested in writing by the client. Samples requested to be held in non-refrigerated storage shall incur \$5.00/ sample/ 3 months. Additional refrigerated storage shall incur \$30/ sample/ 3 months. Combination prices apply only if requested. Transfer of report ownership from LabMark to the client shall occur once full and final payment has been settled and verified. All report copies may be retracted where full payment does not occur within the agreed settlement period.

Analysis comments:

Subcontracted Analyses:

Reported by Amdel Limited, NATA accreditation No.1526.

Thank you for choosing Labmark to analyse your project samples. Additional information on www.labmark.com.au



### Quality, Service, Support

Report Time : 12:15:51PM Sample

Receipt



Notice (SRN) for E036715

**Report Date : 17/03/2008** 

The table below represents LabMark's understanding and interpretation of the customer supplied sample COC request (refer to SRN comments section on first page for external subcontracting method details). Please confirm that your COC request has been entered correctly. Due to THT and TAT requirements, testing shall commence immediately as per this table, unless the customer intervenes with a correction prior to testing.

GRID REVIEW TABLE									Re	ques	ted A	naly	sis					
No. Date Depth Client Sample ID	Major cations	Alkalinity (CO3, HCO3, OH)	Chloride	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	NOX (as N)	pH in water	PREP Not Reported	Sulphate	TKN (as N)	Total alkalinity	Total Nitrogen (as N)	External Analysis by Amdel			
146138 13/03 BH06	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠			
146139 13/03 Dup01	•	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠			
Totals:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			

'PREP Not Reported' refers to an internal laboratory instruction - client confirmation of this parameter is not required.

Thank you for choosing Labmark to analyse your project samples. Additional information on www.labmark.com.au

PAGE OF	Combination	Prices only apply if Combo re	equest is circled on	coc.	Form QS0073, Rev.8 : Date Issue 12/05/200
LABMARK	NATA 13542, AQIS N0356	Client Details	Safety Precaution: laboratory sa chemicals, refer	mple bottles may contain preservatic to SAFETEY label on bottle.	on acid / 2009
Dispatch samples to: Unit1/8 Leighton Place Asquith NSW 2077 or 116 Móoray Street South Melbourne VIC 3205	Tel (SYD): 612-9476-6533 Fax (SYD): 612-9476-6533 Tel (MEL): 612-9976-8219 Fax (MEL): 613-9686-8344 Fax (MEL): 613-9686-7344 (DB): 0409449684, (PVV): 0439390209 ros.schacht@labmark.com.au paul.woodward@labmark.com.au	Company & Address: $c K M G_{L}$ Project Manager: $S + f c M G_{L}$ Project Name: $C + c M G_{L}$	rilching C, 33 . Lerkin Samp er Creek. Projec	Eurrders Street Ry ler: Plus NC Dongell Da HO: Co71234 La	バッチャッチ Tel: 02 おびや 53名名 Fx: 02 SJ子 435 CC . Ate Required: b. Quote No:
Global Snecification	ODS   reduire (default is Not requir	ed if Not ticked).		Analysis Req	uest
<ol> <li>Urgent TAT required? ( please cir</li> <li>Fast TAT Guarantee required? ( </li> <li>2. Fast TAT Guarantee required? ( </li> <li>3. Do you wish sediment present in</li> <li>4. Additional QA/QC reported where</li> <li>5. Do you require DIFFERENT stam</li> <li>6. Do you wish chromatograms to bio you wish chromatograms to bio</li> <li>7. Electronic data transfer (circle: faint of the faint of t</li></ol>	cle: 1 day 2 days 3 days days burcharge may apply - Receipt cutoff time 3.00 waters to be included in organic/inorganic exit a sample batches submitted are < 10 samples? dard EQL's from those stated in the current La e supplied? (Additional fee applies). ax _ xis . csv _ pdf ). Please specify. dditional water sample must be submitted for Contact lab if consolidating multiple analyses i	YE in vot toked). ) ) hm) hm/ tactions? bMark price catalogue? bMark price catalogue? tactions a spike analysis. the a single sample container.	(tick)         129           (tick)         139           (tick)         139	8         8         8         8         9	Nutrient Tests No op More ND ND ND ND ND ND ND ND ND ND ND ND ND
	Matrix	Container Type (Nat. = unpreserved, G=glass, P=plasti	IS (Ce-6 	bec A res (qie (qie (die bC H PC H PC H PC H C H I C I C	N, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10
Lab. Number Sample ID	Depth Sample Sample Sample Sample Sampling Sampling Sampling Soli Soli Soli Soli Soli Soli Soli Soli	0.05-1L         43ml         43ml         0.1-1L         0.1-1L         0.1-2ZL(P)         0.1-1L           (a) Nat.         VDA(c)         VOA(c)         VOA(c) <td>APC b1-6C/W2 B1EE b1-6C/W3 M1BE b1-6C/W3 AHC b1-6C/W3 AHC b1-6C/W3 Compo (elde) &lt;8&gt; &lt;3&gt; &lt;10 &lt;8&gt; &lt;3&gt; &lt;10 &lt;10 &lt;10 &lt;10 &lt;10 &lt;10 &lt;10 &lt;10</td> <td>VOC PT-GC/MS TPH (C10-36) GC Phenols GC/MS Phenols GC/MS SVOC GC/MS SVOC GC/MS Phenols GC/MS Freeig Carles OF, OF, Carles OF, OF, Carles OF, OF, Carles OF</td> <td>(داداو) (۲۰۰۹) EC (داداو) الم (داداو) الم (داداو) TF, TY (داداو) TP, orth (داداو) TP, orth ( (داداو) TP, orth ( (داداو) TP, orth ( (داداو) TP, orth ( (داداو) TP, orth ( ( (داداو) TP, orth ( ( ( ( ( ( ( ( ( ( (</td>	APC b1-6C/W2 B1EE b1-6C/W3 M1BE b1-6C/W3 AHC b1-6C/W3 AHC b1-6C/W3 Compo (elde) <8> <3> <10 <8> <3> <10 <10 <10 <10 <10 <10 <10 <10	VOC PT-GC/MS TPH (C10-36) GC Phenols GC/MS Phenols GC/MS SVOC GC/MS SVOC GC/MS Phenols GC/MS Freeig Carles OF, OF, Carles OF, OF, Carles OF, OF, Carles OF	(داداو) (۲۰۰۹) EC (داداو) الم (داداو) الم (داداو) TF, TY (داداو) TP, orth (داداو) TP, orth ( (داداو) TP, orth ( (داداو) TP, orth ( (داداو) TP, orth ( (داداو) TP, orth ( ( (داداو) TP, orth ( ( ( ( ( ( ( ( ( ( (
146138 BIT 6	13/3			· · · · · · · · · · · · · · · · · · ·	
146139 Dup 21	Σ/ <sup>2</sup> / <sup>2</sup>				
Totals					
*Metals (circle): As, Cd, Cr, Cu, N Be, B, Al, V, Mn, Fe, Co, S¢	<b>li, Pb, Zn, Hg</b> , Cr <sup>e+</sup> , Cr <sup>3+</sup> , Fe <sup>2+</sup> , Fe <sup>3+</sup> , Cor e, Sr, Sn, Mo, Ag, Ba, TJ, Bi, Sb	mments (Highly contaminated samples): D		Lab Report No. EO3671S	Security Seal Applied YES/NO Security Seal Serial #
Relinquished by $_{ m (print)}$ : $\mathcal{S}\mathcal{A}$	che Chertens Signed:	Are.	Date:	Received By:	Date: Time:
Relinquished by (print):	, Signed:	Ċ	Date:	, Received By:	Date: Time:
		-	Nucd St 14	308 -	C Labmark Pty. Limited 2003

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**CHAIN OF CUSTODY S**4204



This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO/IEC 17025 Accreditation Number: 1464

Labmark P/L Unit 1 / 8 Leighton Plc Asquith NSW 2077 Australia

### Attention: Jyothi Lal

Project	08ENCA0006759
Client Reference	E036715
Received Date	18/03/2008 02:00:00 PM

Customer Sample ID			BHO6	DUP 1		
Amdel Sample Number			907100	907101		
Date Sampled			13/03/2008	13/03/2008		
Inorganics						
Test/Reference	PQL	Unit				
4480 Sulphide in Water						
Sulphide	0.1	mg/L	<0.1	<0.1		
Sample History						
Where samples are submitted/	analysed over	several days	s, the last date of extra	ction and analysis is	reported.	
Description				Extracted	Analysed	
4480 Sulphide in Water					20/03/2008	





### Amdel Internal Quality Control Review

### 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. Amdel QC Acceptance/Rejection criteria are available on request.
- Proficiency trial results are available on request.
- 4. Actual PQLs are matrix dependant. Quotes PQLs may be raised where sample extracts are diluted due to interferences.
- 5. Results are uncorrected for matrix spike or surrogate recoveries.
- 6. Test samples duplicated or spiked, are for this job only and are identified in the following QC report.
- 7. SVOC analyses on waters are performed on homogenized, unfiltered sample, unless noted otherwise.
- 8. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.

### **Holding Times**

Please refer to 'Sampling and Preservation Chart for Soils & Waters' for holding times. (Amdel form AD-FOR\_ADM-020)

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 Acknowledgement. If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitablity 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.

### **Quality Control Results**

### Laboratory: EN\_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
907927 [ Method Blank ]				•			
4480 Sulphide in Water		_					
Sulphide	mg/L	<0.1			< 0.1	Т	
907929 [Laboratory Control Sample]				•			
4480 Sulphide in Water		_	Expected Value	Percent Recovery			
Sulphide	mg/L	1.0	1.0	101	80-120 %	Т	

### Sample Integrity

Custody Seals Intact (if used)	Yes
Attempt to Chill was evident	Yes
Samples correctly preserved	Yes
Organic samples had Teflon liners	N/A
Samples received with Zero Headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

### Authorised By

Darrel Luck Anthony Crane

Production Manager - Inorganics
Operations Manager

Accreditation Number: 1464

### Laboratory Manager

Anthony Crane

Final Report

**Operations Manager** 

First Reported: 20 March 2008 Date Printed: 20 March 2008



### - Indicates Not Requested

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

Amdel Limited shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretaton given in this report. In no case shall Amdel Limited be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

The samples were not collected by Amdel staff.





Accredited for compliance with ISO/IEC 17025. The Accretine to compute with aborner measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the APLAC mutual recognition arrangement for the Austantanianian standards (ATA is a signal of the the APLAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

AOIS AUSTRALIAN QUARANTINE AND INSPECTION SERVICE

### SYDNEY License No. N0356

Quarantine Approved Premises criteria 5.1 for quarantine Quarantine Approved Premises criteria 5.1 for quarantine containment level 1 (QCI) facilities. Class five criteria cover premises utilised for research, analysis and testing of biological material, soil, animal, plant and human products.

**CUSTOMER CENTRIC - ANALYTICAL CHEMISTS** 

### FINAL CERTIFICATE OF ANALYSIS - ENVIRONMENTAL DIVISION

E036886 Laboratory Report No: ERM Australia Pty Ltd (NSW) **Client Name:** Light Horse Landfill **Client Reference: Contact Name:** Stefan Charteris S4205 **Chain of Custody No:** WATER Sample Matrix:

Cover Page 1 of 4 plus Sample Results

Date Received: 28/03/2008 Date Reported: 04/04/2008

This Final Certificate of Analysis consists of sample results, DQI's, method descriptions, laboratory definitions, and internationally recognised NATA accreditation and endorsement. The DQO compliance relates specifically to QA/QC results as performed as part of the sample analysis, and may provide an indication of sample result quality. Transfer of report ownership from Labmark to the client shall only occur once full & final payment has been settled and verified. All report copies may be retracted where full payment has not occured within the agreed settlement period.

QUALITY CONTROL

### QUALITY ASSURANCE CRITERIA

							GLOBAL A	CCEPTANCE (	CRITERIA (GAC)
Accuracy: Precision:	matrix spike: lcs, crm, met surrogate spi laboratory du	hod: ke: ıplicat	1 1 a te: 1	in first 5-20, then 1 eve per analytical batch ddition per target organ in first 5-10, then 1 eve	ery 20 s ic meth ery 10 s	amples od samples	Accuracy:	spike, lcs, crm surrogate:	general analytes 70% - 130% recovery phenol analytes 50% - 130% recovery organophosphorous pesticide analytes 60% - 130% recovery phenoxy acid herbicides, organotin 50% - 130% recovery
	laboratory tri	plicat	e: r F	e-extracted & reported v RPD values exceed acce	when di ptance	uplicate criteria	Precision:	anion/cation bal method blank:	l: +/- 10% (0-3 meq/l), +/- 5% (>3 meq/l) not detected >95% of the reported EQL
Holding Times:	soils, waters:		R ta V	tefer to LabMark Preser able 'OC's 14 days water / sc	vation o	& THT		duplicate lab RPD (metals):	0-30% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)
			V V	AC's 7 days water or 14 AC's 14 days soil	4 days a	acidified		duplicate lab RPD:	0-50% (>10xEQL), 0-75% (5-10xEQL) 0-100% (<5xEQL)
			P N N	esticides 7 days water, 14 esticides 7 days water, 14 fetals 6 months general fercury 28 days	14 days elemen	soil ts	QUALITY ANALYTE	CONTROL SPECIFIC AC	CEPTANCE CRITERIA (ASAC)
Confirmation:	target organic	e analy	ysis: C	C/MS, or confirmatory	colum	n	Accuracy:	spike, lcs, crm surrogate:	analyte specific recovery data <3xsd of historical mean
Sensitivity:	EQL:		T ()	ypically 2-5 x Method I MDL)	Detectio	on Limit	Uncertainty	y: spike, lcs:	measurement calculated from historical analyte specific control
RESULT ANNO	OTATION								charts
Data Quality Obj Data Quality Indi Estimated Quanti	ective icator	s: d: t:	matrix labora labora	tory duplicate	p: lcs:	pending laboratory	control samp	bcs: ba le bmb:ba	tch specific lcs tch specific mb

not applicable

r:

RPD relative % difference

David Burns Quality Control (Report signatory) david.burns@labmark.com.au

mb:

method blank

Geoff Weir Authorising Chemist (NATA signatory) geoff.weir@labmark.com.au

Breth

Simon Mills Authorising Chemist (NATA signatory) simon.mills@labmark.com.au

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LabMark PTY LTD ABN 27 079 798 39 \* SYDNEY: Unit 1, 8 Leighton Place Asquith NSW 2077 \* Telephone: (02) 9476 6533 \* Fax: (02) 9476 8219 \* MELBOURNE: 116 Moray Street, South Melbourne VIC 3205 \* Telephone: (03) 9686 8344 \* Fax: (03) 9686 7344

Form QS0144, Rev. 1 : Date Issued 06/02/08



ENVIRONMENTAL LABORATORIES

### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

### Laboratory Report: E036886

Cover Page 2 of 4

### **NEPC GUIDELINE COMPLIANCE - DQO**

### 1. GENERAL Results relate specifically to samples as received. Sample results are not corrected for matrix spike, lcs, or Α. surrogate recovery data. Β. EQL's are matrix dependant and may be increased due to sample dilution or matrix interference. C. Laboratory QA/QC samples are specific to this project. D. Inter-laboratory proficiency results are available upon request. NATA accreditation details available at www.nata.asn.au. E. VOC spikes & surrogates added to samples during extraction, SVOC spikes & surrogates added prior to extraction. F. Recovery data outside GAC limits shall be investigated and compared to ASAC (historical mean +/- 3sd). If recovery data <20%, then the relevant results for that compound are considered not reliable. G. Recovery data (ms, surrogate, crm, lcs) outside ASAC limits shall initiate an investigative action. Anomolous QC data is examined in conjunction with other QC samples and a final decision whether to accept or reject results is provided by the professional judgement of the senior analyst. The USEPA-CLP National Functional Guidelines are referred to for specific recommendations. H. Extraction (preparation) date refers to the date that sample preparation was initiated. Note that certain methods not requiring sample preparation (eg. VOCs in water, etc) may report a common extraction and analysis date.

I. LabMark shall maintain an official copy of this Certificate of Analysis for all tracable reference purposes.

### 2. CHAIN OF CUSTODY (COC) & SAMPLE RECEIPT NOTICE (SRN) REQUIREMENTS

- A. SRN issued to client upon sample receipt & login verification.
- B. Preservation & sampling date details specified on COC and SRN, unless noted.
- C. Sample Integrity & Validated Time of Sample Receipt (VTSR) Holding Times verified (preservation may extend holding time, refer to preservation chart).

### 3. NATA ACCREDITED METHODS

- A. NATA accreditation held for each in-house method and sample matrix type reported, unless noted below (Refer to subcontracted test reports for NATA accreditation status).
- B. NATA accredited in-house laboratory methods are referenced from NEPC, ASTM, modified USEPA / APHA documents. Corporate Accreditation No. 13542.
- C. Subcontracted analyses: Refer to Sample Receipt Notice and additional DQO comments. Reported by Amdel Limited, NATA accreditation No.1526.

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 LabMark PTY LTD
 ABN 27 079 798 397

 \* SYDNEY: Unit 1, 8 Leighton Place Asquith NSW 2077
 \* MELBOURNE: 116 Moray Street, South Melbourne VIC 3205

 \* Telephone: (02) 9476 6533
 \* Fax: (02) 9476 8219





**ENVIRONMENTAL LABORATORIES** 

### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

### Laboratory Report: E036886

Cover Page 3 of 4



### 4. QA/QC FREQUENCY COMPLIANCE TABLE SPECIFIC TO THIS REPORT

Matrix:	WATER						
Page:	Method:	Totals:	#d	%d-ratio	#t	#s	%s-ratio
1	Total alkalinity	3	0	0%	0	0	0%
2	Chloride	3	0	0%	0	0	0%
3	Fluoride	3	0	0%	0	0	0%
4	Sulphate	3	0	0%	0	0	0%
5	Ion Balance	3	0	0%	0	0	0%
6	Nitrate as N	3	0	0%	0	0	0%
6	Nitrite as N	3	0	0%	0	0	0%
7	Ammonia as N	3	0	0%	0	0	0%
8	Major cations	3	0	0%	0	0	0%
9	Alkalinity (CO3, HCO3, OH)	3	0	0%	0	0	0%

### GLOSSARY:

#d number of discrete duplicate extractions/analyses performed.

%d-ratio NEPC guideline for laboratory duplicates is 1 in 10 samples (min 10%).

#t number of triplicate extractions/analyses performed.

#s number of spiked samples analysed.

%s-ratio USEPA guideline for laboratory matrix spikes is 1 in 20 samples (min 5%).

This document is issued in accordance with NATA's accreditation requirements.



ENVIRONMENTAL LABORATORIES

### CUSTOMER CENTRIC - ANALYTICAL CHEMISTS

### Laboratory Report: E036886

Cover Page 4 of 4



### 5. ADDITIONAL COMMENTS SPECIFIC TO THIS REPORT

A. All tests were conducted by LabMark Environmental Sydney, NATA accreditation No. 13542, Corporate Site No. 13535, unless indicated below.

B. The following test was conducted by Amdel Limited, NATA accreditation No.1526. :- sulphide.

Laboratory QA/QC data shall relate specifically to this report, and may provide an indication of site specific sample result quality. LabMark <u>DOES</u> <u>NOT</u> report <u>NON-RELEVANT BATCH QA/QC</u> data. Acceptance of this self assessment certificate does not preclude any requirement for a QA/QC review by a accredited contaminated site EPA auditor, when and wherever necessary. Laboratory QA/QC self assessment references available upon request.

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 ABN 27 079 798 397

 \* SYDNEY: Unit 1, 8 Leighton Place Asquith NSW 2077
 \* MELBOURNE: 116 Moray Street, South Melbourne VIC 3205

 \* Telephone: (02) 9476 6533
 \* Fax: (02) 9476 8219

Gu ab Manly	Labora	itory Repor	t No: E	036886			Page: 1	of 9	Final
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (N	SW)	plus cov	er page	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Chartei	is		<b>Date:</b> 04	/04/08	of Analysis
	Client ]	Reference:	Γ	ight Horse L	andfill 0071	234	This report	supercedes reports issued on:	N/A
Laboratory Identification		147907	147908	147909	lcs	dm			
Sample Identification		BH03	Dup 02	BH07	бC	бС			
Depth (m)		ł	ł	1	1	ł			
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	-	1			
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08			
Laboratory Analysis Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08			
Method : E035.1 Total alkalinity Alkalinity	EQL 5	453	455	484	%88	\$			
Results expressed in mg/l unless otherwise spec	cified							-	

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Comments:

E035.1: Determination by colour and/or by titration. Results expressed as CaCO3.

Git allowers	Labora	tory Report	t No: E	036886			Page: 2 (	e fo	Final	
	Client ]	Vame:	E	RM Australi	a Pty Ltd (N	(MS	plus cove	r page	Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Š	tefan Charter	is		<b>Date:</b> 04/	04/08	of Analysis	
	Client ]	Reference:	Г	ight Horse La	andfill 0071	234	This report su	Ipercedes reports issued on:	N/A	
Laboratory Identification		147907	147908	147909	lcs	qm				-
Sample Identification		BH03	Dup 02	BH07	QC	бC				
Depth (m)		ł	:	1	1	1				
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	1	1				
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08				r
Laboratory Analysis Date		31/3/08	31/3/08	31/3/08	31/3/08	31/3/08				
Method : E033.1/E045.1/E047.1 Chloride	Ė	<i>сс</i> с		6110	000	17				
CIIIOTIae	I	CC7	CC7	0410	00%0	<1				
Results expressed in mg/l unless otherwise spec	cified			•			r.			

Comments:

E033.1/E045.1/E047.1: Determination by colour and/or by Ion Chromatography. Sample filtered through a 0.45um filter prior to analysis.

Gi	Labora	tory Report	t No: E	036886			Page: 3	of 9	Final
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (N	SW)	plus cove	er page	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Charter	is		<b>Date:</b> 04	/04/08	of Analysis
	Client ]	Reference:	Г	ight Horse La	andfill 0071	234	This report :	supercedes reports issued on:	N/A
Laboratory Identification		147907	147908	147909	lcs	qm			
Sample Identification		BH03	Dup 02	BH07	QC	QC			
Depth (m)		ł	ł	ł	1	1			
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	1	1			
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08			
Laboratory Analysis Date		31/3/08	31/3/08	31/3/08	31/3/08	31/3/08			
Method : E034.1/E045.1 Fluoride	EQL	Ċ		ç		Ċ			
Fluoride	0.1	0.3	0.3	<0.1	96%	<0.1			
Results expressed in mg/l unless otherwise spec	cified								

Comments:

E034.1/E045.1: Determined by FIA-Ion Selective Electrode and/or by Ion Chromatography. Samples filtered through a 0.45um filter prior to analysis.

Git allowers	Labora	itory Report	t No: E	036886			Page:	4 of 9	[	Final
	Client ]	Name:	E	RM Australi	a Pty Ltd (N	SW)	plus co	ver page		Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	efan Charter	is		Date:	04/04/08		of Analysis
	Client ]	Reference:	Ľ	ight Horse La	andfill 0071	234	This repo	rt supercedes reports	issued on: N/A	
Laboratory Identification		147907	147908	147909	lcs	qm				
Sample Identification		E0HB	Dup 02	BH07	QC	бС				
Depth (m)		ł	1	-	1	ł				
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	1	1				
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08				
Laboratory Analysis Date		31/3/08	31/3/08	31/3/08	31/3/08	31/3/08				
Method : E042.1/E045.1/E056.1 Sulphate Sulphate	EQL 2	11	11	<2	101%	<2				
Results expressed in mg/l unless otherwise spec	cified									

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Comments:

E042.1/E045.1/E056.1: Determination by colour and/or by Ion Chromatography. Sample filtered through 0.45um prior to analysis.

Gu - LAAmil	Labora	tory Repor	t No: E	036886			Page	:: 5 of 9		Final	
	Client ]	Name:	Щ	RM Australi	a Pty Ltd (NS	W)	plus	cover page		Certificat	o
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Chartei	is		Date	: 04/04/08		of Analysis	
	Client ]	Reference:	Γ	ight Horse L	andfill 007123	34	This re	sport supercedes	reports issued on:	A/A	
Laboratory Identification		147907	147908	147909							Π
Sample Identification		BH03	Dup 02	BH07							
Depth (m)		ł	ł	1							
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08							
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08							
Laboratory Analysis Date		4/4/08	4/4/08	4/4/08							
Method :											
Ion Balance	EQL										
Anions total (meq/L)	1	14.3	14.3	160.6							
Cation total (meq/L)	1	14.3	14.3	167.5							
Percentage Difference %	!	0.4	0.3	4.2							
Recutts avarassed in me/Lunless otherwise snee	rified										Ī

Results expressed in me/l unless otherwise specified

Comments:

--: Calculated Ion Balance from major cation/anion determination.

Gi sibaaris	Labora	tory Report	i No: E	036886			Page: 6 of 9		Final
	Client ]	Vame:	E	RM Australi	a Pty Ltd (N	SW)	plus cover pa	je Je	Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	efan Charter	is		<b>Date:</b> 04/04/C	8	of Analysis
	Client ]	Reference:	Ľ	ight Horse La	andfill 0071	234	This report superce	des reports issued on: N/	A
Laboratory Identification		147907	147908	147909	lcs	dm			
Sample Identification		BH03	Dup 02	BH07	QC	QC			
Depth (m)		ł	ł	-	1	ł			
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	1	1			
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08			
Laboratory Analysis Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08			
Method:E037.1/E051.1 Nitrite as N NO2-N	<b>EQL</b> 0.01	0.07	0.07	0.04	101%	<0.01			
Method : E037.1/E051.1 Nitrate as N NO3-N	<b>EQL</b> 0.01	0.85	0.85	0.44	95%	<0.01			

Results expressed in mg/l unless otherwise specified

Comments:

E037.1/E051.1: Nitrate determined by colour. Sample filtered through 0.45um prior to analysis. E037.1/E051.1: Nitrite determined by colour. Sample filtered through 0.45um prior to analysis.

GI - LA Andre IV	Labora	tory Report	t No: E	036886			Page: 7 o	f 9	Final	
	Client ]	Name:	E	RM Australi	a Pty Ltd (N	SW)	plus cover	page	Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	Ś	tefan Charter	is		<b>Date:</b> 04/0	4/08	of Analysis	
	Client ]	Reference:	Γ	ight Horse La	andfill 0071	234	This report sul	percedes reports issued on:	N/A	
Laboratory Identification		147907	147908	147909	lcs	qm				<b></b>
Sample Identification		BH03	Dup 02	BH07	QC	QC				
Depth (m)		ł	;	1	1	1				
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	1	1				
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08				1
Laboratory Analysis Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08				
Method:E036.1/E050.1 Ammonia as N Ammonia	<b>EQL</b> 0.01	13.0	12.9	7.03	92%	<0.01				
Results expressed in mg/ unless otherwise spec	cified									T

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Comments:

E036.1/E050.1: Determined by colour. Sample filtered through 0.45um prior to analysis.

Gi abaarle	Labora	itory Report	t No: E	036886			<b>Page:</b> 8 of 9		Final
	Client	Name:	Щ	RM Australi	a Pty Ltd (N	SW)	plus cover page		Certificate
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Chartei	ris		<b>Date:</b> 04/04/08		of Analysis
	Client	Reference:	Г	ight Horse L	andfill 0071	234	This report supercede	s reports issued on: N	/A
Laboratory Identification		147907	147908	147909	lcs	qm			
Sample Identification		BH03	Dup 02	BH07	QC	QC			
Depth (m)		ł	1	ł	1	1			
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	1	1			
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08			
Laboratory Analysis Date		1/4/08	1/4/08	1/4/08	1/4/08	1/4/08			
Method : E020.1/E030.1									
Major cations	EQL								
Calcium	0.1	37.8	38	222	%66	<0.1			
Magnesium	0.1	$<\!0.1$	<0.1	121	%66	$<\!0.1$			
Sodium	0.1	276	274	3340	101%	$<\!0.1$			
Potassium	0.1	16.7	17	44.1	100%	<0.1			
							-		

Results expressed in mg/l unless otherwise specified

Comments:

E020.1/E030.1: Sample directly analysed by Flame AAS and/or ICP-OES.

Gir all Adminit	Labora	tory Report	t No: E	036886			Page: 9 of	6.	Final	
	Client ]	Name:	Щ	IRM Australi	a Pty Ltd (N	(MS	plus cover	page	Certificate	
ENVIRONMENTAL LABORATORIES	Contac	t Name:	S	tefan Charter	is		<b>Date:</b> 04/0	4/08	of Analysis	
	Client ]	Reference:	Γ	ight Horse L	andfill 0071	234	This report sup	ercedes reports issued o	1: N/A	
Laboratory Identification		147907	147908	147909	lcs	qm				
Sample Identification		BH03	Dup 02	BH07	бc	бc				
Depth (m)		ł	ł	1	:	1				
Sampling Date recorded on COC		27/3/08	27/3/08	27/3/08	1					
Laboratory Extraction (Preparation) Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08				1
Laboratory Analysis Date		28/3/08	28/3/08	28/3/08	28/3/08	28/3/08				
Method:E035.1 Alkalinity (CO3, HCO3, OH)	EQL									
Carbonate	5	183	178	Ş	1	Ş				
Bicarbonate	5	$\delta$	$\delta$	484	88%	ŝ				
Hydroxide	5	270	277	$\Diamond$	ł	$\Diamond$				
Results expressed in mo/l unless otherwise snee	rified									T

Results expressed in mg/l unless otherwise specified

Comments:

E035.1: Determination by colour and/or by titration, followed by calculation. Results expressed as CaCO3.



Quality, Service, Support

Sample

Receipt



Notice (SRN) for E036886

	Chefit Detail	5		
Client Name: Client Phone:	ERM Australia Pty 02 8584 8888	Ltd (NSW)	Please hav when	ve this information ready contacting Labmark.
Client Fax:	02 8584 8800			
Contact Name:	Stefan Charteris		Laboratory Report:	E036886
Contact Email:	Stefan.Charteris@	erm.com	Quotation Number:	- Not provided, standard prices apply
Client Address:	Locked Bag 24		Laboratory Address:	Unit 1, 8 Leighton Pl.
	Broadway NSW 20	07		Asquith NSW 2077
Project Name:	Light Horse Landfil	l	Phone:	61 2 9476 6533
Project Number:	0071234		Fax:	61 2 9476 8219
CoC Serial Number:	S4205		Sample Receipt Contac	ct: Jakleen El Galada
Purchase Order:	- Not provided -		Email:	iakleen.galada@labmark.com.au
Surcharge:	No surcharge appli	ed (results by 6:30pm on	Reporting Contact:	Jyothi Lal
Sample Matrix:	WATER		Email:	jyothi.lal@labmark.com.au
		07/00/0000	NATA Accreditation:	13542
Date Sampled (earling	est date):	27/03/2008	TGA GMP License:	185-336 (Sydney)
Date Samples Rece	IVED:	28/03/2008	APVMA License:	6105 (Sydney)
Date Sample Receip	ot Notice issued:	31/03/2008	AQIS Approval:	NO356 (Sydney)
Date Freiminary Re	eport Due.	03/04/2008	AQIS Entry Permit:	200521534 (Sydney)
Reporting Require	ments: Electronic	Data Download required: Ye	es lr	voice Number: 31104
Sample Condition:	COC rece Samples I Samples I Security s Sample co	ived with samples. Report r received in good order . received with cooling media: received chilled. eals not used . ontainer & chemical preserva	number and lab ID's define Ice bricks . ation suitable .	ed on COC.
Comments:	lon baland	ce added at client request. S	2 subcontracted to AMDE	L-Cardiff.
Holding Times:	Date rece	ived allows for sufficient time	e to meet Technical Holdir	ng Times.
Preservation:	Chemical	preservation of samples sat	isfactory for requested an	alytes.
Important Notes: LabMark shall respo	nsibly dispose of sp	pent customer soil and water	samples which includes t	he disintegration of the sample label. A

sample disposal fee of \$1.00 is applicable on all samples received by the laboratory regardless of whether they have undergone analytical testing. Sample disposal of environmental samples shall be 31 days (water) and 3 months (soil, HN03 preserved samples) after laboratory receipt, unless otherwise requested in writing by the client. Samples requested to be held in non-refrigerated storage shall incur \$5.00/ sample/ 3 months. Additional refrigerated storage shall incur \$30/ sample/ 3 months. Combination prices apply only if requested. Transfer of report ownership from LabMark to the client shall occur once full and final payment has been settled and verified. All report copies may be retracted where full payment does not occur within the agreed settlement period.

Analysis comments:

Subcontracted Analyses:

Reported by Amdel Limited, NATA accreditation No.1526.

Thank you for choosing Labmark to analyse your project samples. Additional information on www.labmark.com.au



### Quality, Service, Support

The table below represents LabMark's understanding and interpretation of the customer supplied sample COC request (refer to SRN comments section on first page for external subcontracting method details). Please confirm that your COC request has been entered correctly. Due to THT and TAT requirements, testing shall commence immediately as per this table, unless the customer intervenes with a correction prior to testing.

GRID R	EVIEW TABLE									Re	ques	ted A	naly	sis				
No. Date Depth	Client Sample ID	Major cations	Alkalinity (CO3, HCO3, OH)	Chloride	Fluoride	HOLD ON HOLD	Ion Balance	Ammonia as N	Nitrite as N	Nitrate as N	NOX (as N)	PREP Not Reported	Sulphate	Total alkalinity	External Analysis by Amdel			
147907 27/03	BH03	•	٠	٠	٠		٠	٠	٠	٠	٠	٠	٠	٠	٠			
147908 27/03	Dup 02	٠	٠	٠	٠		٠	٠	٠	٠	٠	٠	٠	٠	٠			
147909 27/03	BH07	٠	٠	٠	٠		٠	٠	٠	٠	٠	٠	٠	٠	٠			
147910 27/03	Trip blank					٠												
	Totals:	3	3	3	3	1	3	3	3	3	3	3	3	3	3			

'PREP Not Reported' refers to an internal laboratory instruction - client confirmation of this parameter is not required.

**Report Date : 31/03/2008** Report Time: 1:53:09PM

Sample Receipt



Thank you for choosing Labmark to analyse your project samples. Additional information on www.labmark.com.au

PAGE0	Ļ	_	Ŭ	omb	S 4 inati	Pion P	5 rice	luos	y ap	N O NI	F CU	ISTO nbo	DY requ	esti	s circl	uo pa	coc						om OS	50073, F	Rev.8 : Di	ate Issu	s 12/05/200
LABM	ARK	NATA	13542, /	AQIS N	N0356		Clie	int D	etal	S			Safet	/ Prece	aution: lab chemi	oratory si als, refe	ample b r to SAF	ottles m ETEY la	ay cont bel on 1	ain pre: bottle.	servatio	n acid /					
Dispatch sa Unit1/8 Leigh Asquith NSW or 116 Mooray St South Melbour	mples to: ton Place 2077 reet ne VIC 3205	Tel (SYD): { Fax (SYD): { Tel (MEL): Fax (MEL): (DB): 040944! ros.schacht@ paul woodwar	612-9476- 612-9476- 613-9686 613-9686 613-9686 9584, (PM 9584, (PM 91abmark.c	-6533 -8219 -8344 5-7344 V): 0439 com.au ark.com.	)390206 .au	Ø	Comp Projec Projec Projec	any & t Man t Nam t Type	Addre ager: e: (eg. S	ss: E Sn E Servicé	tefar ight	Grou- hok n):	har har se	bor tern La.	, Bula S nd Fil	ing C Samp / @ Project	vier: st No:	5qu 007	inde,	5 4	Da Da	J IMON. te Requ	Frei: Fx: Jired: e No:	Ø	284	888	Ø
Global S	Specificat	ions I re	quire	(defau	It is Not	t require	d if Not	ticked):					FS (fic)	•	Vala	tie Tests		Semi- & Nor	A A	nalysi	s Req	lest	Nitria	nt Tests		1	Othos
			(	-										:2>		1259		125g (n	Tex. 4 tests)				125g (ma	ax, 4 tests)		(eg	TCLP test
<ol> <li>Urgent TAT re</li> <li>Fast TAT Gua</li> <li>Do you wish s</li> <li>Additional QA</li> </ol>	iquired? ( please c rantee required? 1 ediment present ir 'QC reported wher	Surcharge may waters to be inc e sample batche	2 days) apply - Re cluded in c	3 days eceipt ct organic/ ed are <	utoff tirr ' inorga < 10 sar	. days re 3.00p nic extra mples?	m) clions?					100		<2> <2> <0>		11 2xd3m	200	200 mi	200 200	- SM	5508	inion	0.1 - 1L (she	emical group	8	(H'EN	here)
<ol> <li>Do you requir</li> <li>Do you wish α</li> <li>Flectronic dat</li> </ol>	e DIFFERENT sta ahromatograms to a transfer (circle: ) Note1: Note2	ndard EQL's fron be supplied? (Ad faxxlscsv Additional water : Contact lab if co	n those st. dditional fe .pdf ). Ple .sample m onsolidatin	tated in eese spi nust be : ng multi	the curi es). ecify. submitt ple ana	rent Lab ed for la lyses int	Mark pri b. duplic o a sing	ice catal cate & s Je samp	ogue? pike and	alysis. ainer.			1	> <5> <3> <4	9) PT-GC/FID/PID/0	_		CONT OCT	GG/ECD/FPD	Colved/ total )	st - other) cify test - other)	WWW IL IBION	B, TKP	IA befaited All	AD TEFOT , DAY	ons((Ca, Mg,	
				Ma	atrix		Contai	ner Typ	De (Na	t. = unpres	served, G=	glass, P=pi	lastic)	,> (e	40 H(Ce-	SW/: SW/: SM	े 00/11 12	sm\c smc	ь, Р( в, Р(	א <sup>(קו</sup> המאר רוס ו	eqe) əqe	KN'	-04	VIIV	N' N	teo DN	
Lab. Number	Sample ID	Sample Sc Depth	ampling Date	soll water	aîr paint, fillers	ormer Crange Orange	0.5-1L Vt (G) Nat. Orange 0	43ml 43m DA (G) VOA Net. HC range Mare	mt 0.1-11 .(G) (P) C1 H2SO 50n Purple	L 0.1-1L (G) 4 H2SO4	0.1-1L 0. (P) Nat. H Green	Filtered C	1.1-IL (P) aOH, Ott Blue Blue	۾ Combo <sub>(circl</sub>	AHC <sup>b1-GCW</sup> B1EX+ATP	VAC PT-GC/M	VOC PT-GC/M	Phenols of A	SVOC GC/MS	A <u>v</u> xonens sevisolqx∃ eleteM (ene)	ZHE LCCP LCCP <sup>(abec</sup>	(circle) pH, EC (circle) HH, T	(circle) TP, OH	(circle C1, F,	(circle) Free C	(aircle) Major	√1≄H
FORENI	8403			1				-			5	1	-					-				1	1	1		1	~
806241	Dupor			>					_		1	1				_			_			1	1	1		1	_
bobth	SH'by			7			-	-	_		1	1	-				4					1	2	1	3	1	
Olfful	TRIP BUAN																										1
Totals									-		10		-			-											
*Metals (circle): / Be, B, Al,	As, Cd, Cr, Cu, I V, Mn, Fe, Co, S	Ni, Pb, Zn, Hg, e, Sr, Sn, Mo,	, Cr <sup>6+</sup> , Cr Ag, Ba, T	г <sup>3+</sup> , Fe <sup>2</sup> П, Ві, S	<sup>2+</sup> , Fe <sup>3+</sup> 3b	Com	ments	(Highly c	ontamina	aled sam	ples):						ι Ψ Ο	SSCS	386	U F		Security	Seal Ap Seal Se	pplied rial #			ES/NO
Relinquished	by (print): N/	cute cou	Lavo		Sigr	hed:	Ree	ale	Cero	1101				Dat	e: 28	3.08	Rec	eived E	N: (	XX		3	Date	181:	5	Time:	2 pm
Relinquished	by (print):				Sigr	:bed:								Dat	e.		Reci	eived E	N. C	1 40	ala	1 m	Date	25	12/05	Time:	1 400

Work Order       ES0715646         Work Order       ES0715646         Client       ENVIRO RESOURCES         Contact       MS ELIZABETH WATS         Address       GROUND FLOOR, 33:         Contact       MS ELIZABETH WATS         Address       GROUND FLOOR, 33:         Contact       BS684 B800         LOCKED BAG 24 BRO         Email       Elizabeth watson@erm         Telephone       B584 8800         Facsimile       B584 8800         Co-O-C number       C-O-C number         Co-O-C number       ELIZABETH WATSON         Site       This report supersedes any previous report(s)         Colorental			(ALS)
Work Order       : ES0715646         Client       : Envireo RESOURCES         Contact       : MS ELIZABETH WATS         Address       : GROUND FLOOR, 33         Z009       : COCKED BAG 24 BRO         Address       : GROUND FLOOR, 33         Z009       : COCKED BAG 24 BRO         Email       : GROUND FLOOR, 33         Z009       : COCKED BAG 24 BRO         Email       : GROUND FLOOR, 33         Z009       : COCKED BAG 24 BRO         Email       : GROUND FLOOR, 33         Z009       : COCKED BAG 24 BRO         Femail       : GROUND FLOOR, 33         Z009       : COCKED BAG 24 BRO         Femail       : GROUND FLOOR, 33         Telephone       : B584 8800         Project       : 0071234 LIGHT HORS         Order number       : 0071234 LIGHT HORS         C-O-C number       : 0071234 LIGHT HORS         Sampler       : 2269         Sampler       : 2269         Sampler       : 2269         Sampler       : 2269         Sampler       : ELIZABETH WATSON         Site       : CO-C number         Co-C number       : ELIZABETH WATSON         Site       : This	CERTIFICATE	OF ANALYSIS	
Client :: ENVIRO RESOURCES Contact :: MS ELIZABETH WATS Address :: GROUND FLOOR, 33: 2009 LOCKED BAG 24 BRO 2009 LOCKED BAG 24 BRO E-mail :: elizabeth.watson@erm Telephone :: 8584 8800 Project :: elizabeth.watson@erm Stelephone :: 8584 8800 Project :: elizabeth.watson@erm C-O-C number :: 8584 8800 Project :: elizabeth.watson@erm Stelephone :: 2009 Ouder number :: 2269 Sampler :: 2269 Sample		Page	: 1 of 4
Address       : GROUND FLOOR, 33: 2009         2009       LOCKED BAG 24 BRO         E-mail       : elizabeth.watson@erm         Telephone       : 8584 8800         Froject       : 0071234 LIGHT HORS         Order number       : 8584 8800         Project       : 0071234 LIGHT HORS         Order number       : 0071234 LIGHT HORS         C-O-C number       : 0071234 LIGHT HORS         Sampler       : : : : : : : : : : : : : : : : : : :	RCES MANAGEMENT WATSON	Laboratory Contact	: Environmental Division Sydney : Victor Kedicioglu
2009 LOCKED BAG 24 BRO E-mail : elizabeth.watson@erm Telephone : 8584 8888 Facsimile : 8584 8800 Project : 0071234 LIGHT HORS Order number : 0071234 LIGHT HORS Order number : 2269 Sampler : 2268 Sampler : 2268 Sample	R, 33 SAUNDERS STREET, PYRMONT NSW	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone       ::::::::::::::::::::::::::::::::::::	4 BROADWAY NSW AUSTRALIA 2007	ээн Ц Ц	. Michor Kradini Andronavir, som
Facsimile       : 8584 8800         Project       : 0071234 LIGHT HORS         Order number       :         C-O-C number       : 2269         Sampler       : 2269         Sampler       : ELIZABETH WATSON         Site       : 2269         Sampler       : ELIZABETH WATSON         Site       : ELIZABETH WATSON         Couctinents       : ELIZABETH WATSON         Quote number       : EN/009/06         This report supersedes any previous report(s)       : report         release.       : EN/009/06         This Certificate of Analysis contains the following info       : General Comments         • General Comments       • Analytical Results         • Analytical Results       NATA Accredited Laboratory 825         NATA Accredited Laboratory 825       This document is issued in accordance with NATA accreditation requirements.		Telephone	2 Mictor: Acutorogramma assertant o.com 2 +61-2-8784 8555
Project       : 0071234 LIGHT HORS         Order number       :         C-O-C number       : 2269         Sampler       : ELIZABETH WATSON         Site       : EASTERN CREEK         Ouote number       : EN/009/06         This report supersedes any previous report(s)         release.         This Certificate of Analysis contains the following info         • General Comments         • Analytical Results         NATA Accredited Laboratory 825         This document is issued in accordance with NATA accreditation requirements.		Facsimile	: +61-2-8784 8500
Order number       : 2269         C-O-C number       : 2269         Sampler       : ELIZABETH WATSON         Site       : ELIZABETH WATSON         Quote number       : EN/009/06         This report supersedes any previous report(s)         release.       : EN/009/06         This Certificate of Analysis contains the following info         • General Comments         • Analytical Results         NATA Accredited Laboratory 825         Nation Results         NATA Accredited Laboratory 825         This document is issued in accordance with NATA accreditation requirements.         WORLD RECOGNISED         MORLD RECOGNISED	HORSE LANDFILL	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
C-O-C number : 2269 Sampler : ELIZABETH WATSON Site : ELIZABETH WATSON Site : EASTERN CREEK Quote number : EN/009/06 This report supersedes any previous report(s) release. This certificate of Analysis contains the following info elease. This Certificate of Analysis contains the following info elease. This Certificate of Analysis contains the following info or General Comments • Analytical Results • Analytical Results • Analytical Results • Analytical Results • This document is issued in accordance with NATA accreditation requirements.			
Sampler       : ELIZABETH WATSON         Site       : EASTERN CREEK         Quote number       : EN/009/06         This report supersedes any previous report(s)       :         This report supersedes any previous report(s)       :         This certificate of Analysis contains the following info       •         General Comments       •         Analytical Results       NATA Accredited Laboratory 825         NATA Accredited Laboratory 825       This document is issued in accordance with NATA accreditation requirements.		Date Samples Received	: 12-NOV-2007
Site :: EASTERN CREEK Quote number :: EN/009/06 This report supersedes any previous report(s) release. This Certificate of Analysis contains the following info • General Comments • Analytical Results NATA Accredited Laboratory 825 NATA Accredited Laboratory 825 This document is issued in accreditation requirements. Month RECOGNINED	TSON	Issue Date	: 20-NOV-2007
Quote number       : EN/009/06         This report supersedes any previous report(s) release.         This Certificate of Analysis contains the following info         • General Comments         • Analytical Results	X	No. of earnables received	
This report supersedes any previous report(s) release. This Certificate of Analysis contains the following info • General Comments • Analytical Results • Analytical Results		No. of samples analysed	4
This Certificate of Analysis contains the following info • General Comments • Analytical Results NATA Accredited Laboratory 825 NATA Accredited Laboratory 825 This document is issued in accordance with NATA accreditation requirements. Accredited for compliance with	ort(s) with this reference. Results apply to the	e sample(s) as submitted.	All pages of this report have been checked and approved for
NATA Accredited Laboratory 825 NATA Accredited Laboratory 825 This document is issued in accordance with NATA accreditation requirements. Accredited for compliance with	ng information:		
accreditation requirements. Accredited for compliance with	y 825 Signatories This document has been electronic in carried out in compliance with procedure	cally signed by the auth ss specified in 21 CFR Part 11	rized signatories indicated below. Electronic signing has been
accreditation requirements.	Signatories	Position	Accreditation Category
WORLD RECOGNISED Accredited for compliance with	ts. Ankit Joshi	Inorganic Chemist	Inorganics
	with Celine Conceicao Hoa Nuuven	Spectroscopist	Inorganics Inorganics
ACCREDITATION ISO/IEC 17025.	Sarah Millington	Senior Inorganic Chem	st Inorganics

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: 3 of 4	: ES0715646	<b>ENVIRO RESOURCES MANAGEMENT</b>	· 0071234 LIGHT HORSE LANDFILL
Page	Work Order	Client	Project



## **General Comments**

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been preformed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes.

Key : CAS Number = Chemistry Abstract Services number LOR = Limit of reporting

A = This result is computed from individual analyte detections at or above the level of reporting

EK085: LOR raised for samples BH02 and BH08 due to matrix interferrence.



## **Analytical Results**

Sub-Matrix: WATER		Clie	ent sample ID	BH09	BH05	BH02	BH08	
	Clie	ent samplii	ng date / time	08-NOV-2007 15:00	08-NOV-2007 15:00	09-NOV-2007 15:00	09-NOV-2007 15:00	
Compound	CAS Number	LOR	Unit	ES0715646-001	ES0715646-002	ES0715646-003	ES0715646-004	ł
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	-	mg/L	Ŷ	₹	₹	۲	I
Carbonate Alkalinity as CaCO3	3812-32-6	-	mg/L	₹	₽	79	2	I
<b>Bicarbonate Alkalinity as CaCO3</b>	71-52-3	-	mg/L	773	1180	79	638	ł
Total Alkalinity as CaCO3		٦	mg/L	773	1180	158	638	-
ED040F: Dissolved Major Anions								
Sulphate as SO4 2-	14808-79-8	-	mg/L	5	411	58	88	
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1.0	mg/L	2310	376	81.1	462	ł
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	-	mg/L	96	78	₽	10	
Magnesium	7439-95-4	-	mg/L	117	06	₹	13	-
Sodium	7440-23-5	-	mg/L	1390	761	140	536	-
Potassium	7440-09-7	٦	mg/L	26	2	12	8	
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.2	0.3	0.8	0.7	-
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N		0.010	mg/L	0.011	0.019	0.169	0.038	1
EK058G: Nitrate as N by Discrete Analyser								
^ Nitrate as N	14797-55-8	0.010	mg/L	<0.010	26.8	0.113	0.045	
EK059G: NOX as N by Discrete Analyser								
Nitrite + Nitrate as N		0.010	mg/L	0.012	26.8	0.282	0.083	I
EK085M: Sulphide as S2-								
Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<10.0	<10.0	
EN055: Ionic Balance								
A Total Anions		0.01	meq/L	80.7		6.64	27.6	
Total Anions	-	0.01	meq/L		44.7			
A Total Cations		0.01	meq/L	75.3	44.5		25.1	
Total Cations		0.01	meq/L			6.40		
A lonic Balance	-	0.01	%	3.51		2.01	4.77	
Ionic Balance		0.01	%		0.25		ł	I



ANALYTICAL CHI Environmei	emistry & testing services otal Division		
	INTERPRETIVE QUA	LITY CONTROL I	REPORT
Work Order	: ES0715646	Page	: 1 of 6
Client Contact	: ENVIRO RESOURCES MANAGEMENT : MS ELIZABETH WATSON	Laboratory Contact	: Environmental Division Sydney : Victor Kedicioglu
Address	: GROUND FLOOR, 33 SAUNDERS STREET, PYRMONT NSW 2009 LOCKED BAG 24 BROADWAY NSW AUSTRALIA 2007	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail Telephone Facsimile	: elizabeth.watson@erm.com : 8584 8888 : 8584 8800	E-mail Telephone Facsimile	: Victor.Kedicioglu@alsenviro.com : +61-2-8784 8555 : +61-2-8784 8500
Project Site	: 0071234 LIGHT HORSE LANDFILL	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
C-O-C number Sampler	: 2269 : ELIZABETH WATSON	Date Samples Received Issue Date	: 12-NOV-2007 : 20-NOV-2007
Quote number	: EN/009/06	No. of samples received No. of samples analysed	4 · · · ·
This report supersede This Interpretive Qual Analysis Ho Quality Com Brief Methoc Summary of	s any previous report(s) with this reference. Results apply to the sample(s) as submitted. ity Control Report contains the following information: ding Time Compliance rol Parameter Frequency Compliance 1 Summaries Outliers	All pages of this report have been o	shecked and approved for release.
	Environment Part of the ALS 277-289 Woodpark Ro Tol. +61-2-8784 8855 Fax.	al Division Sydney Laboratory Group ad Smithfield NSW Australia 2164 +61-2-8784 5500 www.alsolobal.com	
		Tothers Limited Company	

## Analysis Holding Time Compliance

dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in Sample date The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. the Summary of Outliers. the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares guarantee a breach for all non-volatile parameters.

### Matrix: WATER

Evaluation:  $\mathbf{x}$  = Holding time breach;  $\checkmark$  = Within holding time. Evaluation > > > 5 > > > > × × > > Due for analysis 22-NOV-2007 07-DEC-2007 07-DEC-2007 06-DEC-2007 06-DEC-2007 06-DEC-2007 11-NOV-2007 23-NOV-2007 06-DEC-2007 07-DEC-2007 07-DEC-2007 10-NOV-2007 Analysis 14-NOV-2007 14-NOV-2007 12-NOV-2007 14-NOV-2007 13-NOV-2007 13-NOV-2007 13-NOV-2007 13-NOV-2007 13-NOV-2007 13-NOV-2007 Date analysed 14-NOV-2007 12-NOV-2007 Evaluation l l l l Extraction / Preparation Date extracted Due for extraction l l ł l 1 l I l l ł I I I I I ł ł I I ł ł I 08-NOV-2007 08-NOV-2007 09-NOV-2007 08-NOV-2007 09-NOV-2007 08-NOV-2007 09-NOV-2007 08-NOV-2007 09-NOV-2007 08-NOV-2007 09-NOV-2007 09-NOV-2007 Sample Date BH05 BH05 BH08 BH05 BH05 BH08 BH05 BH08 BH05 BH08 BH08 BH08 EK057G: Nitrite as N by Discrete Analyse ED045G: Chloride Discrete analyser ED037P: Alkalinity by PC Titrator ED093F: Dissolved Major Cations ED040F: Dissolved Major Anions EK040P: Fluoride by PC Titrato Clear Plastic Bottle - Natural **Clear Plastic Bottle - Natural** Clear Plastic Bottle - Natural Clear Plastic Bottle - Natural **Clear Plastic Bottle - Natural** Clear Plastic Bottle - Natural **Clear Plastic Bottle - Natural** Container / Client Sample ID(s) BH02, BH02, BH09, BH02. BH09, BH02, BH09. BH09, BH02. BH09, BH09. BH02, Method

: 3 of 6	ES0715646	ENVIRO RESOURCES MA	0071234 LIGHT HORSE L/
Ð	k Order	nt	ect



Page Work Order Client Project	: 3 of 6 ES0715646 ENVIRO RESOURCES MANAGEMENT 0071234 LIGHT HORSE LANDFILL						$\sim$	ALS
Matrix: WATER					Evaluation:	× = Holding time I	oreach ; 🗸 = Within	holding time.
Method		Sample Date	EX	traction / Preparation			Analysis	
Container / Client Sample I.	D(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: NOX as N by D	Discrete Analyser							
Clear Plastic Bottle - Ns	atural							
BH09,	BH05	08-NOV-2007	ł	1		13-NOV-2007	10-NOV-2007	×
Clear Plastic Bottle - Ns	atural							
BH02,	BH08	09-NOV-2007	1			13-NOV-2007	11-NOV-2007	×
EK085M: Sulphide as S2	Ä							
Clear Plastic Bottle - Zii	nc Acetate/NaOH							
BH09,	BH05	08-NOV-2007	1			14-NOV-2007	15-NOV-2007	>
Clear Plastic Bottle - Zil	nc Acetate/NaOH							
BH02,	BH08	09-NOV-2007	-			14-NOV-2007	16-NOV-2007	>







# **Quality Control Parameter Frequency Compliance**

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: WATER

Evaluation: x = Quality Control frequency not within specification ; < = Quality Control frequency within specification. oificatio Ousliky Control Shi Data /0/1

Quality Control Sample Type		ပိ	unt		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Reaular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	7	20	10.0	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	0	20	10.0	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	÷	4	25.0	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Filtered	ED040F	2	20	10.0	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Filtered	ED093F	0	20	10.0	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.0	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	7	7	28.6	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulphide as S2-	EK085	-	8	12.5	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	-	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	10.0	10.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	÷	4	25.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Filtered	ED040F	÷	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Filtered	ED093F	-	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	~	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	~	7	14.3	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulphide as S2-	EK085	-	ø	12.5	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	-	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	٢	4	25.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Filtered	ED040F	-	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Filtered	ED093F	~	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	۲	20	5.0	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	-	7	14.3	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulphide as S2-	EK085	-	8	12.5	5.0	>	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	←	20	5.0	5.0	>	ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	+	4	25.0	5.0	>	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	-	20	5.0	5.0	>	ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	~	7	14.3	5.0	>	ALS QCS3 requirement


- ENVIRO RESOURCES MANAGEMENT 0071234 LIGHT HORSE LANDFILL



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<b>Brief Me</b>

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the

Certificate of Analysis. Sources from which ALS metho	ods have been developed a	re provided within	the Method Descriptions.
Analytical Methods	Method	Matrix	Method Descriptions
Alkalinity by PC Titrator	ED037-P	WATER	APHA 21st ed., 2320 B This procedure determines alkalinity by both manual measurement and automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Major Anions - Filtered	ED040F	WATER	APHA 21st ed., 3120 Sulphur and/or Silcon content is determined by ICP/AES and reported as Sulphate and/or Silica after conversion by gravimetric factor.
Chloride by Discrete Analyser	ED045G	WATER	The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method2 017-1-L april 2003
Major Cations - Filtered	ED093F	WATER	APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises filtered sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Fluoride by PC Titrator	EK040P	WATER	APHA 21st ed., 4500 FC CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite as N by Discrete Analyser	EK057G	WATER	APHA 21st ed., 4500 NO3- B. SEAL Method 2-018-1-L February 2003. Nitrite is determined by direct colourimetry by SEAL. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrate as N by Discrete Analyser	EK058G	WATER	APHA 21st ed., 4500 NO3F. SEAL Method 2-018-1-L February 2003. Nitrate is reduced to nitrite by way of a cadmium reduction column followed by quantification by SEAL. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	APHA 21st ed., 4500 NO3- F. SEAL Method 2-018-1-L February 2003. Combined oxidised Nitrogen (NO2+NO3) is determined by Cadmium Reduction and direct colourimetry by SEAL. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Sulphide as S2-	EK085	WATER	APHA 21st ed., 4500-S2 D Sulphide species present in water samples are immediately precipitated when collected in pretreated caustic/zinc acetate preserved sample containers. After the supermatant is discarded, the resultant precipitate is then coloured using methylene blue indicator and measured using UV-VIS detection at 664nm. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ionic Balance	EN055 - DA	WATER	APHA 21st Ed. 1030F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)



## **Outliers : Quality Control Samples**

Summary of Outliers

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QW/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

# Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.
- For all matrices, no Matrix Spike outliers occur.

### Regular Sample Surrogates

For all regular sample matrices, no surrogate recovery outliers occur.

## **Outliers : Analysis Holding Time Compliance**

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

### Matrix: WATER

Method		Ext	action / Preparation			Analysis	
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days
				overdue			overdue
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
ВН09,	BH05				12-NOV-2007	10-NOV-2007	7
Clear Plastic Bottle - Natural							
BH02,	BH08				12-NOV-2007	11-NOV-2007	۲
EK059G: NOX as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
BH09,	BH05		1		13-NOV-2007	10-NOV-2007	ę
Clear Plastic Bottle - Natural							
BH02,	BH08				13-NOV-2007	11-NOV-2007	2

## **Outliers : Frequency of Quality Control Samples**

The following report highlights breaches in the Frequency of Quality Control Samples.

No Quality Control Sample Frequency Outliers exist.

### ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

### Environmental Division



### SAMPLE RECEIPT NOTIFICATION (SRN)

**Comprehensive Report** 

Work Order	: ES07	15646						
Client Contact	: <b>ENVIR</b> : MS EL	O RESOURCES MANAGEMENT IZABETH WATSON	Laboratory Contact	: Envi : Victo	ronmental Division Sydney or Kedicioglu			
Address	: GROU STREI LOCKI AUSTI	IND FLOOR, 33 SAUNDERS ET, PYRMONT NSW 2009 ED BAG 24 BROADWAY NSW RALIA 2007	Address	: 277- NSV	289 Woodpark Road Smithfie V Australia 2164	∍ld		
E-mail	: elizabe	eth.watson@erm.com	E-mail	: Victo	or.Kedicioglu@alsenviro.com			
Telephone	: 8584 8	8888	Telephone	: +61-	2-8784 8555			
Facsimile	: 8584 8	8800	Facsimile	: +61	2-8784 8500			
Project Order number	Project : 0071234 LIGHT HORSE LANDFILL Drder number			: 1 of	2			
C-O-C number	Co-C number :			ES2	0060256 (EN/009/06)			
Site	: EASTE	ERN CREEK		. LOZ	0000230 (EN/003/00)			
Sampler	: ELIZA	BETH WATSON	QC Level	: NEF QCS	NEPM 1999 Schedule B(3) and ALS QCS3 requirement			
Dates								
Date Samples Rece	eived	: 12-NOV-2007	Issue Date		12-NOV-2007 18:43			
Client Requested D	ue Date	: 20-NOV-2007	Scheduled Reporting	ng Date	20-NOV-2007			
Delivery Deta	ails							
Mode of Delivery		: Carrier	Temperature		: CHILLED - Ice present			
No. of coolers/boxe	s	: 3 HARD	No. of samples rec	eived	: 4			

No. of samples analysed

: 4

### **General Comments**

Sercurity Seal

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.

: Not intact.

- Breaches in recommended extraction / analysis holding times may occur. Please contact ALS for further information (Nanthini Coilparampil).
- NO3 should be analysed within 48 hours of sampling.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Nanthini Coilparampil
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal Aqueous (14 days), Solid (90 days) from date of completion of work order.



### Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

### • No sample container / preservation non-compliance exist.

### Summary of Sample(s) and Requested Analysis

Some items descr process neccessar tasks. Packages r the determination tasks, that are includ When date(s) and have been assumed	ibed below may be y for the executior may contain addition of moisture con ed in the package. d/or time(s) are sh by the laboratory for pr	part of a laboratory n of client requested al analyses, such as tent and preparation own bracketed, these ocess purposes.	R - ED037P Ikalinity as CaCO3 (PC)	<ul> <li>C ED040F</li> <li>Ed Major Anions</li> </ul>	<ul> <li>ED045G</li> <li>by Discrete Analyser</li> </ul>	۲ - ED093F ed Major Cations	<ul> <li>с ЕК040-Р</li> <li>с РС)</li> </ul>	२ - EK058G as N by Discrete Analyser	R - EK085M e as S 2-	र - EN055 - DA alance (DA)
Laboratory sample ID	Client sampling date / time	Client sample ID	NATEF Fotal A	VATEF	VATEF	VATEF	NATEF Iuoride	NATEF Vitrate	NATEF	VATEF onic Ba
ES0715646-001	08-NOV-2007 15:00	BH09	1	✓	1	✓	1	1	-	✓
ES0715646-002	08-NOV-2007 15:00	BH05	1	1	✓	1	1	1	1	✓
ES0715646-003	09-NOV-2007 15:00	BH02	✓	✓	✓	1	✓	✓	✓	✓
ES0715646-004	09-NOV-2007 15:00	BH08	✓	1	✓	1	1	1	1	1

### **Requested Deliverables**

### MR STEFAN CHARTERIS

- A4 - ALL Certificate of Analysis - NATA	Fmail	stefan chateris@erm com
A4 ALL Interpretive Quality Control Depart No Aponymous	Email	
- A4 - AO Interpretive Quality Control Report - No Anonymous	Email	steran.cnatens@erm.com
<ul> <li>A4 - AU Quality Control Report - NATA - No Anonymous</li> </ul>	Email	stefan.chateris@erm.com
- A4 - AU Sample Receipt Notification - Environmental	Email	stefan.chateris@erm.com
<ul> <li>Default - Chain of Custody</li> </ul>	Email	stefan.chateris@erm.com
- EDI Format - ENMRG	Email	stefan.chateris@erm.com
- EDI Format - ESDAT	Email	stefan.chateris@erm.com
MS ELIZABETH WATSON		
- A4 - AU Certificate of Analysis - NATA	Email	elizabeth.watson@erm.com
- A4 - AU Interpretive Quality Control Report - No Anonymous	Email	elizabeth.watson@erm.com
- A4 - AU Quality Control Report - NATA - No Anonymous	Email	elizabeth.watson@erm.com
- A4 - AU Sample Receipt Notification - Environmental	Email	elizabeth.watson@erm.com
- Default - Chain of Custody	Email	elizabeth.watson@erm.com
- EDI Format - ENMRG	Email	elizabeth.watson@erm.com
- EDI Format - ESDAT	Email	elizabeth.watson@erm.com
THE ACCOUNTS PAYABLE		
- A4 - AU Tax Invoice	Email	au.accounts@erm.com

Annex H

### Tables

### Table 1 Analytical Suite and Assessment Criteria Light Horse Landfill - Eastern Creek, NSW

Analyte	Adopted Ecological Investigation Level	Adopted Human Health investigation
		level
Inorganics		
Bicarbonate	nc	nc
Calcium	nc	nc
Carbonate	nc	nc
Chloride	nc	250 <sup>a</sup>
Fluoride	nc	1.5
Magnesium	nc	nc
Nitrate (as N)	0.7	50
Nitrite (as N)	nc	3
Potassium	nc	nc
Sodium	nc	180 <sup>a</sup>
Sulfate	nc	500
Sulfide	nc	nc

### Notes

units mg/L nc no criteria

Ecological investigation levels are derived from the ANZECC (2000) guidelines for fresh and marine water quality.

BoldHigh reliability trigger value for the protection of 95% of freshwater speciesItalicModerate reliability value for the protection of 95% of freshwater speciesHuman health investigation levels are derived from the Australian Drinking Water Guideline (2004) for the protection of human health unless otherwise stated.

а

Australian Drinking Water Guideline (2004) aesthetic guideline value only

Contaminant	Solid Waste	Likely Leachate Concentration	Trade waste Discharge Criteria
	Leachable Concentration		
	TCLP2 (mg/L)	mg/L	mg/L
	_	2.24	100
Aluminium Ammonia as N	nc	0.04	100
Arsenic	5	0.008	1
Barium	nc	2.4	2
Benzene	0.5	0.002	0.1
Benzo(a)pyrene Beryllium	0.04	nc	nc
Bicarbonate	nc	2500	nc
Calcium	nc	139	nc
Cadmium	1	0.0001	1
Carbon tetrachloride	0.5 nc	nc	nc
Chloride	nc	1860	nc
Chlorobenzene	100	nc	nc
Chloroform	6	nc	0.1
Chromium (total) Chromium (VI)	5	0.023 nd	3
Cobalt	nc	0.008	5
Copper	nc	0.002	5
m-Cresol	200	nc	nc
p-Cresol	200	nc	nc
Cresol (total)	200	nc	nc
Cyanide (amenable)	3.5	nc	1
Cyanide (total)	16	nc	nc
2,4-D 1 2-Dichlorobenzene	4.3	nc	nc
1,4-Dichlorobenzene	7.5	nc	nc
1,2-Dichloroethane	0.5		
1.1 Disklaraathulana	0.7	nc	nc
Dichloromethane	8.6	nc	nc
2,4-Dinitrotoluene	0.13	nc	nc
Electrical Conductivity (US/cm)	nc	8573	nc
Ethylbenzene	30	nd 0.8	1 20
Iron	nc	12.5	50
Lead	5	0.002	2
Manganese	nc	0.211	10
Magnesium	nc 0.2	97 nd	nc 0.03
Methyl ethyl ketone	200	nc	nc
Molybdenum	5	nc	100
Naphthalene	nc	13.4	nc
Nickel	2	nc 0.032	3
Nitrate	nc	0.027	nc
Nitrobenzene	2	nc	
C6-C9 petroleum hydrocarbons	nc	0.05	nc
C10-C36 petroleum hydrocarbons	nc	15.11	10 <sup>b</sup>
pH	nc	6.6 - 7.49	7 - 10
Phenol (nonnchalogenated)	14.4	0.233	10
Potassium	nc	230	nc
Polychlorinated biphenyls Polycyclic aromatic	nc	nc	nc
hydrocarbons(total)	nc	13.4	5
Scheduled chemicals	nc	nc	nc
Selenium	1	nc	5
Sodium	nc	1490	nc
Styrene (vinyl benzene)	3	nc	nc
Sulphate	nc	1	2000
1,1,1,2 – Tetrachloroethane	10	nc	nc
Tetrachloroethylene	0.7	nc	0.3
Toluene	14.4	nd	1
Total Dissolved Solids	nc	4520	10000
1,1,1-Trichloroethane	30	nc	nc
Trichloroethylene	0.5	nc	0.1
2,4,5-Trichlorophenol	400	nc	0.05 <sup>a</sup>
2,4,6 Trichrolophenol	2	nc	0.05 <sup>a</sup>
Vinyl chloride	0.2	nc	nc
Xylenes (total)	50	nd 0.191	2
ZIIIC	110	0.471	

Table 2 Potential Contaminant Concentrations within Seepage Water Light Horse Landfill - Eastern Creek, NSW

Notes

nc nd No criteria Non-detect

nd Non-detect
leachate concentration exceeds trade waste critieria
a 0.05 is trade waste critieria for total chlorinated phenolics
b 0.05 is trade waste criteria for total petroleum hydrocarbons (C6 to C36
The likely leachate concentrations are based on leachate sampling analysis completed at Alexandria Solid Waste Landfill by lan Grey
Consulting Ltd. Sampling was completed on 8 occasions at quarterly intervals between 23/01/06 and 17/10/2077.
Solid Waste TCLP data is from the Department of Environment & Conservation NSW (1999) Environmental Guidelines: Assessment,
Classification & Management of Liquid and Non-liquid Wastes EPA, Table A4.
The lande waste are the operative intervale listed on the optioneurotecombustion.

The trade waste criteria are the acceptance standards listed on the sydney water website.

### Table 3 Field Water Quality Parameters Light Horse Landfill - Eastern Creek, NSW

Sample ID	Depth of Screen	Date of Sampling	Temperature	Dissolved Oxygen	Conductivity	Ηd	Redox Potential
	m bTOC		°Celcius	udd	uS/cm		٨
Ecological Investigation Lev	el		рс	6 - 10.5	125-2200	6.5 - 8.0	nc
<b>Human Health Investigation</b>	Level		nc	9<	1000	6.5 - 8.5	nc
3H01 (deep)	128-134	21-Feb-08	21.30	0.22	2680	7.05	-205
3H02 (intermediate)	43.7-49.7	70-vov-60	18.4	3.79	630	9.72	71
3H02 (intermediate)	43.7-49.7	20-Feb-08	22.2	0.15	1554	8.14	-210
3H03 (deep)	134-140	27-Mar-08	25.4	2.81	1941	11.59	-
3H04 (intermediate)	43.6-49.6	08-Nov-07	19.5	0.18	3370	7.67	26
3H04 (intermediate)	43.6-49.6	26-Feb-08	21.9	2.74	4830	7.62	20
3H05 (shallow)	14.7-20.7	08-Nov-07	20.7	2.28	2870	6.99	139
3H05 (shallow)	14.7-20.7	26-Feb-08	20.9	2.41	3590	7.04	<i>L-</i>
3H06 (deep)	140-146	12-Mar-06	23	0.48	2015	10.53	82
3H07 (intermediate)	44.8-50.8	70-vov-60	18.2	0.63	0699	8.98	107
3H07 (intermediate)	44.8-50.8	27-Feb-08	22.1	3.62	8710	8.26	153
3H08 (shallow)	14.8-20.8	08-Nov-07	19	1.7.1	2510	8.54	119
3H08 (shallow)	14.8-20.8	22-Feb-08	21	1.44	4090	7.61	11
3H09 (shallow)	14.0-20.0	08-Nov-07	18.7	2.05	693	7.37	61
3H09 (shallow)	14.0-20.0	20-Feb-08	21.3	2.8	8300	7.08	78
Quarry Pond	na	26-Feb-08	25.4	9.5	1138	8.95	104
Quarry Pit <sup>1</sup>	na	-	nt	nt	1288	8.6	nt
UE Wall Seenade	2		54	44	1070	0 11	ţ

### Notes

				t Datum					vel	ANZECC (2000) South East Australia lowland river ecosystems.	ch have been estimated from the percent saturation trigger values o	nd river systems; and	purposes.	
No Criteria	Not applicable	No data	Metres below top of casing	Metres above Australian Height	Parts per million	Micro semens per cenitmetre	Millivolts	Not tested	ogical and human health investigation lev	ation levels include the trigger values for ,	riteria presented are in mg/L (ppm), whic	ECC (2000) South East Australia lowland	an Drinking Water Guidelines aesthetic p	
nc	na		m btoc	m AHD	bpm	µS/cm	 ∧m	nt	Exceeds both ecolo	Ecological Investiga	Dissolved oxygen ci	- 85-110% for ANZ	- >85% for Australi	

1: Results from Ian Grey Groundwater Consulting (2007) Archbold Road, Eastern Creek: Groundwater and Salinity Assessment for Proposed Quarry Rehabilitation Project and Developable Land.

0.4 0.25 4.2 0.01 2.01 4.77 3.51 g g ъ Ę ц Sonic Balance Ħ ц Ħ nt Ħ Ħ 1390 6 518 702 475 340 536 880 440 289 280 ы 6 484 mq/L 80 muiboS 194 2.5 107 mg/L 5 g g 2 Potassium 26 4 44 85.9 42.7 2.6 ы 45 6.5 ы v muisəngaM mg/l , v 6 3 0.1 2 °. ŝ 66.1 216 21.6 4.1 38.0 23.6 222 mg/L 0.1 ы v 33 muioleO ы 78 10 6 N 0. 2 0 10 <u>0</u> <u>0</u> <10 0.1 0.1 ы ы <0.1 Ħ <0.1 Ħ əbidqluð mg/l nt ×0.1 nt nt nt ъ 129 117 ы 500 395 58 4 26 22 88 131 22 N 4 24 ß 13.82 0.282 13.92 0.083 0.012 2.76 26.8 8.29 1.48 2.90 (besibixO latoT) negoritied) 0.01 nt 2 2 37 138 126 Ę 0.038 0.169 0.019 <0.01 0.06 0.01 0.01 0.02 0.03 0.0 0.34 ő 0.07 0.07 001 (N ss) 911111N mq/l c ). 0 0.113 0.045 0.06 0.04 2.76 0.01 0.85 26.8 8 20 0.44 0.31 <0.01 0.85 0.01 0.02 (N ss) 9161110 0.7 50 0.3 0.8 1.5 0.5 0.3 ი. 0 0.2 0.3 0.5 0.2 1/bu 0.3 0.3 Fluoride 0.1 ò. 0.0 0 ç. 5,410 2310 81.1 233 233 175 534 462 922 2640 ы 376 250 g\_\_\_\_\_Chloride 250 251 23 2 453 455 1360 158 1180 800 484 638 442 773 380 1/gm ы ы 006 nt Alkalinity (total) as CaCO3 Ħ nt ß <1000 <1000 1000 <1000 <1000 270 ы <22 ng/L ы 277 ささ Alkalinity (Hydroxide) as CaCO3 Ħ ŧ Ĕ nt Ħ Ĕ nt 183 178 mg/L ы <5 <2 ŝ <5 55 Carbonate ß ы 79 Ϋ́ v ŝ <u>د</u>22 v v 800 484 442 1180 1360 638 333 Bicarbonate g 62 433 2 2 2 2 2 006 738 773 859 l/ĝm ы ß <0.01 <0.01 0.9 0.5 0.83 nt 0.01 .43 .03 Ħ ц sinommA Ħ Ħ ц E036376 E036886 E036886 E036886 E036886 E036886 E036715 E036715 E036715 E036886 ES0715646 ES0715646 ES0715646 E036442 E036442 E036376 E036376 SDG Nov-07 <sup>=</sup>eb/March 08 27-Mar-08 27-Mar-08 13-Mar-08 27-Mar-08 26-Feb-08 26-Feb-08 22-Feb-08 13-Mar-08 22-Feb-08 22-Feb-08 9-Nov-07 8-Nov-07 9-Nov-07 8-Nov-07 Date 140-146 44.8-50.8 14.8-20.8 14.0-20.0 Depth of 134-140 14.7-20.7 14.8-20.8 uman Health Investigation Level 140-146 14.0-20.0 43.7-49.7 43.7-49.7 134-140 14.7-20.7 Screen m bTOC na cological Investigation Level BH02 (Intermediate) 3H02 (Intermediate) BH07 (intermediate) BH08 (Shallow) H05 (Shallow) 3H08 (Shallow) (H09 (Shallow) 3H05 (Shallow) H09 (Shallow) H03 (deep) Quarry Pond Quarry Pond 3H06 (deep) Sample I.D. up02 up01 ю́. ಕ

Table 4 Chemical Water Quality Results Light Horse Landfill - Eastern Creek, NSW

8/04/2008

1: Results from Ian Grey Groundwater Consulting (2007) Archbold Road, Eastern Creek: Groundwater and Salinity Assessment for Proposed Quarry Rehabilitation Project and Developable Land. 2: Investigation level present is the aesthetic trigger value listed within NHMRC (2004). No health based guideline value is listed.

SDG: sample delivery good (laboratory report number)

m bTOC: metres below the top of the well cassing

na: not applicable

- : no data <mark>Value exce</mark>

nt: not tested

and

 Table 5

 Estimated Hydraulic Conductivities

 Light Horse Landfill - Eastern Creek, NSW

	Depth of			Hydraulic C	onductivity
Sample ID	Screen	Date of Testing	Method of Testing	Bouwer-Rice	Hvorslev
	m bTOC			m/day	m/day
BH01 (deep)	128-134	Nov 07 - Mar 08	Long term water level analysis	-	8.70E-06
BH03 (deep)	134-140	Nov 07 - Mar 08	Long term water level analysis	-	1.75E-06
BH04 (intermediate)	43.7-49.7	70-vov-07	Rising Head Slug Test	6.37E-06	7.90E-06
BH05 (shallow)	14.7-20.7	70-vov-07	Rising Head Slug Test	2.10E-01	2.50E-01
BH06 (deep)	140-146	Nov 07 - Mar 08	Long term water level analysis	-	2.18E-06
BH07 (intermediate)	44.8-50.8	Nov 07 - Mar 08	Long term water level analysis	-	5.95E-06
BH08 (shallow)	14.8-20.8	70-vov-07	Rising Head Slug Test	1.46E-03 - 3.0E-03	1.78E-03 - 3.82E-03
BH09 (shallow)	14.0-20.0	09-Nov-07	Rising Head Slug Test	3.18E-03	4.07E-03

m bTOC: metres below the top of the well casing.

Annex I

### Water Balance Modelling

	1974 2007	
	32	
	3.7	1354.4
0	5.9	182.9
dec	5.1	153
von	4.5	39.5
oct	3.7	11
sep	()	1
aug	2.(	80.6
	1.8	55.8
'n	1.7	51
n	2	62
may	e	06
apr	3.9	6.0
mar		120

	1887	2007	
	101	1	
	860.8	0.000	
	8 V Z	) t	
dec	73	4	
Nov			
	<u>д</u> 50 д	0.60	
oct	α		
sep	.4	ŕ	
0	л 1	5	
aug	U U	2	
-	57	5	
<u>ب</u>	75.1		
jun	Ľ	C	
ay	70	1	
Ĕ	٧Z	ţ	
apr			
L	6 90	20.0	
ma	~	-	

	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	vou	dec
Mean Monthly Rainfall	95.1	94.1	96.3	74	72.5	75.1	57.6	51	47.8	59.5	72	74.8
Mean Monthly Evaporation	170.5	137.2	120.9	06	62	51	55.8	80.6	111	139.5	153	182.9



1321.91

1.00E-09 8.64E-05

136.3 59.8 Nov 43.2 131 oct 40.9 101.7 sep 31.3 129.6 aug 129.8 34.3 <u>, </u> 39 181 ju 38.4 174 may 54.5 170.5 apr 77.4 201.7 mar 196.4 69.9

2007 1887 2007

120

1182.6

159.6

1887

120

831.3

56

dec



Site information Site name: PROSPECT RESERVOIR Site number: 067019 Latitude: 33.82 °S Longitude: 150.91 °E Elevation: 61 m Commenced: 1887 Status: Open Latest available data: 16 Jul 2008

Mean Monthly Evaporation









Area (m2)	264242.2	208218.67	195254.46	158861.83	120140.68	64636.455	19256.228	12077.848	
ie (m3)	1283.04	2528.32	7839.64	93773.6	894.352	46886.8	9377.36	0	

Calculated area (m2)	12077.848	264242.2	dimensionless
Area	12000	265000	1.628571
Radius	62	290	Slope (Z)

volume	1553	1331	1275	110	30006	527	110	
diameter (m)	580	514.8571429	498.5714286	449.7142857	391.0857143	286.8571429	156.5714286	124
radius (m)	290	257.4286	249.2857	224.8571	195.5429	143.4286	78.28571	62
depth (m)	140	120	115	100	82	50	10	0

	Leachate Level Average Monthly Rainfall (m above base		Leachate Level 90th Percentile Monthly Rainfall (m above base
Lower Variance (mm)	of landfill)	Higher Variance (mm)	of landfill)
40.9	40.9	74	114.9
5.27	5.27	25.15	30.42
0.59	0.59	4.87	5.46
0.1	0.1	2.9	3

Figure 6: Changes in Landfill Leachate Water Elevations with Changes in Leachate Dewatering Rates



Leachate Level 10th Percentile Monthly Rainfall (m above base of Landfill)	0	0	0	0		
Pumping rate (m3/day)	150	250	350	500		140

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