

Kiama Council

Annual Surface & Groundwater Monitoring Report (EPL) Gerroa Waste Disposal Depot

(EPL: May 2020 to February 2021 & Ammonia Monitoring: March 2020 to February 2021)

Report E2W-025 DR001 (V2)

19 March 2021



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Client: Kiama Municipal Council

Project: Annual Surface & Groundwater Monitoring Report Gerroa Waste Disposal Depot (EPL: May 2020 to February 2021, & Ammonia Monitoring: March 2020 to February 2021)

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Report: 19 March 2021 Reference: E2W-025 DR001 (V2)

Water Sampling & Laboratory Analyses Completed By: ALS Environmental Pty Ltd; EPL May 2020 to February 2021 (4 rounds) Ammonia Monitoring; March 2020 to February 2021 (5 rounds)



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1. Introduction

Earth2Water Pty Ltd (E2W) was engaged by Kiama Municipal Council (Council) to provide an annual groundwater and surface water monitoring report for the Gerroa Waste Disposal Depot (GWDD). The GWDD Environment Protection Licence (EPL) was revoked in May 2008 and altered the previous reporting periods from August-July, to 1 April 2008 - 31 March 2009. The EPL reporting periods and monitoring periods have changed since 2009 (i.e. 2009-2010 monitoring report included results from five monitoring events including February 2009, May 2009, August 2009, November 2009 and February 2010. The 2010-2011 monitoring report included results from four monitoring may 2010, August 2010, November 2010 and February 2011. The 2011-2012 annual report includes results from five monitoring events including May 2011, August 2011, November 2011, February 2012 and May 2012.

The previous EPL reports (2010-2016) were provided as annual reports which included results from four regular quarterly monitoring events (May, August, November and February). The annual report from May 2016 to May 2018 included nine (9) quarterly monitoring events, whilst EPL (June 2018 to April 2019) included ten monitoring events (Ammonia only: 15 June 2018, 12 July 2018, 17 October 2018, 6 December 2018, 4 April 2019, and three EPL quarterly events; 22 August 2018, 16 November 2018, 12 February 2019. Last years annual EPL report (2019-2020) includes nine monitoring events (i.e. ammonia analyses @ June 2019, July 2019, September 2019, October 2019, & January 2020), and four quarterly EPL events; May 2019, August 2019, November 2019 and February 2019).

This annual EPL report (2020-2021) includes nine (9) monitoring events (i.e. ammonia analyses @ March 2020, June 2020, September 2020, December 2020, & January 2021), and four quarterly EPL events; May 2020, August 2020, November 2020 and February 2021). This EPL is the sixteenth provided by E2W to the NSWEPA on behalf of Council, and meets the general conditions outlined in the previous EPL (Lic No: 5959, R1.10).

This EPL report also follows NSW EPA correspondence and E2W previous report entitled "Second Interim Groundwater Report- Gerroa Waste Disposal Depot", dated 14 May 2018 which outlined the rising ammonia trends at several deep wells (e.g. MW-1D, MW-3, MW-4, MW-5, MW-6D, MW-7D, Appendix D). The additional monthly monitoring continues to be undertaken to assess the variable to rising ammonia trends at multiple well locations at the former landfill site.

1.1 Background and Remediation Activities

Council has owned and operated the GWDD since the 1960's. It was previously licensed as a Solid Waste Class 1 Landfill, operating under the EPL No. 5959. The site also functioned as a night soil depot for liquid pump out sullage. Land filling operations at the GWDD were discontinued in October 2003.

From July 2004 to February 2005, the landfill was rehabilitated to eliminate, or at least minimise the potential for landfill leachate generation. The waste mound was reshaped, capped with a 0.5 m thick clay barrier and 0.3 m thick combined drainage/re-vegetation layer. The former night soil trench was also remediated in August 2004 (i.e. approximately 300 tonnes of bio-solid sludge were excavated and placed underneath the clay cap).



In February 2005, an irrigation system was installed to assist with the re-vegetation of the landfill mound using a combination of native and annual grasses. A groundwater holding dam (30 x 30 m) was also constructed next to the two existing evaporation ponds to contain and supply water for the irrigation system. A spear point (yield \sim 2 L/sec) was installed on the north-west corner of the landfill mound to allow groundwater (and landfill leachate) to fill the holding dam as well as supply water for the irrigation system.

The sludge pond (southern lined dam) at Gerroa Landfill has not been used since Council ceased undertaking the septic clean-outs. Waste Processing Solutions Pty Ltd was engaged by KMC in September 2009 to de-water the sludge in the lined pond, and subsequently taken to a Soilco Pty Ltd owned site. Removal of the pond liner (HDPE) was undertaken in October 2011 by Council and disposed to Shellharbour landfill (note: spillage of residual sludge may have occurred during removal of the liner).

Up until November 2008, Ecowise Pty Ltd (now ALS) performed the quarterly surface and groundwater monitoring at the landfill site. E2W and Council undertook the monitoring in November 2008, and subsequently Council and/or ALS performing the quarterly monitoring rounds herein. Water samples are sent to ALS for laboratory analyses. The access to the landfill is currently secured, with gates locked.

1.2 Objectives

The objective of the ongoing monitoring is to assess the potential impact of the GWDD on local surface and groundwater systems. This round of monitoring provides an assessment of water quality trends associated with the landfill rehabilitation works completed in February 2005.

2. Scope of Work

E2W was commissioned by Council to collate and interpret surface and groundwater data from the GWDD on the following dates

- EPL Events: 28 May 2020, 13 August 2020, 6 November 2020, and 1 February 2021. Each monitoring event comprised the following:
 - Sampling of onsite and offsite groundwater wells; MW-1S, MW-1D, MW-3, MW-4, MW-5, MW-6S, MW-6D, MW-7S, MW-7D, MW-9, MW-10 and MW-11.
 - Ammonia Monthly Monitoring: Sampling dates included: 8 Januarty 2021, 18 December 2020, 9 September 2020, 17 June 2020, 5 March 2020. Wells samples include; MW-1D, MW-3, MW-5, MW-6D, MW-7D, MW-11, MW-12, MW-13 & MW-14.
- Sampling of surface water at all five locations along Blue Angle Creek (ML-1, ML-2, ML-3, ML-4, ML-5¹). In previous reporting periods, several testing locations (i.e. ML-1, ML-3 and ML-4) were inaccessible due to being located on private property belonging to Cleary Brothers).

Similar EPL reports were previously completed by E2W for the dates; 2003-2004, 2004-2005, 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010, 2010-2011, 2011-2012, 2012-2013,

¹ November 2008 was the first time ML-5 had been sampled since October 2004.



2013-2014, 2014-2015, 2015-2016, 2016-2018, and 2019-2020. Council has indicated (2017) that EPL reports are no longer required, however monitoring is conducted to assess the water quality and address any requirements for site management or remediation.

E2W completed the following scope of work to satisfy Council's surface and groundwater monitoring program at GWDD:

- Assist Council to interpret quarterly sampling results and provide recommendations.
- Prepare this annual report for May 2020 to February 2021 to provide information in accordance with Section R1.10 of the EPL (No. 5959). The annual report is to include the following:
 - 1. Tabulation of the monitoring data obtained for the period.
 - 2. Graphical representation of the current and previous monitoring data. Statistically significant variations or anomalies will be highlighted.
 - 3. Analyses and interpretation of monitoring data.
 - 4. Analyses and response to any complaints received.
 - 5. Identification of any deficiencies in the environmental performance of the GWDD, as highlighted by the monitoring data, trends and/or accidents.
 - 6. Proposal of recommendations to address the above identified deficiencies.
 - 7. Recommendations on improving the overall environmental performance of the facility.

This annual report includes four rounds of additional monitoring at key wells to assess ammonia trends at selected locations (refer to *E2W*, *"Second Interim Groundwater Report Gerroa Waste Disposal Depot, dated 14 May 2018*).

Based on NSWEPA correspondence, ammonia results from wells (MW-1D, MW-3) are as follows:

- MW-1D: On 10 November 2016 and 20 February 2017, ammonia levels at this monitoring point were 12.5mg/L and 6.65mg/L respectively. These are the highest recorded results since 2011 results.
- MW3: On 31 May 2016 and 10 November 2016, ammonia levels at this monitoring point were 4.31mg/L and 1.30mg/L respectively. It is noted that on 16 February 2016, ammonia was detected as 20.9mg/L however, Council's consultant indicated that this result was an anomaly. Aside from this result, and 7.78mg/L being detected on 18 February 2013, all other results have been below 1.00 mg/L.

The 6 wells located in proximity to the landfill mound (MW-1D, MW-3, MW-4, MW-5, MW-6D, MW-7D) are recommended to be monitored for ammonia on a more regular basis, including the three downgradient wells (MW-12,13, 14) next to MW-1D (refer to Figure 4).

3. Licence Criteria and Relevant Guidelines

The EPL for the GWDD was revoked by the DECC in May 2008. The ongoing groundwater monitoring is undertaken to assess the effectiveness of the capping works and environmental status of the landfill post closure and rehabilitation. The revocation notice is subject to the following conditions:

• The licensee must maintain the landfill capping works.



- The licensee must undertake groundwater monitoring at groundwater wells MW-1S, MW-1D, MW-3, MW-4, MW-5, MW-6S, MW-6D, MW-7S, MW-7D, MW-9, MW-10 and MW-11 (in accordance with Table 3.1 below).
- Should the monitoring results indicate ammonia concentrations greater than 20% above ammonia concentrations reported in Table GW-1 of Kiama Municipal Council, Gerroa Waste Disposal Depot Annual Groundwater and Surface Water Monitoring Report August 2006 to May 2007, dated 17 August 2007, the licensee must notify the EPA within 7 days of receiving the results (Appendix C).
- The licensee must undertake surface water monitoring at surface water monitoring points ML-1, ML-2, ML-3, ML-4 and ML-5 (in accordance with Table 3.1 below).
- Should the monitoring results indicate ammonia concentrations greater than 10% above ammonia concentrations reported in Table SW-1 of Kiama Municipal Council, Gerroa Waste Disposal Depot Annual Groundwater and Surface Water Monitoring Report August 2006 to May 2007, dated 17 August 2007, the licensee must notify the EPA within 7 days of receiving the results (Appendix C, exceedances are present).

Parameters	Monitoring Frequency –	Monitoring Frequency –	
	Groundwater	Surface water	
Alkalinity	Quarterly (#1)	Quarterly (#1)	
pH	Quarterly (#1)	Quarterly (#1)	
Conductivity	Quarterly (#1)	Quarterly (#1)	
Total Dissolved Solids	Quarterly (#1)	Quarterly (#1)	
Nitrogen (Ammonia)	Quarterly (#1)	Quarterly (#1)	
Phosphorous (Total)	Quarterly (#1)	Quarterly (#1)	
Nitrate	Quarterly (#1)	Quarterly (#1)	
Nitrite	Quarterly (#1)	Quarterly (#1)	
Total Kjeldahl Nitrogen	Quarterly (#1)	Quarterly (#1)	
Calcium	Annual	Annual	
Chloride	Annual	-	
Fluoride	Annual	-	
Magnesium	Annual	Annual	
Sulphate	Annual	-	
Sodium	Annual	Annual	
Bicarbonate	Annual	Annual	
Carbonate	Annual	Annual	
Potassium	Annual	Annual	
Dissolved Organic Carbon	Annual	-	
Iron	Annual	Annual	
Manganese	Annual	Annual	
Redox Potential	Annual	Annual	
Faecal Coliforms	-	Annual	
Enterococci	-	Annual	

Table 3.1: Surface and Groundwater Monitoring Requirements

Note: Bicarbonate/alkalinity was conducted on quarterly basis (only an annual requirement). Quarterly (#1) = monitoring is conducted on quarterly basis by KMC, however EPL requires sampling only "twice a year". The enterococci analyses was not conducted for the surface water events during 2019 to 2021 (Note: enterococci is not a reliable indicator of landfill leachate at the site).

The parameters listed in Table 3.1 were included in the three quarterly monitoring events from May 2020 to February 2021 (Table 6). Annual parameters were sampled during the August 2016,

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November 2018, February 2019, and August 2019/2020 monitoring periods. Ammonia was measured in the five monitoring rounds from March 2020 to February 2021.

Ongoing quarterly monitoring with the same parameters is proposed for the future monitoring reports. A temporary monthly monitoring program is underway (Since late 2017) to address the rising ammonia trends in several key wells at the landfill site.

The DECC's Contaminated Sites: Guidelines for Assessment and Management of Groundwater Contamination (March 2007) outlines a best-practice framework for assessing and managing groundwater contamination. The guidelines are made under the Contaminated Land Management Act (1997) and recommend adopting the ANZECC (2000) chemical concentration trigger values for the protection of (fresh and marine) aquatic ecosystems.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000/2018) guidelines include risk-based trigger levels and indicative interim working levels (IIWLs). The IIWLs are of low reliability and used when insufficient data is available to calculate a trigger level. It should be noted that the ANZECC (2000) water quality guidelines are applicable to receiving water and not to groundwater. However, they form an appropriate basis for undertaking a screening level assessment of groundwater quality. The selection of the applicable guideline values should be based on an assessment of potential pathways by which human or environmental exposure might take place and the beneficial end use of the groundwater (i.e. ecosystem support).

The choice of a beneficial use classification for groundwater at the site depends on the quality of the water and its potential use in the long term. Although groundwater in the aquifer surrounding the waste disposal facility is likely to be of relatively good quality (depending on the presence of saline intrusions), there are no known groundwater extraction bores (agricultural or domestic) within the immediate vicinity. Therefore, the most appropriate beneficial use category of the groundwater is considered for the protection of aquatic ecosystems in the discharge zones of nearby Blue Angle Creek and Seven Mile Beach (i.e. fresh and marine water, respectively).

Based on the closest environmental receptors being both marine and fresh waters (i.e. Seven Mile Beach, Blue Angle Creek and Crooked River Estuary), the guidelines adopted for the site are based on the protection of both marine and freshwater aquatic ecosystems. These assessment guidelines are presented with the summarised analytical results (i.e. Tables; Groundwater GW-1, Surface Water SW-1).

Exceedances of ANZECC (2000) trigger values for marine water ecosystems have been highlighted in Tables GW-1 and SW-1.

4. Environmental Setting

The GWDD is located approximately 1.5 km southwest of the Gerroa Road bridge crossing of Crooked River and near the northern end of Seven Mile Beach. Blue Angle Creek is located around 80 m to the northwest of Crooked River Road (Figure 1).

The facility covers an area of approximately 3.2 hectares. The location and general layout of the site is shown in Figures 1 and 2. Prior to the remediation of the site in February 2005, the GWDD comprised the following:



- An elevated landfill mound ranging from 4 m to approximately 15 m AHD.
- Two lined evaporation sludge ponds. These ponds accepted septic sludge associated with Gerringong's upgraded sewerage system. These ponds are now lined and used to hold groundwater pumped from the site to enable irrigation on the landfill mound.
- A night soil deposit, which historically accepted night soil sludge; and
- A small recycling facility.

The former night soil depot was located adjacent to the north-western slope of the landfill mound (Figure 2). The former depot consisted of two excavated infiltration trenches which, up until August 2002, received pump-out wastewater from septics in the Gerringong/Gerroa region. The two trenches were approximately 100 m in length (5 m wide) and while operational, partially filled with untreated wastewater.

4.1 Climate

Between 1895 and 2011, the average yearly rainfall at Gerringong Mayflower Village (Latitude 34.75° S, Longitude 150.82° E) is 1,343.4 mm/year, with the heaviest rainfalls occurring in summer and autumn months.

However, rainfall data from Toolijooa (Nyora) Station is taken from July 2012 due to the closure of Mayflower Village Station. Climatic data indicates Gerringong/Gerroa received approximately 1559 mm of rain from February 2015 to February 2016² (Appendix B). The highest months of above average rainfall were recorded in April 2015 (426.4 mm), and August 2015 (378 mm), whilst January 2015 (316 mm i.e. just prior to reporting period).

The rainfall in 2016 and 2017 was only 953 mm/year and 889 mm/year (January to December) indicating drought conditions. The rainfall from January to July 2018 is 429 mm/7 months indicating the persistence of dry weather. The rainfall from May 2018 to April 2019 is only 860mm/year, indicating again the persistence of dry weather (drought conditions).

The rainfall from March 2019 to February 2020 was only 774 mm/year, which is approximately 35% less than the average annual rainfall (Appendix B). The below average rainfall since 2016/2017 and lowest in 2019/2020, is the key factor in ammonia trends around the landfill mound due to less dilution from the reduced runoff.

The rainfall during 2020 to 2021 = 1152.8 mm, indicating a return to the annual average.

4.2 Topography

A general layout of the site topography is presented in Figure 1. The GWDD is situated within an estuarine landscape consisting of dune ridges, swamps and lagoons. The vegetation surrounding the facility comprises scrub and a littoral rainforest. Local relief is less than 5 m AHD and slopes less than 5%. The landfill forms a mound, reaching some 12 m above the surrounding ground surface.

The reduced groundwater level (RL) of the landfill footprint area ranges from approximately 3.3 to 5.2 m AHD. The footprint area (23,000 m2) and height of the rehabilitated landfill mound (15.9 m AHD, July 2005) is practically the same as pre-remediation conditions (i.e. October 2003).

² Information obtained from the Bureau of Meteorology website (www.bom.gov.au/climate).



4.3 Geology

The GWDD is located within the Seven Mile Soil Landscape as defined by Hazelton (1992). Coastal Plain Quaternary marine sands and Quaternary alluvium underlie the site.

Previous site investigations, as discussed in the URS report (2002), identified light brown fine-grained dune sands to a depth of 4 to 6 m below grade. The sands vary in thickness (between dune ridges and swales) and are largely contained above the groundwater table.

Beneath the dune sands, fine-grained grey beach sands containing shell fragments are present to a depth of approximately 14 m. The base of the sequence comprises estuarine silty and sandy clays. Further inland, the sedimentary sequence comprises estuarine clays closer to the surface, particularly in the vicinity of Blue Angle Creek where the ground surface is 2 to 3 m lower than the landfill area.

4.4 Hydrogeology

The GWDD is underlain by an unconfined and permeable sandy aquifer. Groundwater is encountered at a depth of approximately 3 - 4 m below ground level (i.e. approximately 1 m AHD) at the landfill area and becomes shallower towards Blue Angle Creek to the west and Seven Mile Beach to the east.

The groundwater quality varies from potable to saline, with electrical conductivities ranging from 0.3 to 50 mS/cm. The groundwater generally becomes more saline with depth and in the vicinity of tidal saline water bodies (i.e. Blue Angle Creek and Seven Mile Beach).

The hydraulic conductivity of the beach and dune sands at Gerroa has a geometric average of 10 m/day (Gerroa-Gerringong Sewerage Scheme EIS, 1999). It is noted that the organic silty sands between 0 - 0.15 mbgl have a lower permeability (approximately 0.1 m/day, E2W site investigations, March 2004).

In the area of the GWDD, groundwater gradients are controlled by topography, the Seven Mile Beach shoreline, Blue Angle Creek and Crooked River Estuary. It is interpreted that a natural groundwater divide runs through the landfill (URS 2003, E2W 2004), with groundwater to the west flowing towards Blue Angle Creek and groundwater to the east towards Seven Mile Beach. It is likely the natural groundwater divide is influenced by the coastal dunes and presence of the landfill mound (due to increased recharge). The position of the groundwater divide may change with the tide and seasons. During 2004/2005 (a drought period), the predominant flow direction is inferred to be towards Seven Mile Beach.

Groundwater discharge at Blue Angle Creek and Seven Mile Beach will be influenced by the presence of a fresh groundwater/salt water interface. The interface results from the density difference between the groundwater and sea water and is a dynamic and complex region with upward hydraulic gradients, tidal fluctuations, micro-biological processes, groundwater and surface interaction and substantial salinity variations. The groundwater/salt water interface can be associated with enhanced natural attenuation (biodegradation, dilution, sorption etc.), which acts to reduce the levels of contaminants prior to their discharge to marine ecosystems.

Groundwater is also interpreted to discharge as baseflow within Blue Angle Creek. Due to the action of tides, salt water is intermittently present in Blue Angle Creek with salinity governed by



tide levels. The saline water intrusion at high tide extends approximately 2 km upstream of the confluence between Blue Angle Creek and Crooked River.

It is understood offsite migration of contaminants (nutrients, iron and some ammonia) has occurred in the local shallow and deep groundwater systems (URS 2002, 2003; E2W 2004, 2006). This groundwater contamination arises from nutrient enrichment, which is associated with the former landfilling operations at the GWDD.

The leachate plume identified in the well network arises from historical waste disposal at the site, which commenced in the 1960s. The landfill remediation (completed in February 2005) will reduce future landfill leachate generation, however shrinking/diminishing of the existing plume will depend on natural attenuation processes (i.e. dilution, adsorption, biodegradation dispersion etc.) over time (years).

The groundwater quality immediately outside the footprint area is subjected to increased dilution arising from runoff (1 ha) and groundwater recharge from the landfill mound. This dilution together with natural attenuation decreases the leachate levels in the aquifer.

4.5 Hydrology

The hydrology of the area is dominated by Blue Angle Creek, Crooked River and Seven Mile Beach (Figure 2).

The closest environmental receptors of water running through the GWDD are Blue Angle Creek, Seven Mile Beach and Crooked River Estuary (Figure 1). Blue Angle Creek flows into the Crooked River Estuary at the northern end of Seven Mile Beach. The estuary discharges into the ocean when the mouth is open.

Previous Crooked River and Blue Angle Creek surface water quality investigations were discussed in the URS report (2002). The results indicate a considerable variation in water quality, particularly between dry and wet conditions, which may be associated with inputs from the wider catchment area.

When the entrance to Crooked River is open, the lower part of the river is well flushed with oceanic waters. This results in levels of nutrients, bacteria and toxicants that generally comply with guideline levels. Immediately following wet weather, water quality in the estuarine section of Crooked River generally deteriorates, with increased levels of particulate material, bacteria, sulphide, nutrients and metals (URS, 2003).

Of the four main tributaries that feed into the estuarine section of Crooked River, water quality in Blue Angle Creek was the most degraded with phosphorus, nitrogen, hydrogen sulphide, copper and zinc (URS, 2003). Surface water runoff from the landfill mound is diffused and infiltrated into the surrounding sandy soils.

5. Previous Monitoring Results

The primary conclusion from the monitoring report submitted by URS (2002-2003) prior to remediation in 2005 is summarised below:





• High concentrations of nutrients, in particular ammonia-nitrogen, continue to be detected under the site and migrating offsite. The levels recorded are well in excess of ANZECC (2000) guidelines for the protection of fresh and marine water ecosystems.

The following key points are also noted:

- High concentrations of ammonia-nitrogen and TKN were consistently detected in monitoring wells MW-1 and MW-5, which are located on the outer extent of the facility. This indicates the potential for migration of the nutrient plume in a south-easterly direction towards Seven Mile Beach. High concentrations of ammonia-nitrogen were also detected in monitoring wells MW-3 and MW-7, which are also located on the outer extent of the facility, indicating the potential for migration of the nutrient plume in a north-westerly direction towards Blue Angle Creek.
- Elevated concentrations of ammonia-nitrogen were detected in the shallow monitoring wells MW-9 to MW-11, adjacent to Blue Angle Creek.

6. Surface and Groundwater Monitoring

Surface and groundwater monitoring between May 2020 and February 2021 for the EPL was undertaken by ALS Environmental. ALS also conducted the additional monitoring (ammonia only) at nine (9) key wells between March 2020 and February 2021 (Figure 4).

Sampling was carried out on the following dates for the EPL Wells:

- 28 May 2020,
- 13 August 2020,
- 6 November 2020; and
- 1 February 2021.

Refer to Tables (GW-1 and SW-1). The February 2021 and May 2020 monitoring rounds include ammonia results at the three downgradient wells (MW-12,13,14).

The sample dates for assessing ammonia trends at the 9 key groundwater Wells (MW-1D, MW-3, MW-5, MW-6D, MW-7D, MW-11, MW-12, MW-13 & MW-14) are as follows:

- 8 January 2021,
- 18 December 2020,
- 9 September 2020,
- 17 June 2020,
- 5 March 2020.

Refer to Table 7 and the a summary of results.

The recommended procedure for sample collection, storage, handling and quality control generally employed by ALS is outlined in the NEPM (2013). E2W used the November 2008 sampling round to instruct Council staff on surface and groundwater sampling protocol. The samples are all sent to ALS (Sydney) for laboratory analyses. E2W understand that ALS carry out the quarterly sampling at the GWDD and submit the samples to ALS (Sydney via the Wollongong office) for analyses.



6.1 Monitoring locations

The following outlines the nature of the monitoring and analytical program at the site and the conditions at the time of sample collection from information provided by ALS and/or Council. Groundwater was sampled from six monitoring wells (MW-3, MW-4, MW-5, MW-9, MW-10, MW-11), and three nested wells (i.e. MW-1S/MW-1D, MW-6S/MW-6D and MW-7S/MW-7D, where S = shallow, D = deep).

Additional samples were collected from three wells (MW-12,13,14) located on the east side of the waste mound to better assess the ammonia trends in proximity to MW-1 and MW-1D.

Surface water was sampled at five locations (ML-1, ML-2, ML-3, ML-4 and ML-5) along Blue Angle Creek (Figure 2). The available surface water monitoring results are presented in tables (SW-1).

Variable EC levels in surface water testing locations indicate that sampling may not have been undertaken during low tide (sampling at low tide provides a reflection of groundwater discharge).

6.2 Sampling Sites - Groundwater

The sampling sites are described below, while sampling depths for the bundled piezometers and conventional wells are summarised in Table 6.2.

- MW-1S (shallow 6 m depth) and MW-1D (deep 10.5 m depth) Located next to the previous multilevel piezometer MW-1 and approximately 40 m from the SE corner of the landfill perimeter. The well is situated down-gradient of the landfill mound and intended to intersect flow heading towards Seven Mile Beach.
- MW3 Approximately 20 m to the north of the landfill clearing, fronting native bushland. This well is to establish background water quality conditions and determine offsite migration of groundwater in a northerly direction.
- MW4 Located immediately adjacent to the night soil depot, which is a source of potential nutrient and bacterial contamination.
- MW5 Approximately 30 m to north of the night soil depot. The well is within the extent of contamination arising from the depot and landfill-impacted groundwater.
- MW-6S (shallow 6 m depth) and MW-6D (deep 10.5 m depth) Located next to multilevel piezometer MW-6 and approximately 50 m NW of landfill and night soil depot. The well is situated down-gradient of the landfill and night soil depot.
- MW-7S (shallow 6 m depth) and MW-7D (deep 10.5 m depth) Located 15 m to the east of multilevel piezometer MW-7 and approximately 100 m NW of landfill and night soil depot. This well was installed to establish background water quality conditions and determine offsite migration of groundwater contaminants towards Blue Angle Creek.
- MW9 Located offsite and adjacent to Blue Angle Creek downstream of ML-1 to determine if potentially contaminated groundwater is discharging into the estuarine environment.
- MW10 Located offsite and adjacent to Blue Angle Creek downstream of ML-1 to determine if potentially contaminated groundwater is discharging into the estuarine environment.
- MW11 Located offsite and adjacent to Blue Angle Creek downstream of ML-1 to determine if potentially contaminated groundwater is discharging into the estuarine environment.
- MW-12,13,14: Shallow wells installed in July 2007 to assist with remedial works (if required) on the downgradient boundary of the landfill mound. These three wells have been monitored to



better characterise the water quality trends (i.e. ammonia, refer to Table 7) on the downgradient boundary of the site (Figure 4).

6.3 Sampling Sites - Surface Water

Blue Angle Creek

- ML-1. Approximately 100 m upstream of the depot along Blue Angle Creek at the end of the tidal limit. This sampling location was chosen to establish upstream water quality and offsite conditions.
- ML-2. Approximately 500 m downstream of the depot along Blue Angle Creek. This sampling location was chosen to establish offsite and downstream water quality and assess the potential for contamination associated with the depot.
- ML-3. Approximately 200 m upstream of the flood gates along Blue Angle Creek, and 100m upstream of ML-4. This sampling location was chosen to establish upstream water quality and offsite conditions due to agricultural activities in the catchment area.
- ML-4. Approximately 100 m upstream of the flood gates along Blue Angle Creek. This sampling location was chosen to establish upstream water quality and offsite conditions.
- ML-5. Approximately 400 m downstream of the flood gates along Blue Angle Creek, between MW-9 and MW-11. This midstream sampling location was chosen to establish offsite receptor water quality conditions.

The surface water and groundwater sample locations are illustrated in Figure 2, and Table 6.1.2.

Tuble 0.1.2. Montoring Summary for May 2020 to 1 cortairy 2021					
Sample ID	Screen Interval	May 2020 to February			
	(m AHD)	2021			
& Sample Location					
MW-1S	Approx. 0 to -3 Aug & Nov 2020 (
MW-1D	MW-1D Approx4 to -7				
MW-3 0 to 1.5		Х			
MW-4	0.79 to -0.71	Х			
MW-5	0.55 to -0.95	Х			
MW-6S	Approx 0 to -3	Aug 2020 (1)			
MW-6D	Approx -4 to -7	X			
MW-7S	Approx 0 to -3	Х			
MW-7D	Approx -4 to -7	Х			
MW-9	-0.53 to -1.53	Х			
MW-10	-0.525 to -1.525	Х			
MW-11	0.095 to -0.905	Х			
ML-1	Upstream of landfill	4 dates sampled			
ML-2	Downstream of landfill	4 dates sampled			
ML-3	Upstream of landfill	4 dates sampled			
ML-4	Upstream of landfill	4 dates sampled			
ML-5	Opposite landfill	4 dates sampled			

Table 6.1.2: Monitoring Summary for May 2020 to February 2021

Notes: X = Sample collected. MW = Monitoring well sample from landfill site. <math>ML = Surface water sample from Blue Angle Creek. The 6 wells (MW-1S/MW-1D etc) are considered more reliable monitoring locations (compared to multilevel piezometers) as they were constructed with standalone 50 mm diameter PVC screens and not the 7 mm poly tubing (low flow system). The MW-12,13,14 are constructed with 3m PVC (50mm diam) well screens at approx. 1 to -2 mAHD.



6.4 Sample Collection and Laboratory Analysis

The surface and groundwater analytical program from May 2020 to February 2021 is presented in Tables GW-1 (groundwater) and SW-1 (surface water). The nested wells (MW-1S, MW-1D, MW-6S, MW-6D, MW-7S, MW-7D) installed in 2006 have replaced the bundled piezometers 3 (i.e. MW-1, MW-6, MW-7). The results from the nested wells are graphed separately for the water quality trend assessment.

The 6 wells located in proximity to the landfill mound (MW-1D, MW-3, MW-4, MW-5, MW-6D, MW-7D and MW-12,13,14) are monitored for ammonia on a more regular basis to assess ammonia trends (Figure 2, Table 7).

7. Water Monitoring Results

All groundwater and surface water analytical results from 2003 to 2021 are presented in Tables GW-1 and SW-1, with the most recent (9) monitoring data highlighted. The field records and laboratory reports are presented in Appendix A and Table 6 (summary of data set). Results for the additional wells (9) to assess ammonia trends are presented in Table 7.

Compliance exceedances are noted in Appendix C (i.e. ML-3 & ML-4, and mostly at MW-11 during 2019-2020). Further investigations are required to assess the ammonia trends at MW-11 and links to the onsite wells (MW-6D/MW-7D, with rising ammonia trend) as the data indicates leachate plume migration towards the Blue Angle Creek and 7 Mile beach (Figure 4).

A summary of all available monitoring data (2003 to 2021) is presented in Graph-1 to Graph-7. The graphs illustrate ammonia and total phosphorous concentrations (key indicators of leachate impact) for the groundwater wells⁴ and surface water sampling locations as well as the depth to groundwater (m AHD, 2001 to 2021).

The graphs illustrate the ammonia concentrations in the shallow (Graph-1) and deep monitoring wells separately (Graph 2). Contaminant migration rates and flushing characteristics are different at shallow and deep levels of the aquifer.

The graphs highlight water quality trends with respect to seasonal and water level changes, as well as water quality improvements associated with the landfill rehabilitation completed in 2005.

The monitoring data shows that ammonia concentrations at MW-3 and MW-5 have returned to low levels (below ANZECC 2000) in late 2017 to April 2019, with several exceptions. Elevated ammonia concentrations at three EPL wells (MW-1D, MW-6D and MW-7D) require further monitoring to assess the trends, and potential remedial actions (as required). The previously rising ammonia trend at MW-11 may have related to plume migration, however has recently returned to low levels and decreasing ammonia trends.

The additional wells (MW-12,13,14) monitored on the downgradient boundary indicate elevated and rising ammonia concentrations on the east flow path (i.e. ammonia between 26.6 to 97.7



³ The bundled wells were believed to provide spurious results due to the low purge volumes.

⁴ Results from multilevel piezometers MW-1, MW-6 and MW-7 (Graph-01 & Graph-03) are considered anomalous due to well construction issues.



mg/L). The ammonia concentrations on the eastern boundary have stabilised from the previous monitoring period.

7.1 Groundwater Data

Groundwater was collected from a network of twelve monitoring wells at onsite and offsite locations (Figure 2) from May 2020 to February 2021. The results of the groundwater results obtained are summarised in Table GW-1, Graph-1 to Graph-5 and the following subsections.

7.1.1 Groundwater Depth and Flow Regime

The depth to groundwater was measured prior to each sampling event (in conventional wells) using a water level probe. The depth to the groundwater below top of casing and relative to a common reference (i.e. Australian Height Datum, m AHD) is presented in Table GW-1. The inferred groundwater contours are presented in Figures 3A & 3B. Reduced groundwater levels (m AHD) between 2001 and 2021 is illustrated in Graph-5.

A broad groundwater divide is interpreted to occur at the landfill mound (sand dune area) and inferred to be located midway between Crooked River and Seven Mile Beach. As the position of the groundwater divide is influenced by the surface water bodies, the prevailing dry climate and recharge through the waste mound, it is likely local groundwater flow characteristics have altered over recent years. The drought conditions indicate a relatively flat hydraulic gradient directed to the west and east, respectively.

The drought period (2017 to 2019/2020) is interpreted to increase ammonia concentration around the landfill mound. The increased ammonia is interpreted to arise from the lower rainfall/runoff input and recharge over the leachate plume (i.e. less dilution from rainfall recharge) and plume movement from under the mound. The higher rainfall during 2020/2021 has stabilised and slightly decreased the previous ammonia trend.

The reduced groundwater levels from the twelve wells indicate a relatively low to moderate water table elevation. Field sampling records show that the depth to groundwater between October 2003 and February 2012 is below 1.87 mAHD. The groundwater levels recorded from the 2011-2012-2013, 2014-2015 monitoring round are similar to slighter lower than the 2015-2016 monitoring period, reflecting variable rainfall patterns and leachate movement over time. The 2015-2016 wet weather and higher water table is similar to the February 2011 wet period. The water levels during 2016-2018 show a decline due to lower than average annual rainfall during 2016 to 2018. Rainfall during from June 2018 to May 2019 (860 mm/yr) is lower than previous years and is reflected in the lowering water table trend (Graph-5).

The rainfall from March 2019 to February 2020 was 774 mm/year, causing a general lowering of the water table (i.e. <1m and around 0.5m AHD at most areas). The groundwater level rose in the past year given the higher rainfall in 2020/2021 (1,152. 8 mm).

The inferred groundwater contours for the site are presented in Figures 3A & 3B (reflecting dry and wet weather periods). The groundwater levels and degree of mounding has significantly lowered over the past year. The groundwater levels reflect a dynamic groundwater environment and period of low rainfall. Ammonia concentrations on the east boundary are considered to reflect a low recharge environment and low dilution.

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7.1.2 Field Parameters

The groundwater, field parameters measured during sampling are considered indicative only (small purge volumes). Insitu measurements (within borehole) are likely to provide a more accurate rendition of the field chemistry, especially with respect to dissolved oxygen.

7.1.3 pH (field) and Redox

The groundwater pH measured from the twelve wells ranges from approximately pH 5.2 to PH 8.0. The pH in each well was generally stable over the monitoring rounds (May 2020 to February 2021).

On its own, pH is not considered a reliable indicator of leachate contamination, as sediments and decomposing organic material associated with the creek bed also have an influence on pH.

Redox is not consistently measured during monitoring periods. Redox potential is measured annually (August 2016, 2017, 2018, 2019, 2020) with positive (116 mV) to negative (-138 mV) readings and is generally comparable to previous monitoring periods. The negative redox readings are generally associated with the presence of landfill leachate and elevated ammonia concentrations.

7.1.4 Total Dissolved Solids (TDS and EC)

The TDS levels in groundwater collected from the site range from approximately 191 to 18,000 mg/L (fresh to brackish). The lowest and highest TDS levels were obtained from MW-5 and MW-9, respectively. The elevated TDS level for MW-9/10/11 is related to the well's proximity to Blue Angle Creek and associated tide and estuary mouth closure influences.

Salinity increases as groundwater flows towards Blue Angle Creek (MW-9 to MW-11). A decrease in salinity (TDS) occurs in several wells close the landfill perimeter (i.e. MW-3, MW-4, MW-5), which is interpreted to occur from dilution arising from an increase in stormwater runoff from the landfill mound post-capping (& decreased leachate generation).

7.1.5 Dissolved Oxygen (DO)

Field analyses from the twelve wells recorded dissolved oxygen (DO) concentrations ranging from between approximately 1.07 and 7.74 mg/L. The concentrations of DO reported for the site from 2003 to 2021 are variable. However, measurements may reflect the instruments (imprecise) used and/or purging process.

Based on the distribution of DO in the groundwater at the site, it is inferred that landfill leachate caused a depletion of groundwater DO and is generally increasing due to decreasing nutrient concentrations. This phenomenon is seen on many landfill sites, where organic carbon and nutrients provide surplus electron acceptors, which react with and consume the available DO in the groundwater. It is likely the groundwater under the landfill mound is anaerobic due to the presence of the landfill leachate (DOC, ammonia etc) and poor flushing due to the landfill capping.

7.2 Nutrients

7.2.1 Nitrogen

Groundwater collected from the monitoring wells at the GWDD were analysed for ammonianitrogen, total Kjeldahl nitrogen (TKN) and oxidised nitrogen (nitrate and nitrite). Discussions regarding potential impact to the environment will focus on ammonia-nitrogen, as it is the main indicator of groundwater contamination from leachate.



The guidelines for total ammonia-nitrogen for the protection of fresh water and marine ecosystems vary according to pH and temperature. Given the range of pH and temperature measured across the site and in Blue Angle Creek, the guidelines are 1.88 and 2.84 mg/L for fresh and marine waters, respectively (at a pH of 7.3).

At least one groundwater samples collected from MW-1D, MW-6D, MW-7D, and MW-11 exceeded the ANZECC (2000) trigger value for ammonia. These monitoring wells are located east or west of the landfill mound, indicating leachate is migrating towards Blue Angle Creek.

Groundwater wells (MW-1, MW-3 and MW-4 pre-rehabilitation) initially reported the highest concentrations of ammonia. Following the landfill rehabilitation, ammonia levels have declined in the shallow groundwater system and are below ANZECC guidelines (Graph-1, except MW-3 in February 2016 which is inferred as an anomaly).

Groundwater from deep wells (MW-1D, MW-6D and MW-7D) showed a consistent declining trend until 2017/2018 (& below ANZECC 2000), however an increasing ammonia trend is evident from 2019 to 2020, the trend stabilised and potential changes in the 2020-21 period.

The three wells (MW-6D/MW-7D and MW-1D) show an irregular but increasing ammonia trend with some elevated concentrations starting from 2017/2018, and 2019/2020 (Appendix D, Table 7). The ammonia results from the additional wells (MW-12,13,14) indicate an elevated and rising concentrations on the east side of the mound (i.e. ammonia from 26.6 to 97.7 mg/l). The trends in 2020/2021 show potential stabilisation and possible decrease.

Nitrate was analysed for all samples with MW-1D, MW-6S, MW-6D, MW-7D, MW-9, MW-10 are generally below or marginally exceeded the ANZECC (2000) guideline (freshwater trigger value, 0.7 mg/L).

All groundwater samples analysed on at least occasion from all wells during May 2020 to February 2021 exceed ANZECC (2000) fresh and marine water TKN trigger values (0.5 and 0.12 mg/L, respectively). Monitoring wells located adjacent to Blue Angle Creek (i.e. MW-9, MW-10) continue to report stable or decreasing concentrations of ammonia, (Graph-1). The ammonia concentrations at MW-11 (2019-2020) indicate potential increase and landfill leachate plume migration from the landfill mound (i.e. refer to ammonia trends at MW-7D/6D). The rising trend at MW-11 decreased in the 2020-2021 monitoring period.

Table 7.1.3 (below) and Figure 4 provide an overview of groundwater ammonia trends from May 2020 to February 2021 reporting period.





Well ID	Ammonia Trend	Exceedan ce of ANZECC (2000) Ammonia	Trigger 20% exceedance (Ammonia)	Comment
MW-1S	Decreasing trend. below ANZECC	No exceedance	No exceedance	Shallow sample - east of landfill
MW-1D	Recent rising trend. Since mid 2016 to 2019 data is variable with significant ammonia spikes. All results in 2018- 2021 exceeds ANZECC. Reducing Trend in 2020/21	Exceedance	No Exceedance	Deep sample - east of landfill
MW-3	Overall decreasing & stable trend. Anomalous result in February 2016 (20.9 mg/L) and 4.31 mg/L in May 2016. Stable/decrease ammonia in 2017-2021	No Exceedance	No exceedance	North of landfill.
MW-4	Decreasing/stabile trend. below ANZECC	No Exceedance	No exceedance	West of landfill
MW-5	Overall decreasing trend. Two ammonia results in mid 2016 exceed ANZECC (6.93 mg/L). Stable/decrease ammonia in 2017 - 2021	No Exceedance	No Exceedance	North of landfill.
MW-6S	Stable & reducing trend, below ANZECC	No Exceedance	No Exceedance	Shallow sample - down-gradient of night soil deposit
MW-6D	Recent increasing & variable trend. Elevated and spiked ammonia results in 2017-2021 indicating variability and rising trend. Results in 2019-21 exceed ANZECC (2000)	Exceedance	No Exceedance	Deep sample - down- gradient of night soil deposit
MW-7S	Decreasing/Stabilising trend. below ANZECC	No exceedance	No exceedance	Shallow sample - down-gradient and adjacent to Crooked River Road
MW-7D	Former decrease/stable trend to a rising trend (2019-20). Stable trend in 2020 to 2021. Ammonia generally below 1 mg/L prior to mid 2018	Exceedance	No Exceedance	Deep sample - down- gradient and adjacent to Crooked River Road
MW-9	Stable/decreasing trend. below ANZECC	No exceedance	No exceedance	Next to Blue Angle Creek
MW-10	Stable/decreasing trend. below ANZECC	No exceedance	No exceedance	Next to Blue Angle Creek
MW-11	Former decrease/Stabile trend to a rising trend (2019-20) & decreasing trend in 2020/21.	Exceedance	Exceedance	Next to Blue Angle Creek

Table 7.1.3: Groundwater Ammonia Trends – May 2020 to February 2021

Note: Three wells (MW-9, 10, 11) are located on the creek bank, potentially affected by flood waters and vegetation. ANZECC (2000) refers the marine trigger value (2.84 mg/L). The TKN/Ammonia ratio for MW-9/MW-10 are different to MW-11 (i.e. similar to MW7D/6D ammonia).

As outlined in the revocation notice, ammonia concentrations greater than 20% above ammonia concentrations reported in Table GW-1 of Kiama Municipal Council, Gerroa Waste Disposal Depot - Annual Groundwater and Surface Water Monitoring Report - August 2006 to May 2007, dated 17 August 2007 are to be highlighted (refer to Appendix C). The results from ML-3 & ML-4 and ML-11 exceeded the 10% trigger value.



7.2.2 Total Phosphorus (TP)

The ANZECC (2000) TP guideline for fresh and marine ecosystems is 0.05 and 0.025 mg/L, respectively. Between May 2020 and February 2021, all groundwater sample results exceeded the ANZECC (2000) trigger values (Table GW-1 and Graphs 3 & 4).

The well MW-6D (former night soil deposit) reported a maximum of 12.1 mg/L on 10 November 2016. TP was at 6.84 mg/L in the 2011-2012 monitoring period, however decreased to a maximum of 4.8 mg/L in the 2012-2013 monitoring period. In 2013-2014 and 2014 -2015 total phosphorous was a maximum of 9.07 mg/L and 3.93 mg/L, respectively indicating variability.

In November 2015 the TP was reported at 12 mg/L at MW-6D. The highest TP was 2.54 mg/L from August 2018 to February 2019. During the 2019 to 2020 monitoring period, TP was more stable and ranged from 2.48 to 3.54 mg/L. TP ranged from 2.52 to 3.76 mg/L at MW-6D during 2020 to 2021.

The well (MW-7D) reported a maximum (TP =8.14 mg/L in November 2015) which is similar to previous years (TP =8.46 mg/L, November 2014). TP at MW-6D and MW-7D (near former night soil) shows variability (Graph-4) and may relate to the 2013 dewatering/sludge pond decommissioning and mobilisation of nutrients during rainfall. TP concentrations are relatively stable during 2019-2020, and 2020-2021 which ranged from 0.8 to 1.20 mg/L, and 0.81 to 0.89 mg/L, respectively.

The concentrations of TP immediately east and north of the landfill (MW-3 and MW-5) and next to Blue Angle Creek (MW-9 to MW-11) are lower, indicating that the former night soil deposit is the likely source of TP in the local groundwater.

In relation to the former night soil deposit (primary TP source), a localised TP plume is interpreted to potentially migrate towards Blue Angle Creek (MW-4/MW-6S to MW-7S, and to MW5). The TP plume is also detected at MW-4 (south of the night soil deposit) with TP ranging from 0.19 to 1.07 mg/L during 2020 to 2021.

The TP concentrations of TP on the east/north (MW-3/MW-1) are likely to originate from the landfill mound. TP concentrations at MW-1S (eastern side of landfill) show a variable trend.

The TP results show variability and likely to be linked to flushing and desorption/sorption within the sandy aquifer following rainfall/runoff.

7.3 Hydrogeochemical Indicators

Concentrations of major ions (i.e. chloride, sulphate, calcium, magnesium, sodium, alkalinity and potassium) are presented in Table GW-1. The concentrations at all monitoring wells are within previously reported ranges and characterised by the ions sodium, chloride and bicarbonate (alkalinity).

The landfill is interpreted to contribute some concentrations of ions including calcium, potassium, magnesium and bicarbonate/alkalinity. Contribution of sodium and chloride is difficult to ascertain as these ions are common in the marine environments (e.g. salt spray, tidal influence) and abundant in wells close to Blue Angle Creek (MW-9, MW-10, MW-11) or in proximity to Seven Mile Beach (MW-1S, MW-1D).





7.3.1 Inorganic Contaminants (Iron, Manganese and Fluoride)

Iron concentrations were only analysed for samples collected in August for each year (2016, 2017, 2018, 2019 and 2020). Concentrations of iron (filtered at the laboratory) ranged between 0.22 and 12.8 mg/L (MW-6D @ maximum). All wells (excluding MW-5, MW-7s) reported concentrations above the ANZECC (2000) guideline for iron in freshwater ecosystems (0.3 mg/L). Multiple natural and landfill related sources of iron are likely to exist at the site and offsite area (lithology and landfill).

The ANZECC (2000) guideline for iron is an indicative interim working level (IIWL) and is of low reliability. No guideline is available for iron in marine water, which is more relevant for Blue Angle Creek and Crooked River receiving water bodies.

Manganese concentrations were analysed for samples collected in August 2016, 2017, 2018, 2019 & 2020. Concentrations of manganese ranged between 0.003 and 0.138 mg/L, without exceeding the ANZECC (2000) freshwater guideline (1.9 mg/L).

The levels of filterable iron and manganese are generally similar to previous reporting periods. Variation in the concentrations may also reflect turbidity of water samples and filtering procedures.

Concentrations of fluoride (analysed in August 2016, 2017, 2018, & 2019) ranged from <0.1 to 0.4 mg/L, which are similar to previous reporting periods. No reliable ANZECC (2000) guideline exists for fluoride in fresh or marine waters. Fluoride was not analysed in August 2020.

7.4 Organic Contaminants

Dissolved organic carbon (DOC) concentrations were only analysed for samples collected on the August 2016, 2017, 2018, 2019, 2020, & 2021. The concentration of dissolved organic carbon (DOC) in samples from the twelve wells ranged from 5 mg/L to 124 mg/L (maximum at MW-1s). The results are generally comparable to previous monitoring periods.

No recommended ANZECC (2000) guidelines exist for DOC and used to indicate potential organic carbon related to landfill leachate (DOC is linked with elevated landfill leachate concentrations at the site).

7.5 Discussion and Trends - Groundwater

The key trends in groundwater levels and nutrient contamination from 2003 to 2021 are presented in Graph-1 to Graph-5. The recent variable ammonia trends (2015 to 2021) at deep wells (MW-1D, MW-3, MD6D) are also included in the graphs. The three deep wells (& MW-12,13,14) are monitored monthly-to-bimonthly basis to assess if any remedial/control measures are required to address the variable ammonia trends.

The monitoring data indicates that ammonia concentrations in the deep groundwater were approaching the ANZECC guidelines following landfill rehabilitation works (Graph-2). Trends for the deep wells (MW-1D, MW-6D and MW-7D) show a declining trend from 2009 to 2017/2018, however an increasing to variable trend occurring during drought conditions (up to 2020). The higher rainfall during 2020/2021 is interpreted to stabilise and potentially be decreasing ammonia trends.





The ammonia concentrations are elevated (Above ANZECC 2000) in proximity to MW-1D as shown by MW-12,13,14 (Figures 2 & 4, Table 7).

Groundwater (ammonia) trends for the three wells (MW-9, 10) located adjacent Blue Angle Creek show a stable or declining trend (Graph-1). These two wells are influenced from tides and flooding (including estuary mouth closures).

The well (MW-11) also located near the creek show variable and increasing ammonia trend up to 2020, indicating the migration of the leachate plume from the former landfill site. Ammonia has rdecreased rapidly at MW-11 in the 2021 monitoring results. The TKN/ammonia pattern of MW-11 is similar to MW-7D/6D indicating likely landfill leachate (note: MW-9 & MW-10 have different TKN/ammonia ratios related to the creek/catchment area).

Graph-1 indicates ammonia concentrations in the shallow wells have steadily decreased (generally below guidelines) since land-filling operations at the GWDD ceased in October 2003.

Prior to landfill rehabilitation, groundwater quality trends indicate landfill leachate generation may be related to rainfall recharge into buried waste and subsequent groundwater and contaminant migration. The results post-landfill rehabilitation indicates landfill leachate concentrations in the shallow groundwater are decreasing, becoming diluted from attenuation/rainfall via runoff from the landfill mound. The potential for landfill leachate generation was significantly reduced following remedial works, as the buried waste was capped with an impervious clay barrier.

The groundwater ammonia trends (ammonia being a key landfill leachate indicator) indicate shallow groundwater quality is improving.

The deep wells (MW-1D, MW-6D, MW-7D and MW-12,13,14) indicate the leachate plume in the deep parts of the aquifer has increasing to variable ammonia trends due to the prevailing drought conditions (since 2017 to 2020. Table 7). Ammonia trends are interpreted to be stabilising and/or decreasing following the return to average rainfall conditions in late 2020/early 2021.

7.6 Surface Water

Surface water sampling was undertaken in 4 quarterly events from May 2020 to February 2021. Samples were collected from five locations (ML-1, ML-2, ML-3, ML-4 and ML-5) along Blue Angle Creek (Figure 2).

The data set from the 3 sample locations (ML-1, ML-3, ML-4) is limited due to previous restricted access (i.e. land is owned by Cleary Bros with access denied for sampling).

The upstream water quality is relatively may be degraded due to farming and areas of acid soils. Sample locations, ML-1, ML-4 (upstream) are considered appropriate to assess water quality impacts from the upstream sources (CBros land).

The sample locations (ML-5 @ midstream, ML-2& ML-3 @downstream) are suitable to assess impacts from the landfill, however it is noted that the creek also receives groundwater discharge, surface water runoff from the catchment and tidal movements which diminish the potential for observable impacts from the landfill, especially during the high and low tide flows.



All analytical results for surface water monitoring points (ML-1 to ML-5) are presented in Table SW-1.

Blue Angle Creek is tidally influenced and has a marine water influence at all sample locations, as shown by the broad range of TDS/conductivity results (i.e. fresh to saline, Table SW-1). The variable nutrient results (ammonia, TKN) at all surface water locations is interpreted to related to the water quality changes during high and low tide.

The surface water monitoring data at upstream/downstream locations is variable and likely to reflect a combination of tidal sampling regimes and inputs from the broader catchment area (e.g. samples should be coordinated with the tide so that both creek samples are collected during a runout tide when the maximum amount of groundwater (potential leachate) discharges into the creek).

7.6.1 Field Parameters

pH (field) and Redox

The pH was similar at ML-1 to ML-5 and ranged from pH 4.6 to 7.1. Sampling results indicate that pH is slightly acidic at upstream areas with Blue Angle Creek and may relate to the acid soils in the catchment area.

Redox was measured in August 2016, 2017, 2018, 2019, & 2020 monitoring period at all five locations. Redox ranged from 83.9 to 144 mV from upstream to downstream creek locations.

Total Dissolved Solids (TDS and EC)

Restricted access has limited the assessment of upstream and downstream locations in previous years. The monitoring data indicates large fluctuations in TDS/EC due to the tide (low, high) at all five locations. The TDS concentration upstream of the flood gates (ML-1, ML-3, ML-4) was less than those recorded downstream of the flood gates (ML-2).

The EC ranges from 110 uS/cm to 35,600 uS/cm, whilst the TDS ranges from 82 mg/L to 24,800 mg/L at ML1 to ML-5.

The surface water samples are located in the creek that is known to be influenced by tides. The presence of mangroves and other aquatic plants also reflects the typically saline water in Blue Angle Creek.

Groundwater samples collected from MW-9, MW-10 and MW-11 are also brackish/saline (but less than the surface water) indicating a hydraulic connection with the tides in Blue Angle Creek. This data indicates that tidal waters from Crooked River Estuary can influence water quality and elevate the salinity of the 3 wells (MW-9, MW-10 and MW-11).

7.6.2 Nutrients

Nitrogen

Concentrations of ammonia in the surface waters collected from Blue Angle Creek have been and continue to vary with time (Graph-6 and Table 7.2.2). The upstream catchment area of Blue Angle creek is improved pastures and grazing (i.e. agricultural sources of nutrients).



Sample ID	Minimum (mg/L)	Maximum (mg/L)	Trend*	Trigger 10% Exceedance of Ammonia, &Comments
ML-1	0.03	0.37	Increasing	No
				Limited site access & below ANZECC
				guidelines
ML-2	< 0.01	0.51	Increasing	No.
				below ANZECC guidelines
ML-3	0.02	0.34	Increasing	Yes.
				(22/11/2019, 14/2/2020, 6/11/20, &
				1/2/2021)
				below ANZECC guidelines
ML-4	0.02	0.34	Increasing	Yes
			_	(22/11/2019, 1/2/2021)
				below ANZECC guidelines
ML-5	0.04	0.61	Increasing	No.
				below ANZECC guidelines.

Table 7.2.2: Surface Water Ammonia Trends – May 2020 to February 2021

Note: Trend *= relates to increased in ammonia concentrations at each location from March 2020 to February 2021. All ammonia results were below the ANZECC (2000) guidelines and results are similar or lower than previous rounds.

Highest ammonia (ML-5 @ 0.61 mg/L) concentration is associated with high TKN (1 mg/L), brackish water (TDS= 1330 mg/L) which is inferred to reflect background water quality (downstream of fertilised farms, sewerage treatment plant) and potentially the landfill. The ammonia concentrations at the nearby well (MW-11) was showing a rising trend during 2018 to 2020 which may have an influence on the creek water quality.

Sampling at ML-5 (resumed in November 2008 but had not been sampled since October 2004) indicates that the water quality is variable (Table SW-1), indicating multiple pollutant sources and tidal influence.

Previous restricted access to upstream locations (ML-1, ML-3 and ML-4) limits conclusions regarding impacts due to the limited data set and dynamic environment of the creek. E2W note the recent ammonia results (2020 to 2021) from the five sample location indicates a potential rise in ammonia concentrations. However, the data set is variable given the salinity and different tide levels during sampling from upstream to downstream locations.

Elevated ammonia (&TKN) in surface water compared to groundwater wells in proximity to the creek (MW-9, MW-10, and MW-11) indicates that sources of ammonia also occur from the upstream catchment area (agricultural land and fertiliser use).

Concentrations of TKN exceeded the ANZECC (2000) guidelines for fresh and marine waters for all samples collected along Blue Angle Creek. The highest concentration was reported at the upstream location (ML-1 = 1.4 mg/L on 1/2/2021), which may also indicate the influence of fertiliser and degraded runoff from the surrounding agricultural activities. Concentrations of TKN in groundwater are elevated and variable.

Increases in nitrogen from upstream and downstream of the landfill have been observed during previous monitoring periods. While these increases may be attributable to the discharge of



ammonia-rich groundwater from the landfill, other sources (random) of nitrogen input such as runoff from sub-catchments and nutrients bound in sediments cannot be discounted. It is also possible that poor quality estuarine waters from Crooked River move up Blue Angle Creek during tidal cycles. Sewerage discharges into sand dunes may also occur due to capacity issues at the Gerroa sewerage treatment plant.

Interpretation of the nutrients into surface water bodies from the landfill is complicated by the sampling regime (i.e. sampling at various tides) and other potential sources of nitrogen. The fluctuating flow regime near Blue Angle Creek and wet weather events may reduce the potential for landfill leachate to impact the creek.

The recent monitoring data and rising ammonia trends from MW-11 and MW-7D/MW-6D indicate that closer monitoring of the creek is required during the prevailing drought conditions as landfill leachate may discharge in the area of sample locations (ML-5/ML-3).

Total organic carbon (TOC) was not measured during the 2018 to 2021 monitoring period.

As stipulated in the revocation notice, ammonia concentrations greater than 10% above ammonia concentrations reported in Table SW-1 of Kiama Municipal Council, Gerroa Waste Disposal Depot - Annual Groundwater and Surface Water Monitoring Report - August 2006 to May 2007, dated 17 August 2007 are to be highlighted (Appendix C).

Exceedances greater than the trigger (10% above ammonia) were reported at ML-3/ML-4 and MW-11 in the 2020-2021 monitoring period (Appendix C). The ammonia trigger (10%) exceedances for ML-3 & ML-4 are below the ANZECC 2000 guidelines.

Total Phosphorous (TP)

Concentrations of TP from Blue Angle Creek were analysed from all samples collected in May 2020 to February 2021 (Table SW-1).

Previous levels (2011-2012 monitoring period) reported an increase in TP concentrations, which exceeded the IIWLs ANZECC 2000, (fresh 0.05 mg/L, marine 0.025 mg/L) at ML-2 and ML-5 for all sampling rounds. The 2012-2013 monitoring period reported an variable increase in TP concentrations which exceeded the ANZECC 2000, (fresh 0.05 mg/L, marine 0.025 mg/L) at ML-2 (0.05 mg/L, May 2012 and 0.13 mg/L, February 2013) and ML-5 (1.95 mg/L, February 2013). The 2013-2014 monitoring period reported two exceedences of the ANZECC 2000 guidelines for ML-2 in May 2013 & February 2014 (0.09 mg/L and 0.12 mg/L, respectively) and one exceedence at ML-5 in 2013 (0.06 mg/L).

TP concentrations at ML-2 ranged from 0.04 mg/L to 0.09 mg/L and continue to show a variable trend for 2016-2018. During 2018 to 2019, the TP concentrations at ML-2 ranged from <0.05 mg/L to 0.2 mg/L and showing an ongoing variable trend. The trend is likely to reflect the dynamic nature of the surface water and surrounding rural environment.

ML-5 reported all TP concentrations ranged from 0.05 mg/L to 0.08 mg/L in 2016-2018, and <0.05 to 0.06 mg/L from 2018 to 2019. TP is variable over time (Graph-7). The variability is considered to reflect the dynamic nature of a tidal environment and multiple sources (agriculture, natural sources and possibly the landfill).



The following TP concentrations were reported for the 2019 to 2020, and **2020 to 2021** monitoring period;

- ML-1. TP ranges from 0.16 to 0.26 mg/L, and <0.05 to 0.1 mg/L.
- ML-2. TP ranges from <0.05 to 0.24 mg/L, and <0.05 to 0.09 mg/L.
- ML-3. TP ranges from 0.32 to 0.36 mg/L, and 0.02 to 0.13 mg/L.
- ML-4. TP ranges from 0.22 to 0.31 mg/L, and <0.01 to 0.09 mg/L.
- ML-5. TP ranges from <0.05 mg/L to 0.32 mg/L, and 0.02 to 0.11 mg/L.

The TP data indicates that TP is elevated in the upstream/background samples. All sample locations exceed the ANZECC (2000) guidelines for TP and TKN, which is indicative of fertiliser/agricultural activities in the catchment area. The TP concentrations in 20202021 are lover than the previous year (2019/2020).

7.6.3 Bacteriological Contaminants

Surface water sample locations (ML-2 and ML-5) were analysed for thermotolerant (faecal) coliforms and enterococcus coliforms in August 2016, 2017 & 2018 (Table SW-1), but not during the 2019 to 2021 monitoring period. The bacterialogical results are considered to relate to the local fauna and grazing in the area, and not the landfill leachate as the micro-organisms are filtered out in the groundwater system.

Previous monitoring results are as follows:

- Sample result from ML-2 (1 CFU/100 mL) and ML-5 (1 CFU/100 mL) in August 2018 for enterococcus were below the ANZECC (2000) fresh and marine guidelines (35 CFU/100 mL). Samples result from ML-2 (44 CFU) in August 2017 for enterococcus was above ANZECC (2000) fresh and marine guidelines (35 CFU/100 mL).
- For August 2016, August 2017 and August 2018, the downstream sample (ML-2) reported enterococcus of 28, 44 and 1 CFU/100 mL respectively, whilst the midstream sample (ML-5) reported 21, 6, 1 CFU/100 mL. The results are considered to reflect seasonal and biological conditions, and not the leachate. Both locations are significantly lower than 2010-2011 monitoring period results (ML-2, 1300 CFU/100 mL and ML-5, 1200 CFU/100 mL, November 2010) but above the 2011-2012 (ML-2, 18 CFU/100 mL and ML-5, 8 CFU/100 mL) and 2012-2013 (ML-2, 4 CFU/100 mL and ML-5, 15 CFU/100 mL).

Multiple sources of coliforms exist in the creek. The rehabilitated landfill represents an insignificant contribution, due to its distance from the creek (i.e. local fauna and flora, farms) and filtering in the aquifer.

7.6.4 Inorganic Contaminants

Total or dissolved organic carbon (TOC/DOC) concentrations were not analysed during the 2019-2021, and previous 2016-2018 monitoring periods. TOC was included for November 2018 and February 2019 monitoring period.

Surface water samples from August 2016, 2017 and 2018 reported elevated concentrations of iron (ML-5 =0.23 mg/L, 0.32 mg/L, 0.18 mg/L and ML-2 = 1.07 mg/L, 0.88 mg/L, 0.18 mg/L). Concentrations were below the ANZECC 2000 guidelines (0.3 mg/L) in August 2018 to May 2019. However, the ANZECC (2000) guideline for iron in fresh water is a low reliability IIWL.

The following Fe & Mn concentrations were reported for the 2019 to 2020 monitoring period;

• ML-2. The Fe (total) = 0.14 mg/L and Mn 0.019 mg/L



• ML-5. The Fe (total) = <0.1 mg/L and Mn 0.035 mg/L

The following elevated Fe & Mn concentrations were reported for the 2020 to 2021 monitoring period, and similar to previous years;

- ML-1 to ML-5. The Fe (total) ranging from 0.54 to 0.65 mg/L
- ML-1 to ML-5. The Mn (total) ranging from 0.01 to 0.012 mg/L

7.6.5 Major Ions

Concentrations of major cations (sodium, potassium, alkalinity, magnesium, calcium) in the surface water (Blue Angle Creek) indicate domination of sodium (marine water influence), which is consistent with previous monitoring rounds.

7.6.6 Quality Assurance/Quality Control

Interpretive Quality Control Reports (QCI, Appendix A) were not provided by ALS (Sydney) for the surface and groundwater laboratory data. ALS is NATA accredited for the analyses performed and appropriate sample bottles and analyses were carried for the monitoring works. Sample bottles are despatched (same day) from the site to the laboratory under chain of custody procedures with appropriately trained field sampling technicians.

The analytical data is considered to be suitable for the quarterly monitoring events during 2020 to 2021.

8. Leachate Plume and Landfill Rehabilitation

The monitoring results have been used to assess potential impacts to fresh and marine aquatic ecosystems. The groundwater migrating from the former landfill discharges to Blue Angle Creek and Seven Mile Beach. The range of groundwater contaminants identified from the latest monitoring events indicates the GWDD is a source of leachate (mostly ammonia and TKN), total phosphorous and iron.

Ammonia is the primary landfill leachate indicator. However, the waste is also a source of dissolved salts, metals and organics associated with the dissolution of ions (predominantly calcium and bicarbonate).

Following the closure of the landfill in 2003 and remedial works completed by Council and E2W in February 2005, the generation and migration of ammonia has declined in the shallow and deep groundwater system (Graphs-1 & 02). Monitoring wells MW-3, MW-4 and MW-5 are considered to reflect the typical groundwater quality arising from the landfill rehabilitation (>80% decrease in ammonia over time).

The deep groundwater monitoring wells (MW-1D, MW-6D and MW-7D) installed in 2006 show water quality improvements but at a slower rate relative to the shallow groundwater. The deep groundwater takes longer to improve due to the slower groundwater flushing and climatic conditions. However, during August 2009 to 2020 the ammonia concentrations in deep wells show a decreasing trend (Graph-2). Since 2018, the deep groundwater wells (MW-1D, MW-6D, MW-7D, and MW-12,13,14) show a rising ammonia trend due to the dry weather (i.e. drought 2017 to 2020).



The ammonia trends are stabilising and decreasing from 2020/2021 due to the return of average rainfall conditions. The ammonia trends are interpreted to relate climatic patterns (low rainfall; 2017-2020) and dilution of the leachate plume from runoff and rainfall infiltration through the aquifer.

The most significant contaminant is ammonia-nitrogen, with a remnant plume extending in both north-west and south-east directions reflecting flows either side of the groundwater divide. Prior to rehabilitation, leachate originating from the landfill and night soil depot infiltrated the shallow aquifer, as well as migrating under the predominant groundwater flow regime towards Seven Mile Beach and Blue Angle Creek, respectively.

E2W consider the leachate plume in the shallow groundwater has shrunk due to the decrease in leachate generation and capping of the landfill. The time series trends show that significant groundwater quality improvements occurred since landfill closure.

Monitoring results indicate a clear improvement in water quality and aquifer restoration during average rainfall conditions. The water quality trends at the site during drought conditions indicate that more time is required to restore the local groundwater quality.

Some elevated phosphorous occurs around the former night soil and is interpreted to arise from rainfall and land disturbance around the source area (i.e. removal of lined ponds in ~ 2011).

The landfill rehabilitation conducted between July 2004 and February 2005 has resulted in a measurable improvement in the shallow groundwater quality at GWDD. While ammonia remains elevated but has began to fall below the ANZECC 2000 guidelines in the deep groundwater, E2W consider that water quality will continue to improve in the shallow/deep aquifer due to the reduced leachate generation, natural attenuation and return of average rainfall conditions.

The surface water results from the 2019-2021 monitoring period reported ANZECC (2000) guideline exceedences (phospherous, TKN) at all sample locations (ML-1 to ML-5). The increasing ammonia in the creek during 2020/2021 requires additional monitoring to assess potential impacts from the leachate plume. The elevated concentrations of MW-11 (near creek) have dereased during 2020/2021 monitoring period.

The surface water environment is dynamic and influenced by tidal flushing and discharges (runoff, seepage, baseflow) from the surrounding catchment and aquifer.

8.1 Ecological Issues

Groundwater migrating from the landfill to Seven Mile Beach is diluted by the dynamic processes operating in this environment. Contaminants contained within this discharge may be diluted and dispersed via biological, chemical and physical processes occurring at the groundwater/salt water interface. Plant uptake of excess nutrients in the groundwater may also occur as the depth to groundwater becomes shallower as it approaches the beach.

The effect of nutrient-impacted groundwater discharging to Blue Angle Creek and/or Crooked River Estuary is unclear and difficult to ascertain given the variability, dynamic environment, and multiple nutrient sources in the catchment area. The landfill contaminants (ammonia, TP) are not significant risk of harm chemicals (e.g. benzene or Pb) and can be naturally attenuated (biodegraded) and taken-up and reduced by the flora.





Potential impacts of landfill leachate to Blue Angle Creek would depend on the groundwatersurface water interaction, climate and the rehabilitation works. Results from MW-9, MW-10 (monitoring wells adjacent creek) indicate a reduction in ammonia (Graph-1), whilst ammonia at MW-11 was rising up to mid 2020, but has recently (November 2020 to February 2021) decreased to below the guidelines. Previously, MW-11 has a history of variable ammonia concentrations; however since May 2010 to February 2018 ammonia was below ANZECC guidelines. The rising ammonia trends during 2018 to 2020 are linked with the drought period (2017-2020).

The well (MW-11) rising ammonia trend is potentially linked to the ugradient wells (MW-6D, MW-7D) which also have rising trends reflecting the migration of the landfill leachate plume. The well (MW-11) may be influenced by the landfill leachate plume and also the creek environment due to its foreshore environment. Further monitoring is required to assess the trends and any management actions.

E2W interpreted that some nitrogen-impacted groundwater would discharge to the creek (and mix with other water in the estuary), however the extent of attenuation of the nitrogen plume prior to discharge is unclear. Attenuation is likely to occur through a combination of dilution, uptake of nutrients by riparian vegetation, mixing of groundwater from the creek, flows and tidal movements within the creek and oxidation of the ammonia to nitrate/nitrite and generation of nitrogen gas.





9. Conclusions

Surface and groundwater quarterly monitoring (4 EPL rounds) was completed at the GWDD by ALS from May 2020 to February 20210. An additional 5 monitoring events were conducted by ALS to assess the ammonia trends at 9 wells (MW-1D, 3,5, 6D, 7D,11, & MW-12,13,14) from March 2020 to January 2021 (Table 7). The monthly & EPL results is used to guide any further monitoring or management/remedial requirements.

The data has been assessed by E2W to identify potential impacts to the groundwater and surface water systems. This EPL follows E2W previous report "Second Interim Groundwater Report-Gerroa Waste Disposal Depot" dated May 2018, which assessed the variable ammonia trends in several deep wells (e.g. MW-1D, MW-3, MW-6D).

The following conclusions are offered:

- The rehabilitation of the landfill mound and night soil depot (completed February 2005) has improved the local groundwater quality. The improvement to local surface water quality is not clear, and impacts are not readily discernible from landfill or background sources (agricultural, tidal water & runoff quality).
- Groundwater at the landfill site is directed towards Blue Angle Creek (base-flow discharge) and Seven Mile Beach via a groundwater salt/water interface.
- The key landfill indicator (ammonia-nitrogen) shows a decreasing/stabilising trend in shallow and deep wells located next to the landfill mound and former night soil deposit. The deep wells (e.g. MW-1D, MW-6D, MW-7D, MW-11, and MW-12,13,14 mg/L) show a rising ammonia trend for 2019-2020, however the trend stabilises and decreases during the 2020/2021 monitoring period. The variable ammonia trends over the past few years relates to the climate, and drought period (2017 to 2020, Table 7). The return of average rainfall (1152.8 mm) during 2020/2021 is interpreted to stabilise and/or reverse the previous ammonia rising trends.
- Concentrations (above ANZECC 2000) of nutrients, in particular ammonia, continue to be elevated and variable in the deep groundwater (MW-1D, MW-6D, MW-7, Figure 4).
- Catchment area characteristics, climate and tidal regime influence the water quality in Blue Angle Creek and the adjacent wells (MW-9, MW-10 and MW-11). The elevated ammonia concentrations at MW-11 (foreshore well) in 2020 has reduced to below the guidelines in 2021.
- Concentrations of total phosphorous (TP) in the shallow/deep groundwater is generally variable, with elevated and variable trends at MW-1D, MW-3, MW-4, MW-5, MW-6D, MW-7D. Areas of variable TP (MW-6D) is associated to the former night soil deposits, with likely mobilisation during rainfall.
- Ammonia concentrations in surface water samples collected at downstream locations (Blue Angle Creek) are generally variable, similar to previous years, and below ANZECC (2000) guidelines.
- An exceedance (greater than 10% above ammonia values in Appendix C) were reported at ML-3, ML-4 and MW-11. Ongoing monitoring of ammonia concentrations is required at the creek to assess any potential impacts that may arise from migration of landfill leachate..
- Total phosphorus (TP) concentrations at ML-5 ranged from 0.02 to 0.11mg/L, whilst TP ranged from <0.01 mg/L to 0.09 mg/L at ML-2. The TP results from the new locations (ML-1, 3 and 4) are similar to ML-2 & ML-5. The TP in surface water is generally variable due to the dynamic nature of the tidal creek. It is likely that water quality in Blue Angle Creek reflects



other nutrient sources (i.e. high TKN, TP) in agricultural catchment, and potentially from the GWDD.

- All other water quality indicators were consistent with the previous monitoring results.
- Monitoring results indicate an improvement in water quality and aquifer restoration at the former Gerroa landfill. Additional monitoring is required to verify the ammonia trends upon the return of average rainfall conditions.

The monitoring data shows that ammonia concentrations at MW-3 and MW-5 have returned to low levels (below ANZECC 2000) since 2018. Elevated ammonia concentrations at three EPL wells (MW-1D, MW-7D, MW-6D) and new wells (MW; 12,13,14, ammonia ranges from 26.6 to 97.7 mg/L) require further monitoring to assess the trends, and need for any remedial actions (i.e. extractiom of groundwater, as required). The rise in ammonia at the eastern boundary is linked to the recent drought period, with some evidence of the ammonia trends stabilising and decreasing with the return to average annual rainfall in 2021.

The current water quality trends are linked to the drought period (2017-2020) and changing aquifer conditions with less rainfall recharge/dilution.

The nutrient concentrations (particularly ammonia) in the shallow and deep groundwater are likely to continue to decrease over time (note: phosphorous may take longer to decline as it is likely to adsorb/retarded by the aquifer matrix and mobilised by rainfall). The landfill capping system reduces rainfall infiltration into the buried waste (reduces leachate generation) and diverts runoff from the 3 Ha capped mound into the aquifer, causing dilution and attenuation of the residual leachate.

Monitoring of surface and groundwater conditions at the GWDD following the completion of landfill remediation has provided beneficial data regarding the effectiveness of the rehabilitation works. The "surface and shallow" groundwater quality is improving and generally meeting the ANZECC (2000) guidelines. More consistent water quality and meeting of the guidelines is expected in the future, especially when the annual rainfall returns to average conditions (e.g. Gerroa rainfall = average of 1.2 m/year, whilst rainfall @ 2019/20 = 0.75 m/year)

Based on recent groundwater trends, it is interpreted that the deep groundwater quality improvement is also dependant on the prevailing climate with the rising ammonia trends relate to the drought, and onset of a wet cycle from 2021. The ammonia trends are interpreted may reverse back to declining trends with the return of average rainfall conditions.

9.1 Recommendations

In order to improve the quality of monitoring at the site, E2W recommends that the following is incorporated into subsequent sampling rounds:

- Continue to monitor and assess ammonia trends of the 3 eastern boundary wells (MW-12,13,14) at approximately 2 monthly intervals. Remedial works are recommended at above 100 mg/L (ammonia) at the four wells (MW-12,13,14, MW-1D) located on the east boundary.
- E2W recommend that council should consider remedial works (e.g. such as groundwater extraction & irrigation of the mound) if the ammonia concentrations continue to rise and/or consistently exceed 50 mg/L (ammonia) at the creek foreshore area (e.g. MW-11 or MW-7D).
- Obtain survey details (RL) for the 6 piezo-meter wells (MW-1S/MW-1D, MW-6S/MW-6D and MW-7S/MW-7D) to enable reduction of groundwater levels to mAHD.



- Assess quality assurance/control from laboratory and perform re-analyses for elevated results.
- Review tidal charts and climate prior to surface water sampling. Sample collection should be co-ordinated with the tide so that both creek samples are collected during a low run-out tide when the maximum amount groundwater discharges into the creek.
- Closer monitoring of key locations (SW: ML-3/ML-5, & GW: MW-11/MW-7D) at the creek area which receives baseflows from the landfill site (i.e. check for ammonia rises & spikes).







Figures

&

Graphs

 $-e_2W$

-earth_water



Source: Neil Charters Pty Ltd

SITE LOCATION

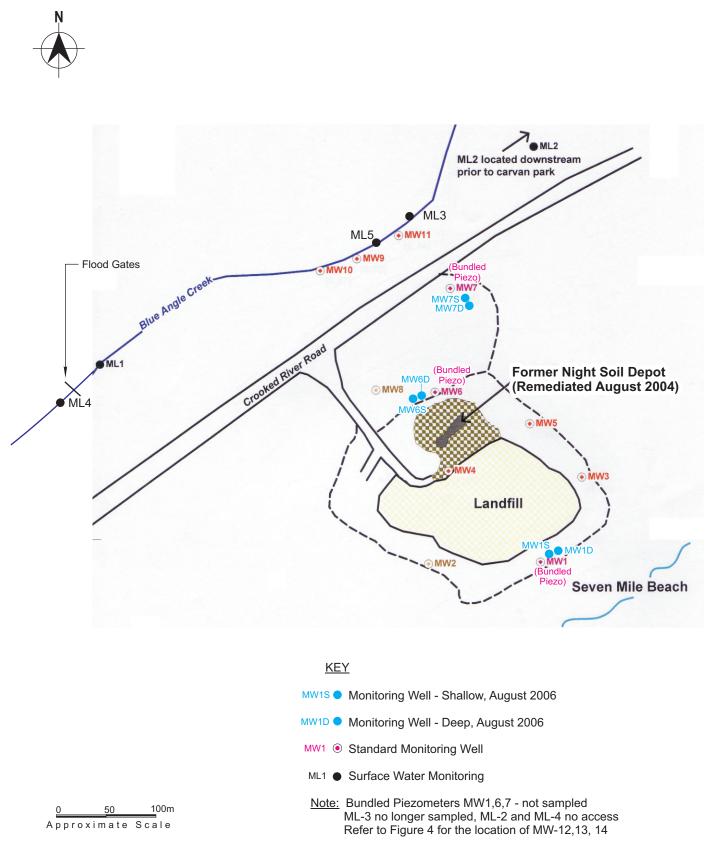
GERROA ANNUAL MONITORING REPORT (2020-2021)

Date: March 2021

Reference: E2W-025_55.cdr

Figure 1





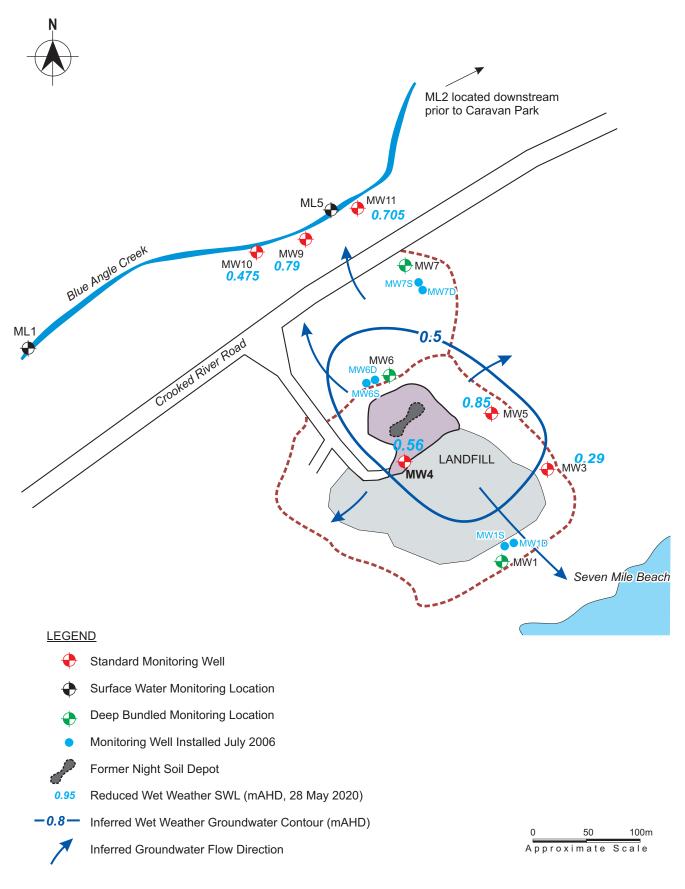
Landfill Rehabilitation Works; 2004 to 2005

Source: URS Australia Pty Ltd

Date: March 2021 Reference: E2W-025_01.cdr

SITE LAYOUT & WELL LOCATIONS



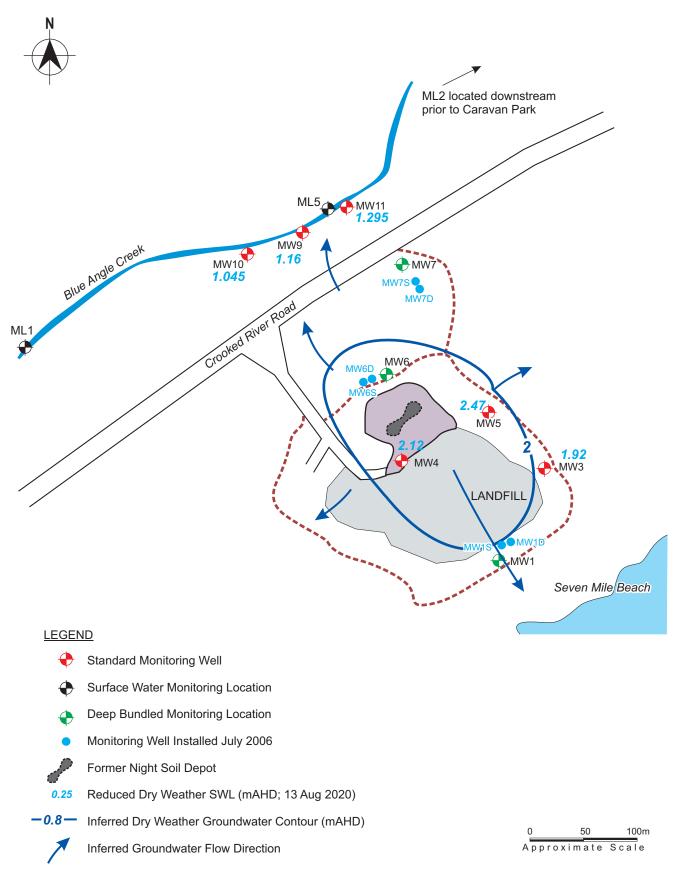


Source: URS Australia Pty Ltd- baseplan

INFERRED GROUNDWATER FLOW REGIME (Dry, May 2020)

GERROA ANNUAL MONITORING REPORT (2020-2021)

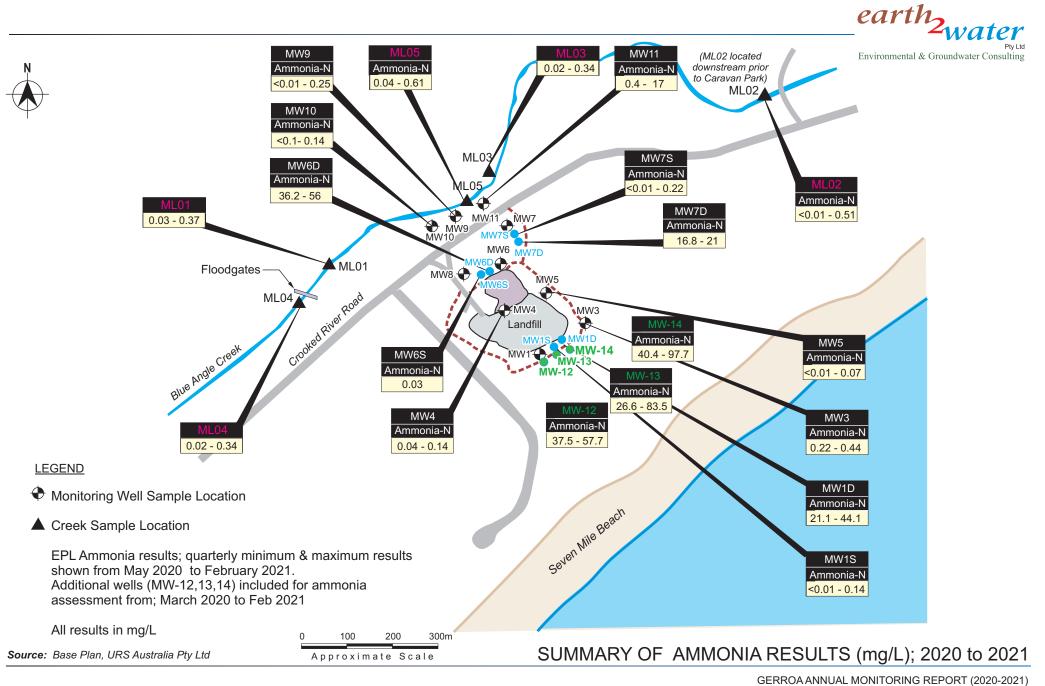




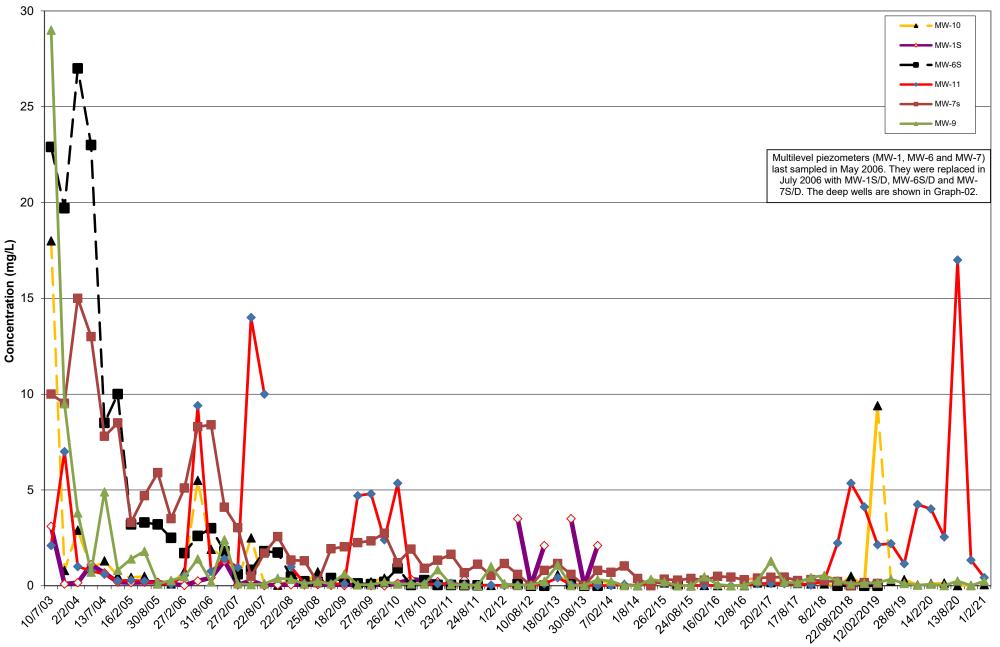
Source: URS Australia Pty Ltd- baseplan

INFERRED GROUNDWATER FLOW REGIME (Wet, Aug 2020)

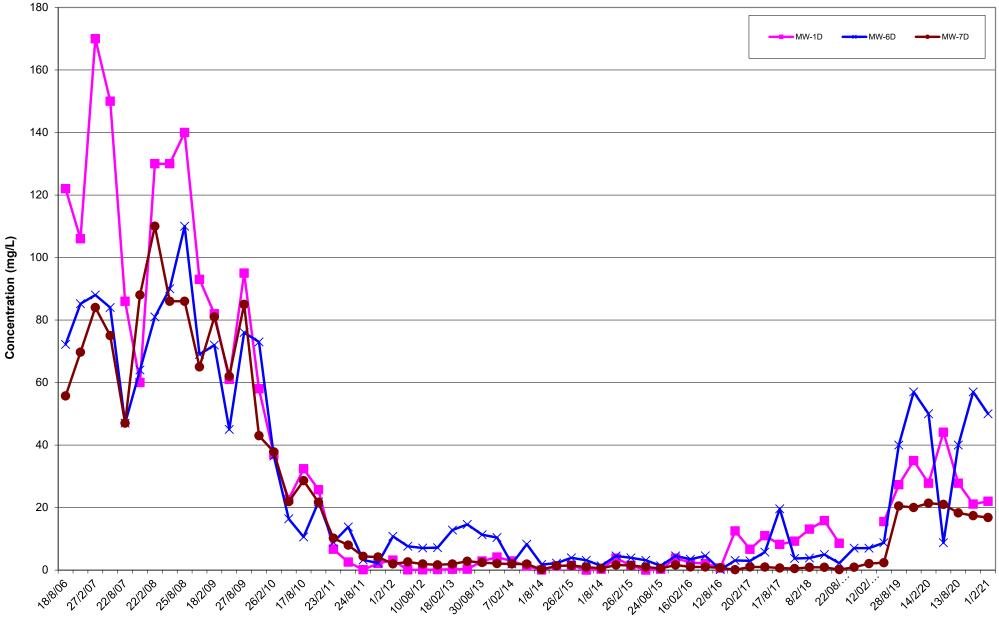
GERROA ANNUAL MONITORING REPORT (2020-2021)



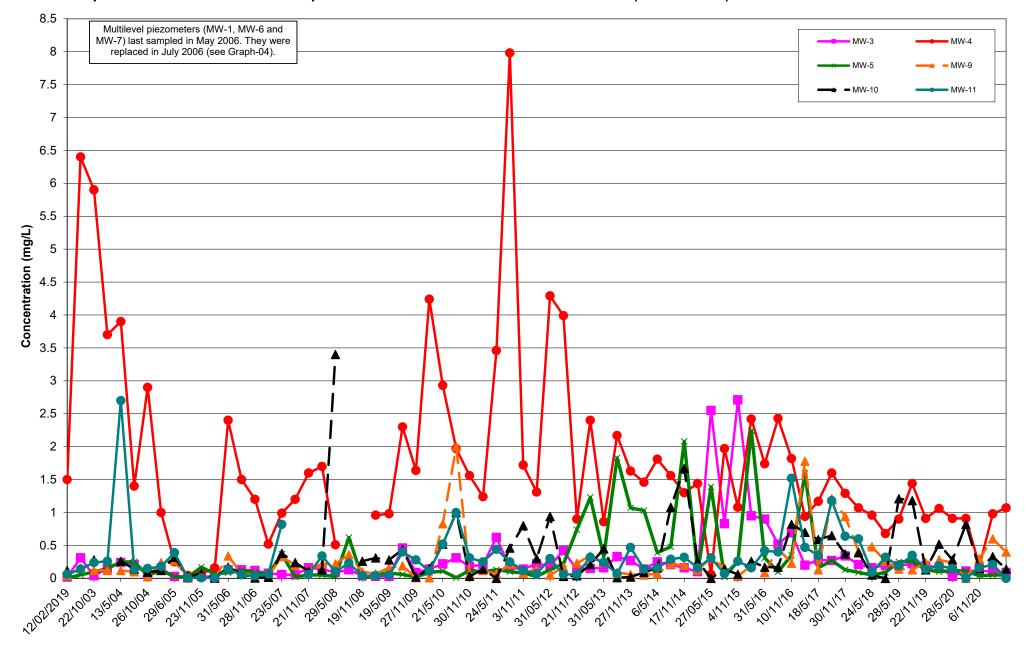
Date: 12 March 2021



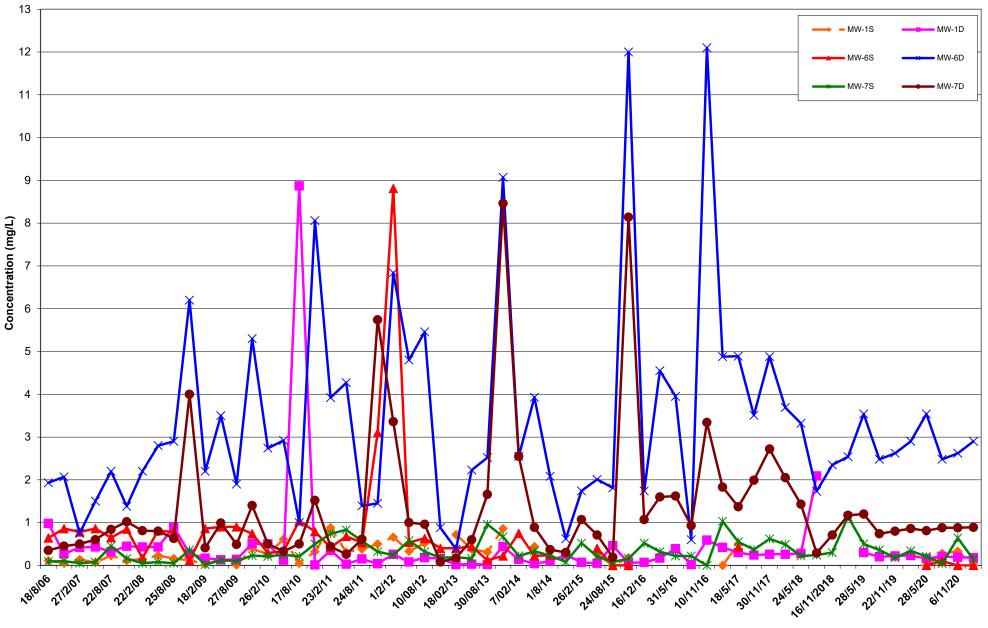
Graph-01: Groundwater Ammonia Time-Series Trends - Shallow & Creek Wells (2006 to 2021)



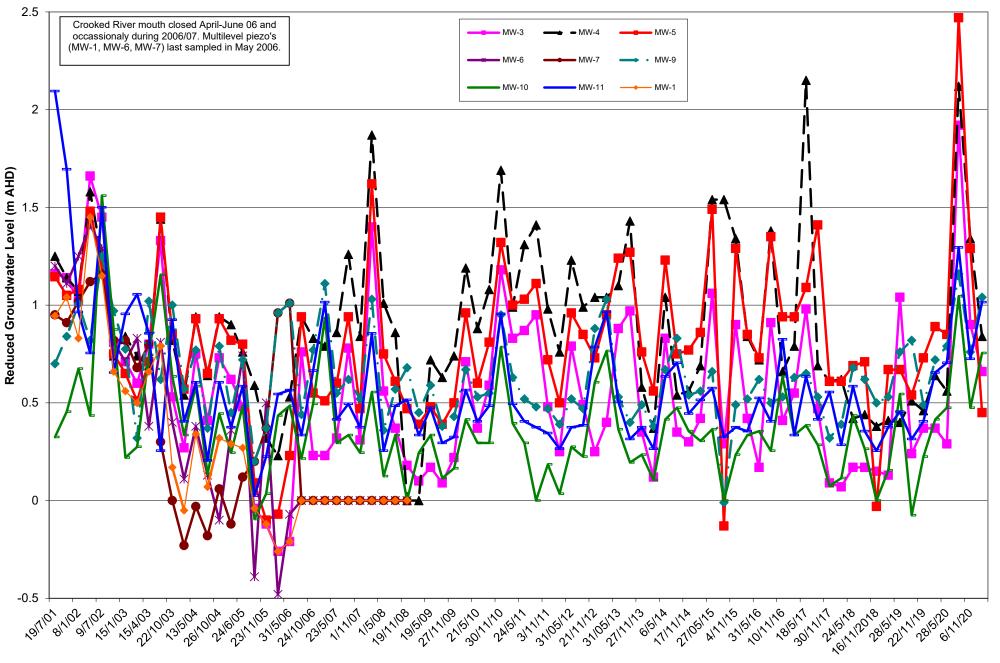
Graph -02: Groundwater Ammonia Time-Series Trends - Deep Wells (2006 to 2021)



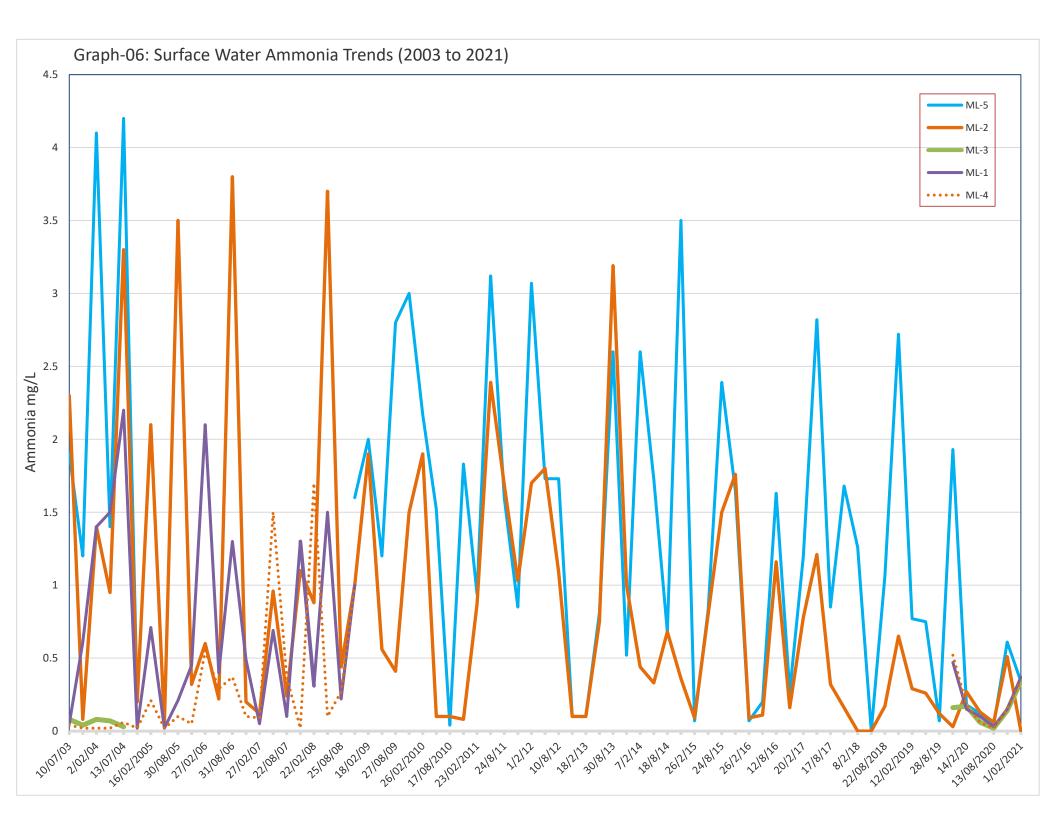
Graph-03: Groundwater Total Phosphorous Time-Series Trends - Standard Wells (2006 to 2021)

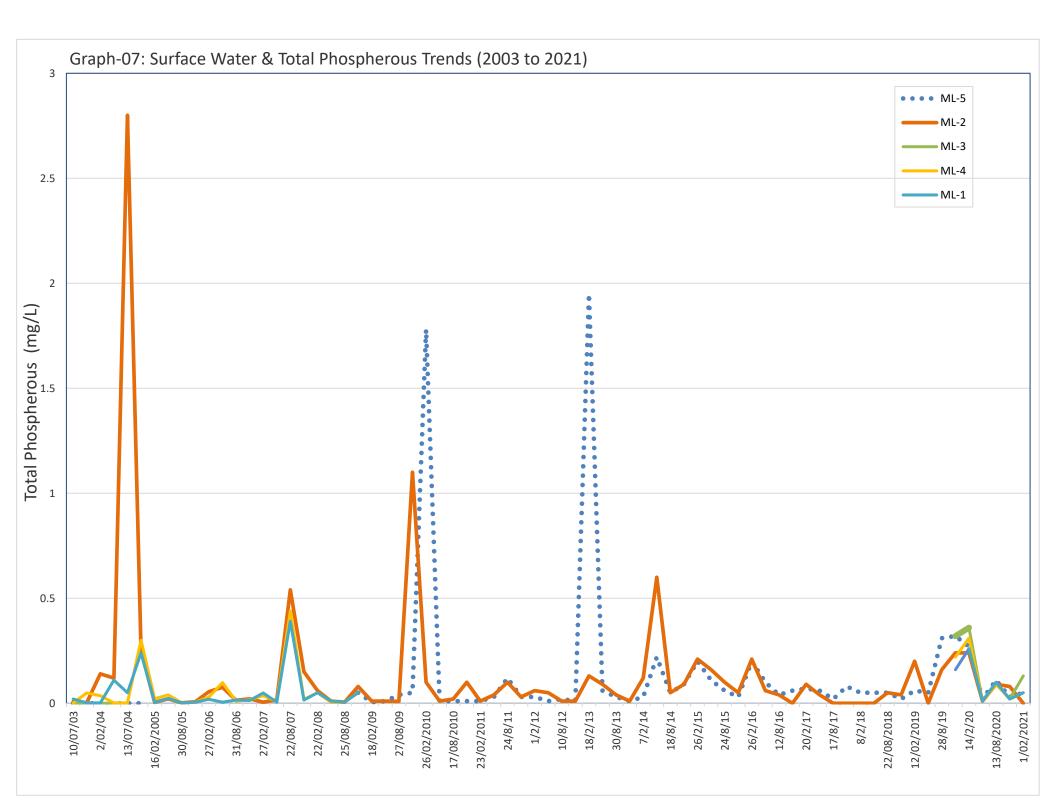


Graph-04: Groundwater Total Phosphorous Trends - New Shallow & Deep Wells (2006 to 2021)



Graph-05: Depth to Groundwater (m AHD) Trends; 2001 to 2021







Tables



Sample ID	ANZEC	C, 2000	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S	MW1S
Field Measurements	Fresh	Marine	21/5/10	18/2/13	17/11/14	26/2/15	27/5/15	24/8/15	4/11/15	16/2/16	31/5/16	12/8/16	10/11/16	20/2/17	18/5/17	17/8/17	30/11/17	8/2/18	24/5/18	28/5/20	13/8/20	6/11/20	1/2/21
Ground Level (m AHD)			NA																				
Depth to Groundwater (m AHD)																							
Groundwater depth (m bTOC)			3.74	3.75	NA	NA	3.06		3.2	NA	NA	NA	NA	NA	3.11	NA	NA	NA	NA	NA	NA	NA	NA
Height of Stick up (m)			0.65	0.65			0.65		0.65						0.65						0.65	0.65	
Groundwater Depth (mbgl)			3.09	3.1			2.41		2.55						2.46						2.24	3.21	
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.8	7			6.2		6						6.4						6.5	6.4	
Temperature (T deg C)			-																				
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		1.95	1.1			0.772		0.342						0.691						0.482	0.315	
Salinity (ppt)			-																				
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	1.39	1.48			2.19		2.2						2.29						2.35	4.14	
Dissolved Oxygen (%)			-																				
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-																				
Redox Potential (mV)			-																		-44.6		
Comments			nc	nc																			
Sodium			-																	<10	61	<10	96.50
Potassium			-																		2		
Calcium			-																		24		
Magnesium			-																		8		
Chloride			-																		111		
Alkalinity (as CaCO3)			386	362			102		51						139						70	76	
Bicarbonate			386	362			102		51						139						70	76	
Carbonate (as CaCO3)			<1	<1			<1		<1						<1						<1	<1	
Sulphate (SO4)			-																	MB	<10	MB	LCS
pH (lab)			-																				
Total Dissolved Solids (TDS)			1300	640			734		385						561						522	361	
Hardness (as CaCO3)			-																				
Total Suspended Solids (TSS)			-																				
Iron (filtered)	0.3 (1)		-																		10.6		
Manganese	1.90		-																		0.01		
Nitrate (NO3 as N)	0.7 (7)		0.26	<0.10			<0.01		<0.01						<0.01						<0.10	<0.01	
Nitrite (NO2 as N)			<0.01	<0.10		1	<0.01		<0.01						<0.01						<0.10	<0.01	
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.27	0.13		1	0.09		0.23						0.31						<0.01	0.14	
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	4.4	1.8			3.5		2.1						5.5						4.3	2.9	
Dissolved Organic Carbon			-									1									124		
Fluoride (Electrode)			-																		0.3		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	0.61	0.72		1	0.26		0.2			1			0.50						0.28	0.33	

Note: Exceeds ANZECC (2000) guidelines

marine/fresh water ecosystems

35 1. Trigger value is an indicative interim working level only (IIWL).

Ammonia trigger at pH = 8.0, for a 95% protection, corrected for average pH = 7.3.
 Trigger value for oxides of Nitrogen (NOx) for lowland rivers in NSW.

Focus of this monitoring report nc = no comment NA = not available

Trigger value for oxides of Nitrogen (NOX) for marine ecosystems in NSW.
 Trigger value for total Nitrogen in lowland rivers in NSW.

Trigger value for total Nitrogen in marine ecosystems in NSW.
 Trigger value for a 95% proetction level.
 Guidelinefor water quality and aesthetics: primary contact.

a. Reference only, not dirtectly applicable to groundwater.

ample ID	ANZEC	C, 2000	MW1D MV	/ 1D M	W 1D 1	WW1D	MW1D	WW 1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1E	MW1	MW1E	MW10	MW10	MW10	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1D	MW1	D MW10	MW1	D MW1	D MW1	D MW ¹	ID MW	1D MW	W1D 🚺	MW1D	MW1E	S MW1	DMV						
eld Measurements	Fresh	Marine	21/5/10 17/	8/10 30	11/10	23/2/11	24/5/11	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/1	3 7/2/14	6/5/14	1/8/14	17/11/1	4 26/2/15	27/5/15	24/8/15	4/11/15	16/2/16	31/5/16	12/8/16	10/11/16	20/2/17	18/5/17	17/8/17	30/11/17	8/2/18	24/5/18	22/8/18	22/8/1	8 22/8/18	22/8/1	8 22/8/1	8 28/5/1	9 28/8/	19 22/11	1/19 14/:	/2/20 7	28/5/20	13/8/20	0 6/11/2	0 1/:
round Level (m AHD)			NA												-	-	-	-																															
epth to Groundwater (m AHD)															-	-	-																																
roundwater depth (m bTOC)			3.62 3.												3.1															3.46													8 3.8					3.73	
aight of Stick up (m)													0.62																															62 0.6					2 0.
roundwater Depth (mbgl)			3 2.				2.5						3.15	2.98		2.38	3.02					2.92	2.3							2.84					3.21								6 3.2		3.11				3.
	6.5-8.0 (a)	8-8.4 (a)	6.9 7	.2	6.8	7	7.30	7.60	7.60	7.50	7.80	7.5	7.5	7.5	7.30	7.5	7.5	7.5		7.6			7.5	7.7	7.3	7.3	7.3	7.2	7.4	7.2	7.4	7.4	7.4	7.2	7.3	7.5	7.5	7.5	7.5	7.5	7.4	7.2	2. 7.3	2 7	7.2	7.4	7.3	7.4	7
emperature (T deg C)			-	-	-	-	-	-	-	-	-				-	-	-	-																															
ectrical Conductivity (mS/cm) 0	0.125-2.2 (a)		2.4 2.	43 1	2.22	1.95	1.72	11.00	1.26	0.99	0.59	<1	0.657	0.695	0.63	0.624	0.624	0.59		0.467	0.622	0.636	0.707	0.709	0.803	0.631	0.652	0.735	0.992	0.844	0.834	0.862	0.884	1.04	1.38	1.28	1.28	1.28	1.28	1.28	1.5	1.8	1.7	76 1.6	.68	1600	1580	1380	/ 1/
alinity (ppt)			-	-	-	-	-	-	-	-	-				-	-	-	-																															
	8.5-11.0 (a)	9.0-10.0 (a)	2.56 2.			2.31	1.54	2.51	1.72	2.60	5.30		1.98	2.6	1.97	1.62	2.50	1.82	1.88			2.50	3.45	3.05	1.71	3.7	3.00	1.98	3.40	2.97	3.20	2.90	3.1	2.12	2.74	4.13	4.13	4.13	4.13	4.13	3.36	17	1.2	22 0.9	1.96	1.81	1.11	1.29	2
ssolved Oxygen (%)			-	- 1	8.20	-	-	-	-	-	-	22.2			-	-	-	-		36.2																													
	6-50 (a)	0.5-10 (a)	-	-	-	-	-	-	-	-	-				-	-	-	-																															
adox Potential (mV)			-	-	-	-	-	-91.6	-	-	-	<0.1			-	-78		-		60				-37				-90.0				-115				152	152	152	152	152		-12	3				-129		
omments			nc r	с	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	-	-	-	-																															
odium			-	-	239	-	-	118	-	-	-	22			-	22	-	-		14				37				31				48				78	78	78	78	78		119	9			<10	116	<10	<
otassium			-	-	44	-	-	15	-	-	-	11			-	15	-	-		10				13				13				17				24	24	24	24	24		41					36		
alcium			-	-	115	-	-	68	-	-	-	64			-	62	-	-		65				72				81				62				84	84	84	84	84		94					79		
agnesium			-	-	64	-	-	27	-	-	-	23			-	24	-	-		20				24				22				20				29	29	29	29	29		50	1				38		
nloride			-		188	-	-	146	-	-	-	12			-	20	-	-		21				37				66				63				205	205	205	205	205		243	3				234		
kalinity (as CaCO3)			611 4	34 3	231	345	297	316	322	363	279	288	293	292	284	316	298	254	283	225	280	296	272	262	291	252	287	298	309	302	302	286	<1	<1	<1	308	308	308	308	308	384	425	5 47	9 4	487	542	452	407	3
carbonate			611 4	34	231	345	297	316	322	363	259	288	293	292	284	316	298	254	283	225	280					252	287	298	309	302	302	286	333	371	358	308	308	308	308	308	384	42	5 47	9 4	487	542	452	407	3
arbonate (as CaCO3)			<1 <	1	<1	<1	<1	<1	<1	<1	21.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1			<1	<1	<1	333	371	358	<1	<1	<1	<1	<1	<1			<	<1	<1	<1	<1	<
ulphate (SO4)			-	-	160	-	-	34.00	-	-	-	6			-	6	-	-						10				10				13				15	15	15	15	15		10	1				56	-	-
(lab)			-	-	-	-	-	-	-	-	-				-	-	-	-	7.20	7.60	6.40	7.20						7.2				7.4																-	-
tal Dissolved Solids (TDS)			1340 13	30 1	420	1160	940	700	772	580	340	264	418	320	372	328	328	309	272	334	397	355	379	443	480	419	378	408	476	440	460	400	466	542	671	647	647	647	647	647	639	878	3 87	9 8'	812	931	812	706	7
ardness (as CaCO3)			-	-	-	-	-	-	-	-	-				-	-	-	-																														-	-
otal Suspended Solids (TSS)			-	-	-				-						-	-	-																			-								_					-
	0.3 (1)		-	- 9	9.93			0.10	-			< 0.05			-	< 0.05	-			< 0.05				< 0.05				0.07				0.05				<0.05	<0.05	< 0.05	<0.05	5 <0.0	5	4.5	3	_			4.26	-	-
anganese	1.90		-		036	-		0.008	-	-	-	0.001			-	0.010	-			0.00				0.006				0.010				0.013						0.011				0.0					0.02		-
	07(7)		1.36 4		0.86	0.76		2.39	1 79	<0.01	1.57	2	2.13	2.38	1.06		0.03	0.11	0.17		1.4	0.35	1.87		0.13	0.02	0.16		0.02	0.53	0.03		0.79	0.03	0.04	1 92		1.92	1.92					01 <0.	0.01	<0.01	< 0.01		1 0.
trite (NO2 as N)	0.1 (1)		0.06 0			0.02	0.08		0.06	<0.01		<0.01		<0.01					0.03		<0.01						< 0.01			0.03		0.03				0.16		0.16		0.16	<0.01				0.01		< 0.01		1 <0
	1.88 (2)	2.84 (2)	22.6 3				2.56	0.12	2.15	2.16	0.07	0.00	0.17	0.26	0.00	2.88			1.29						3.78			0.66						13.1	15.8	8.58				8.58			3 35					21.1	
	0.5 (5)	0.12 (6)	45.2 5					1.70	2.15	4.00	1.50	1.4	10	1.2	1.10	3.4		3.1	1.23		2.1				4.6	3.3			15.8	8.7	13.9		9.24		15.8	8.8		8.8					5 34.					23.3	
ssolved Organic Carbon	0.5 (5)	0.12 (0)	4J.2 J.		22	3.0	4.00	12	3.30	4.00	1.50		1.0	1.4	1.10	45	4.4	3.1	1.0	0.0	4.1	1.0	0.0	9		3.5	2.0	9	13.0	0.7	13.8	12	3.24	13.1	13.0	10			0.0	10		17		<u> </u>	3.0	43.2	19		_ <u>_</u> `
uoride (Electrode)			-		:0.1			0.2	-	-		0.1			-	0.2	-		-	0 10	-	-	-	0.20				01		-		0.2						0.2	0.2			0.2		—			0.20		+-
	0.05 (7)	0.005 (7)	0.12 8.			-	0.03		-	-	-		0.16	0.02	0.03		-	0.1			0.3		0.05				0.00		0.50	0.42	0.00			0.00						2.09			0.2		-	0.40		0.19	0.
	0.05(7)	0.025 (7)	0.12 8.	8/ <	0.01	0.35	0.03	0.15	0.04	0.26	0.08	0.18	0.16	0.02	0.03	0.02	0.44	0.1	0.0	0.1	0.3	0.1	0.05	0.46	0.06	0.17	0.39	0.02	0.59	0.42	0.30	0.24	0.26	0.26	0.28	2.09	2.09	2.09	2.09	2.09	0.3	0.2	0.2	Z 0.2	.23	0.16	0.21	0.19	U.
Exceeds ANZECC (2000) guide marine/fresh water ecosyster		35	Not		lue is an	indicativ	e interim	working le	evel only	(IWI.)					er value fo er value fo				osystems	in NSW.																													
Focus of this monitoring report			2. A	mmonia	trigger a	t pH = 8.0	0, for a 95	% protec	tion, corr	rected for	raverage	pH = 7.3			elinefor wa				rimary co	ntact.																													
	NA = not av	ailable	3. T	rigger va	lue for o	xides of N	Nitrogen (NOx) for	lowland r	ivers in N	NSW.				ence only																																		
							Vitrogen (V.																																					
									rs in NSV																																								

1)																						
N 3	MW 3	MW3	MW3	MW 3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3	MW3
B/10	30/11/10	23/2/11	24/5/11	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	6/5/14	1/8/14	17/11/14	26/2/15	27/5/15	24/8/15	4/11/15	16/2/16
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
59	1.18	0.83	0.87	0.95	0.48	0.25	0.79	0.49	0.25	0.40	0.88	0.97	0.35	0.12	0.83	0.35	0.30	0.42	1.06	0.29	0.90	0.42
86	3.27	3.62	3.58	3.5	3.97	4.2	3.66	3.96	4.2	4.05	3.57	3.48	4.1	4.33	3.62	4.1	4.15	4.03	3.39	4.16	3.55	4.03
45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45

Field Measurements Sround Level (m AHD) Depth 2 Groundwater (mAHD) Sroundwater depth (m bTOC) Height of Stick up (m)	Fresh	Marine	21/5/10 4	17/8/10	30/11/10	22/2/44																																							
Depth 2 Groundwater (mAHD) Groundwater depth (m bTOC)			4						3/11/11	1/2/12	31/5/12	10/8/12 2	1/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	6/5/14	1/8/14	17/11/14	26/2/15	27/5/15 24/	3/15 4/1	11/15 1	6/2/16 31	/5/16 12	/8/16 10/1	1/16 20/	2/17 18/	5/17 17/8/	17 30/11/	17 8/2/18	24/5/18	22/8/18	16/11/18	12/2/19	28/5/19	28/8/19	22/11/19	14/2/20	28/5/20	13/8/20 1	6/11/20	1/2/21
Groundwater depth (m bTOC)				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4.00	4.00	4.00	4.00	4.00 4.	00 4	.00	4.00 4	1.00 4	.00 4	.00 4.	.00 4.	00 4.0	0 4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Groundwater depth (m bTOC)			0.37	0.59	1 18	0.83	0.87	0.95	0.48	0.25	0.79	0.49	0.25	0.40	0.88	0.97	0.35	0.12	0.83	0.35	0.30	0.42	1.06 0	29 0	0.90	0.42 0	17 0	.91 0.	.41 0.	55 0	98 0.4	7 0.05	0.07	0.17	0.17	0.15	0.13	1.04	0.24	0.37	0.37	0.29	1.92	0.90	0.66
			4.08	3.86	3.27	3.62	3.58	3.5	3.97	4.2	3.66	3.96	42	4.05	3.57	3.48	4.1	4.33	3.62	4.1		4.03									47 3.9	8 4.36	4.38	4.28	4.28	4 30	4.32	3.41	4.21	4.08	4.08	4 16	2.53	0.55	3 79
leight of Stick up (m)							0.00																											-											
			0.45	0.45	0.45	0.45			0.45	0.45	0.45		0.45	0.45	0.45		0.45	0.45	0.45	0.45								.45 0.			45 0.4					0.45	0.45	0.45	0.45	0.45	0.45	0.45			0.45
Groundwater Depth (mbgl)			3.63	3.41	2.82	3.17	3.13	3.05	3.52	3.75	3.21	3.51	3.75	3.6	3.12	3.03	3.65	3.88	3.17	3.65	3.70	3.58	2.94 3.	71 3	1.10	3.58 3	3.83 3	.09 3	.59 3.	45 3.	02 3.5	3 3.9	3.93	3.83	3.83	3.85	3.87	2.96	3.76	3.63	3.63	3.71	2.08	3.10	3.34
H (field) 6.	5.5-8.0 (a)	8-8.4 (a)	7	7.1	7	7.2	7.50	7.50	7.80	7.40	7.50	7.3	7.5	7.4	7.20	7.6	7.4	7.4		7.1			7.1 7	.3 7	7.2	7	7.0	7.2 7	.6 7	.1 7	.3 7.4	1 7.3	7.2	7.3	7.2	7.1	7.4	7.9	7.4	7.4	7.3	7.6	7.4	7.4	7.4
emperature (T deg C)																		•																										_	
Electrical Conductivity (mS/cm) 0.1	125-2.2 (a)		0.74	0.74	0.754	0.48	0.56	0.70	0.47	0.46	0.39	<1 (0.633	0.631	0.51	0.704	0.760	0.787		0.946	0.932	0.812	0.598 0.9	62 0.	.843 0	0.822 0.	.701 0	.84 0.1	795 0.1	755 0.1	33 0.62	25 0.42	5 0.394	0.391	0.4	0.393	0.394	0.467	0.526	0.435	0.59	0.805	0.413	0.543	0.709
Salinity (ppt)					•		-	•		-	-				-																														
Dissolved Oxygen (mg/L) 8.1	.5-11.0 (a)	9.0-10.0 (a)	3	1.91	2.67	1.68	4.50	2.07	1.58	1.76	2.66	0.7	1.75	1.94	1.68	1.84	1.54	2.36	2.69	1.4	2	3.8	3.05 3.	21 1	.54	2.8 1	.38 2	.46 3.	.01 1.	86 2.	41 1.8	0 2.88	2.27	3.53	4.16			3.48	3.12	2.61	9	4.03	1.08	1.67	2.47
Dissolved Oxygen (%)			-	-	28.20	-	-		-	-	-	7			-	-		-		14.5																								_	
	6-50 (a)	0.5-10 (a)					-		•						-			•																									_	-	-
Redox Potential (mV)				-		-	-	-81.6	-		-	<0.1			-	-137		-		-114			-1	38			2	35.0			-13	4			77.1				-113				-132		
Comments			nc	nc	nc	nc					nc		nc	nc	nc	nc	nc	nc																											
Sodium					71		-	37			-	27			-	49				86				3				89			65	5			10				25			101	12	96.7	106
otassium					3		-	2			-	3			-	3				3				3				2			2				2				4				3		
Calcium					90		-	88			-	102				79				117			ę					73			50)			54	_			77				61		
Magnesium			-	-	6		-	53	•		-	9			-	8		•		12 205				3				11			7	_	_		5				6				5 25		
Chloride				-	127		-			-	-				-	92	-											26		54 2			-		27			-	61						
Ikalinity (as CaCO3)			329	2/4	215	1/1	125	259	193	235	165		295	270		227	216		292.00									253 2			01 201					139	145	78	182	207	182	213		180	162
Bicarbonate			329	2/4	215	1/1	125	259	193	235	157		295	270			216	194	292.00		245							253 2			01 201					139	145	78	182	207				180	162
Carbonate (as CaCO3) Sulphate (SO4)			<1	<1	<1	<1	<1	<1	<1	<1	8.00	<1	<1	<1	<1	<1	<1	<1	<1	<1 11.00	<1	<1		3	<1	<1		<1 · 13	1 ·	:1 🔹	1 <1	216	188	172	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
H (lab)					20			3	•			51				0			7.0	7.1	62	6.8		3				13		_		_	_	_	51	-	-		51				51		
otal Dissolved Solids (TDS)			384						322	340		100	100		298	363	494	443	387					35 4	188	476 4	146 4	140 4	64 4			5 292						244	337			551	276	328	470
dal Dissolved Solids (TDS) lardness (as CaCO3)			384	436	484	318	390	414	322	340	238	496	432	268	298	363	494	443	387	729	585	485	366 5	55 4	188	4/6 4	146 4	40 4	64 4	32 4	12 35	5 292	267	195	219	224	300	244	337	288	380	551	276	328	470
otal Suspended Solids (TSS)						•			•									•												_		-	-	-	-	-								\rightarrow	
	0.3 (1)				14.3			7.55	•			9.44			· ·	6.86				15.0								.32		_	5.0	2	-	-	2.12	-			3.93				3.58	\rightarrow	
	1.90		•		0.109			0.07	•			0.060				0.064				0.127								110		_	0.05		-	-	0.050				0 107				0.049	\rightarrow	
	0.7 (7)		0.1	0.02	0.105	0.21	0.07	0.07	<0.01	<0.01	0.02	0.009	0.73	5 50	0.6		0.02	0.21	<0.01	< 0.01	<0.01	0.06	0.01 0.	02 0	02	0.02 0		.08 0.	00 0	05 0.	0.02		1.1	0.9		0.09	< 0.01	0.01	<0.01	< 0.01	<0.01		<0.01	<0.01	0.01
litrite (NO2 as N)	0.7 (7)		<0.01	<0.02	<0.04	<0.01	<0.07		<0.01				0.04		0.02		<0.02	<0.21				< 0.00				0.02 0					.01 <0.0					<0.03				<0.01			<0.01		
	1.88 (2)	2.84 (2)	0.62		0.66	0.26	-0.01	0.42		0.23	0.04		0.44		0.93		0.25		0.13			0.18				20.9 4		1.56 1.					0.27			0.64		0.34	0.38		0.42		0.22		
		0.12 (6)			1.7	0.20	0.50				0.04				1.5		0.25						0.5 0.					2.9 3			2 1.3		0.05			0.04		0.34					0.22		
Dissolved Organic Carbon	0.0 (0)	0.12 (0)			11	0.0	0.00	10	0.00	0.00	0.4	6				12	v./		0.0	18	0.1	v./		2				11			2 1.3		. 0.05	5.05	7	3.23	2.76	0.0	9.00	0.0			11.00	0.0	0.0
luoride (Electrode)			-	-	<0.1			0.1				0.1				0.1			-	<0.1				10	-			0.2		-	0.2		-1	+	0.2		2.70		0.2				0.2	+	
	0.05(7)	0.025 (7)	0.14	0.22		0.18	0.21		0.16	0.14	0.22		0.42	0.13			0.33	0.27	0.14		0.21	0.16			183	271 0		.90 0.	52 0	69 0			0.34	0.21			0.19	0.22		0.17	0.03	0.11	0.12	0.1	0.09
lote:	0.00 (7)	0.010(1)	0.14	0.22	0.31	0.10	0.21	0.02	0.10	0.14	5.22	0.13	0.42	0.73	0.70	0.10	0.00	0.27	0.14	0.20	0.21	0.10	v., 2.	00 0							0.2	0.2	0.34	3.21	1 3.10	1 3.20	0.10	0.22	0.10	v.1/	0.00	0.11	0.12		0.00

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 Nume
 Constant
 Integre value is an indicative inferior working level only (IMA).

 maniative harder cocyclements
 36
 1. Trigger value is an indicative inferior working level only (IMA).

 Pocus of this meaturing report
 2. America indication inferior working level only (IMA).
 2. America indication inferior working level only (IMA).

 r = no comment
 NA = not available
 3. Trigger value for rolated of Norgen (NG) for animal rives in NSW.

 1. Trigger value for rolated informacy (NG) for animal cocyclements in NSW.
 5. Trigger value for rolated nitrives in NSW.

Trigger value for total Nitrogen in marine ecosystems in NSN 7. Trigger value for a 95% proetcion level.
 Guidelinefor water quality and asethetics: primary contact.
 Reference only, not dirtectly applicable to groundwater.

Sample ID	ANZECC,	2000	MW4	MW 4	MW 4	MW4	MW4	MW 4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4 N	1W4 N	MW4 M	W4 M\	V4 MW	4 MW	MW4	4 MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4	MW4
Field Measurements	Fresh	Marine	21/5/10	17/8/10	30/11/10	23/2/11	24/5/11	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	6/5/14	1/8/14	17/11/14 2	26/2/15 2	7/5/15 24	4/8/15 4	11/15 16	2/16 31/	16 12/8/	16 10/11/1	6 20/2/1	7 18/5/17	17/8/17	30/11/17	8/2/18	24/5/18	22/8/18	16/11/18	12/2/19	28/5/19	28/8/19	22/11/19	14/2/20	28/5/20	13/8/20	6/11/2	1/2/21
Ground Level (m AHD)				4.79		4 79		4 79					4.79				4 79				4.79							9 4.79									4.79		4.79		4.79	4.79			4.79
Depth to Groundwater (m AHD)			0.88	1.08	1.69	0.00	1 31	1.41	0.00	0.76	1.23	0.00	1.04	1.04	11	1.43	0.58	0.37	1.04	0.54	0.56	0.69	1.54	1.54	1.34 0	.84 0.	1.3	8 0.66	0.79	2.15	0.69	0.61	0.62	0.42	0.44	0.38	0.41	0.4	0.51	0.46	0.64	0.56	2.12	1 34	0.84
			0.00	1.00	1.00	0.00	1.01	1.41	0.96	0.70	1.10	0.00	4.2				4.66	0.01	4.2				-		3.9 4						4.55	4.63	4.62		4.80	4.86	4.83	4.84	4.73		4.6		-	-	-
Groundwater depth (m bTOC)			4.36	4.16	3.55	4.25	3.93	3.83	4.26	4.48	4.01	4.25		4.2	4.14	3.81		4.87																						_		4.68	3.12	3.9	4.4
Height of Stick up (m)			0.45	0.45	0.45	0.45	0.45		0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45							.45 0.					0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45		0.45	0.45	0.45	0.45	
Groundwater Depth (mbgl)			3.91	3.71	3.1	3.80	3.48	3.38	3.81	4.03	3.56	3.80	3.75		3.69	3.36	4.21	4.42	3.75	4.25	4.23				3.45 3					2.64		4.18	4.17				4.38		4.28	4.33	4.15	4.23	2.67		3.95
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.9	6.8	6.4	6.4	6.80	6.80	6.90	6.90	6.80	7	6.8	7	6.30	7	7.1	7		7.1			6.6	7	6.4 6	6.1 6	6 6.3	7.1	6.6	6.8	6.8	7	6.3	7	6.6	6.6	7.0	7.2	6.9	7	6.8	7	7	7.2	7.2
Temperature (T deg C)			-	-	-	-	-	-	-	-	-				-	-	-	-																											
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.75	0.81	0.468	0.47	0.73	0.68	0.72	0.70	0.58	<1	0.7	0.829	0.44	0.47	0.632	0.683		0.472		(0.555 0	.555 0	.418 0.	207 0.6	85 0.39	2 0.56	0.58	0.523	0.675	0.738	0.774	0.834	0.838	0.803	0.825	0.81	0.842	0.821	0.785	0.837	0.807	0.483	0.461
Salinity (ppt)			-	-	-	-	-	-	-	-	-				-	-	-	-																											1
Dissolved Oxygen (mg/L)	8.5-11.0 (a) 9	.0-10.0 (a)	2.55	2.32	1.46	2.21	1.78	3.09	2.64	2.34	3.22	1.1	2.48	1.7	2.26	2.49	2.32	1.97	4.10	2.70	2.10	3.60	3.57 3	3.39	3.03 2	2.4 2.	12 2.2	3 3.68	1.34	3.45	3.20	3.72	2.79	5.1	3.48			3.44	4	3.9	2.94	5.1	4.8	4.9	4.19
Dissolved Oxygen (%)			-	-	15.90	-	-	-	-	-	-	10.8			-	-	-	-																											
Turbidity (NTU)	6-50 (a) ().5-10 (a)	-	-				-	-	-	-							-																											
Redox Potential (mV)			-	-		-		-41.5	-	-	-	<0.1			-	-34		-		-128				76											2.1				94				22.9		
Comments			nc	nc	nc	nc	-	-	-	-	nc					-	-	-																											
Sodium			-	-	14.00	-	-	12	-	-	-	13				13	-	-		10				14			13				13				14				19			98.1	25	93	693
Potassium			-	-	1.00	-	-	2	-	-	-	4				4	-	-		3				2			4				5				4				5				5		
Calcium			-	-	91.00	-	-	109	-	-	-	117			-	68	-	-		88				90			59				105				131				130			_	117		
Magnesium			-	-	7.00	-	-	7	-	-	-	6			-	6	-	-		5				6			5				7				9				10			_	11		
Chloride			-		23.00	-	-	25	-	-	-	14			-	13	-	-		11				18			24				14				20				45			_	59		
Alkalinity (as CaCO3)			274	303	234	151	248	282	251	296	293	323	315	227	137	215	276	284	250	220	258			230		37 3			237	224	310	<1	<1	<1	366	330	306	<1	290		332	371	288		198
Bicarbonate			274	303	234	151	248	282	251	296	293	323	315	227	137	215	276	284	250	220	258		215	230		37 3	101		237	224	310	380	399	432	366	330	306	<1	290		332	371	288	240	
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1 <			<1	<1	<1	380	399	432	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1
Sulphate (SO4)			-	-	11.00	-	-	10.00	-	-	-	<1			-	10	-	-		7.00				9			19				8	_	_		7				25				24		
pH (lab)			-	-					-	-	-								6.8			6.3					6.3				6.8									-	+	-		+	
Total Dissolved Solids (TDS)			354	352	330	252	318	400	388	382	342	376	406	278	262	248	314	351	304	326	376	311	295	330	258 2	26 4	6 20	3 342	317	308	364	422	442	416	478	484	501	394	488	436	524	468	420	298	272
Hardness (as CaCO3) Total Suspended Solids (TSS)			-	-	-	-	-	-	-	-	-				-	-	-	-														_	_												+
	0.0 (4)		-	-	21.40	•	•	17.10		-	-	7.98				- 1.61	•	-		10.30				0.05							0.97	_	_		11.8				10.40				0.70		<u> </u>
Iron (filtered)	0.3 (1)		-	-		-	-		-	-	-	7.98			-		-	-		0.424				0.05			<0.0				0.97		_												<u> </u>
Manganese	1.90		- 0.26	-	0.38	-	-	0.35	-	0.04	-	0.299	0.05	0.45	-	0.272	-	- 0.02	0.28	0.03		0.19	0.16 0		0.01 0		0.01	3	0.00		0.252	0.04	0.04	<0.01	0.241	0.04		0.01	0.283		0.15	0.00	0.074		0.03
Nitrate (NO3 as N) Nitrite (NO2 as N)	0.7 (7)		<0.01	10.03	<0.05	0.31	<0.01	<0.04	<0.01	<0.04	<0.07	<0.19	<0.05	<0.15	0.88	<0.09	<0.03	<0.02	<0.28							02 0.	01 <0.0	0.03	0.02	1 <0.01	<0.12	<0.01		<0.01	<0.02	<0.01		<0.01	<0.01		<0.01				<0.03
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.38	NU.U1	0.01	0.07	4.46	0.01	NU.01	0.00	0.40	NU.01	NU.01	<0.01	4.00	<0.01	<0.01 0.07	NU.01	0.00	0.09	0.01	0.00	0.76	0.01 4	0.01 10	40 0	1 0.0	0.44	0.06	0.40	NU.01	NU.01	×0.01	NU.U1	NU.01	0.05	0.06	0.05	0.02		0.08	0.02	0.41		0.14
Ammonia (NH3 as N) Total Kieldhal Nitrogen (TKN)				1.5	1.5	0.91	1.10	0.58	2.60	1.68	0.18	12	0.15	0.44	1.86	<0.01	17	0.22	0.28		0.35	0.09	2.1	0.3	0.7 0	.12 0.	7 0.8	5 0.11 1.6	1.0	1.2	0.13	0.15	0.10	0.06	0.08	<0.1	0.06			0.1		0.11			
Dissolved Organic Carbon	0.5 (5)	v. 12 (0)	1.3	1.5	1.5	3.1	2.00	1.70	2.00	1.00	0.90	7	1.4	U.0	15.30	12	1.7	0.7	1.0	9	J.0	0.3		3	0.7 0	2	7 0.8	1.6	1.0	1.2	9.0	0.0	0.0	0.0				1.4	4.00		0.0	0.9	1.8		1.0
Fluoride (Electrode)					0.20	•	-	9		-	-	0.2			-	0.2	-	-		9				120			4	1	-	-	0.2	+			0.2	3.55	3.74		4.00		+	+	0.2	+	+
Total Phosphorus (TP)	0.05(7)	0.025 (7)	4.24	2.93	1.97	1 56	1.24		7.09	1 72	1 21		3.99	0.0	2.4	0.2	2 17	16	146	1.81	1 56	1.3			1.97 1	.08 2	12 1.7		1.82	0.94	1.17	1.6	1 20	1.07	0.96	0.68	0.90	1.44	0.2		0.01	0.91		0.09	1.07
Note:	0.05(7)	0.020(7)	4.24	2.03	1.07	1.30	1.24	3.40	1.30	1.72	1.31	4.43	3.89	0.9	4.4	v.00	4.17	1.0	1.40	1.01	1.00	1.9	1.44	0.00	1.01	.00 2.	14 1./	4 2.43	1.04	0.94	1.17	1.0	1.29	1.07	0.30	v.00	0.90	1.44	0.91	1.00	0.91	0.91	0.19	0.90	1.07

Exceeds ANZECC (2000) guidelines 35 marine/fresh water ecosystems Focus of this monitoring report nc = no comment NA = not available

Trigger value is an indicative interim working level only (IML).
 Armonia trigger at pl = 4.0, for a 95% protection, corrected for average pl = 7.3.
 Trigger value for toxide Nitrogen 4.0% pl = 0.0% protection level.
 Could be added to a set of the s

Sample ID	ANZECO	C, 2000	MW5	MW 5	MW :	5 MWS	5 MW	V5 MW	5 MWS	5 MW	5 MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5	MW5 M	W5 N	/W5 M	W5 N	IW5 M	N5 M	W5 M	W5 M	W5 M	W5 M	W5 MV	V5 MV	N5 M1	V5 M	W5 M	W5	MW5	MW5	MW5	MW5	5 MWE	5 MWS	5 M	N5 MV
ield Measurements	Fresh	Marine	21/5/10	17/8/10	30/11/1	0 23/2/1	1 24/5	/11 24/8/	11 3/11/1	1 1/2/1	2 31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	7/2/14	6/5/14	1/8/14	17/11/14	26/2/15	7/5/15 24	8/15 4	11/15 16	2/16 31	/5/16 12/	8/16 10/1	1/16 20/	2/17 18/	5/17 17/	8/17 30/	11/17 8/2/	18 24/	/18 22/	16/1	1/18 12	/2/19	28/5/19	28/8/19	22/11/19	14/2/20	0 28/5/2	0 13/8/2	20 6/1	/20 1/2
Ground Level (m AHD)			4.55	4 66	4 66	4 66	4.5	E 4 E		4 55	4 66	4 66	4 55	4.55	4.55	4 55	4.55	4.66	4.55		4.55	4 55	4.55			4.55 4		155 4		55 4.	66 A		.55 4	.55 4.5						4.55	4.55	4.55	4.55				55 4.5
Depth to Groundwater (m AHD)			0.6	4.55	4.00	4.55	1.0	10 4.5	4.33	0.5	0.96	0.85	0.73	0.95	1.24	1.27	0.76	0.56	0.56		0.75	0.77	0.86								.09 1.			.61 0.6						0.67	0.8	0.73	0.89				29 0.4
				0.61	1.32				0.72									0.56			0.75									-			-														
Groundwater depth (m bTOC)			4.15	3.94	3.43	3.75	3.7	2 3.6	4 4.03	4.25	3.79	3.9	4.02	3.8	3.51	3.48	3.99	4.19	4.19	3.52	4	3.98	3.89	3.26 4	.88	3.46 3	3.9 4	.02 3	40 3.	81 3.	.66 3.	.34 3.	.81 4	.14 4.1	14 4.1	06 4.	04 4.	78 4	4.08	4.08	3.95	4.02	3.86	3.9	2.28	3 3.	46 4.
leight of Stick up (m)			0.2	0.2	0.2	0.2	0.2	2 0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2 0	1.2	0.2 0	0.2	0.2 0	2 0	.2 0	.2 0	0.2 0	.2 0	0.2 0.	2 0.	2 0	2 0	.2 0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	: 0	.2 0.
Groundwater Depth (mbgl)			3.95	3.74	3.23	3.55	3.5	52 3.4	1 3.83	4.05	3.59	3.7	3.82	3.6	3.31	3.28	3.79	3.99	3.99	3.32	3.8	3.78	3.69	3.06 4	68 3	3.26 3	3.7 3	3.82 3	2 3.	61 3.	46 3.	.14 3.	.61 3	.94 3.9	34 3.4	86 3.	84 4.	58 3	3.88	3.88	3.75	3.82	3.66	3.7	2.08	3 3	26 4.
oH (field)	6.5-8.0 (a)	8-84 (a)	7.8	77	72	7.6	8	8	8	7.0	8.1	77	77	7	7	77	7	73			6.9			75 8	00 1	7 80 7	00	71 7	3 7	7 6	9 7	8 7	9 7	80 7	7 7	80 7	6 7	6 7	78	8 10	7 70	7 80	7 70	7.80	7 60	0 8	00 80
emperature (T deg C)	0.0-0.0 (a)	0.0.4 (a)	-			-	-	-		-	-		1.1					-			0.0			1.0 0	.00	1.00 1	.00					.0 1	.0 1	.00 7.				-	1.0	0.10	1.10	1.00	- 1.10	- 1.00	1.00	- 0.	
ectrical Conductivity (mS/cm)	0.125-2.2 (a)		0.52	0.51	0.414	0.31	0.4	4 0.3	1 0.38	0.34	5 0.36	<1	0.477	0.297	0.13	0.427	0.395	0.425			0.126			0.361 0.	331 (041 0	123 (0 43 0	35 0 3	264 0.2	236 0 3	276 0.3	328 0	292 0.3	31 0.3	92 0.4	01 03	371 0	37	0.538	0.44	0.39	0.48	0.429	9 0.655	5 0	02 0.2
Salinity (ppt)	2.122 2.2 (2)		-	-	-	-	-	-		-	-				-	-	-	-																													
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.81	3.08	2.14	2.22	4.1	15 2.8	3 2.15	2.32	2.41	0.9	1.77	1.8	1.52	1.62	2.13	2.09	2.09	2.74	3.2	3.1	2.4				1	.39 1	42 3.	49 1.	63 2	.87 2.	.57 3	.64 2.5	50 3.	1 3.	30			4.49	3	3.72	2.84	4.29	1.52	2 1	86 2.8
Dissolved Oxygen (%)			-		22.60	- 1	-	-	-	-	-	9.3			-	-	-	-			32.7																						-	-	-		-
urbidity (NTU)	6-50 (a)	0.5-10 (a)	-		-	-	-	-	-	-	-				-	-	-	-																													
tedox Potential (mV)			-		-	-	-	-25	-	-	-	< 0.1			-	-147	-	-			75.5				56			-1	44			-2	0.6			14	19				-62.8				-71.2	2	
Comments			nc	nc	nc	nc	-		-	-	nc				nc	nc	nc	nc																					_				-				
odium			-	-	16	-	-	7	-	-	-	9			-	15	-	-			9				12											1	3		_		18		-		31		
otassium			-	-	6	-	-	4	-	-	-	5			-	5	-	-			10				2											1	2				2				3		
alcium					53		-	44	-		-	60				54					16				14											5	3				55				82		
/lagnesium			-		10	-	-	6	-	-	-	8			-	7					3				5												5				5				8		
Chloride			-		30		-	13	-	-	-	15			-	34					26				18											2	0				44				86		
Ikalinity (as CaCO3)			142	144	142	120	17	7 128	3 147	144	126	179	198	112	172	170	158	155	155	158	41	118	113	102 1	18	147	72 .	186 1	56 9	96 11	09 9	99 13	27 .	<1 <	1 <	1 1	56 1	32 1	141	132	134	154	226	173	155	1 ذ	19 11
Bicarbonate			142	144	142	120	17	7 128	3 147	144	121	179	198	112	172	170	158	155	155	158	41	118	113	102 1	18	147	72 .	186 1	56 9	96 11	09 9	99 13	27 1	33 13	15 18	30 13	56 13	32 1	141	132	134	154	226	173	155	1 ذ	19 11
Carbonate (as CaCO3)			<1	<1	<1	<1	<1			<1	5	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1			:1 <	<1 ·			33 13	15 18	30 <	1 <	<1 ·	<1	<1	<1	<1	<1	<1	<1	*	1 <
Sulphate (SO4)			-		14		-	4.0) -	-	-	7			-	4					<10				5			~	10				6				7				8				32		
H (lab)			-	-	-	-	-	-	-	-	-				-	-	-	-		7.20	6.90	6.70	6.40					7	.3			7	.9														
otal Dissolved Solids (TDS)			311	238	258	268	25	2 197	258	204	170	264	326	166	240	224	219	264	264	216	164	234	138	225 1	99	254 1	62 3	270 1	90 1	36 11	97 1	68 1	74 1	80 24	1 22	20 2	12 2	27 2	250	282	240	236	304	240	464	1 2	50 19
lardness (as CaCO3)			-		-	-	-	-	-	-	-				-	-																															
otal Suspended Solids (TSS)			-		-		-	-	-	-	-				-	-																															
on (filtered)	0.3 (1)		-		< 0.05	-	-	< 0.0	5 -	-	-	< 0.05			-	3.22	-				0.25				0.05			0					.07			0.	05				0.09				0.26		
langanese	1.90		-		0.002		-	0.00	1 -	-	-	0.001			-	0.041	-				0.03				.001			0.				0.0	004			0.0	02				0.01				0.00	5	
itrate (NO3 as N)	0.7 (7)		5.15	10.4	4.44	0.96	0.4	4 0.14	4 0.02	1.08	1	1.44	0.03	1.81	< 0.01	0.06	0.14	0.61	0.61	< 0.01	0.63	0.61	< 0.01	0.11 1	.4	0.07 0	.02 1	.40 <0	.01 0.	10 <0	.01 0.	.09 <0	.01 0	.06 <0.	01 <0.	01 0.	02 <0	.01 0	J.02	< 0.01	< 0.01	0.02	< 0.01	1 0.01	< 0.01	J1 <0	.01 0.0
itrite (NO2 as N)			0.22	0.21	0.14	0.15	<0.0	01 0.02	2 <0.01	0.12	0.18	0.1	0.08	0.03	0.01	0.01	< 0.01	0.11	0.11	< 0.01	0.03	0.09	<0.01	<0.01 0	.05 1	0.06 <1	0.01 0	0.01 <0	.01 0.	01 <0	1.01 <0	0> 01.01	.01 <0	0.01 <0.	01 <0.	.01 <0	.01 <0	.01 <0	0.01	< 0.01	< 0.01	< 0.01	< 0.01	1 <0.01	1 < 0.01	1 <0	.01 <0.
mmonia (NH3 as N)	1.88 (2)	2.84 (2)	0.08	< 0.01	0.04	0.03	0.0	0.03	3 0.08	0.02	2 0.03	0.05	0.23	0.55	0.45	0.06	5.88	0.64	0.64	4.47	1.28	1.4	14.5	0.03 1	.77 (0.03 <	D.01 6	6.93 2	34 0.	17 0.	.15 0.	.04 0.	.03 0	.12 0.1	14 0.0	0. 80	02 0.	.08 0	J.06	0.03	0.08	0.05	0.04	0.07	< 0.01	1 <0	.01 <0.
otal Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	1.7	2.6	2.7	0.6	0.8	30 0.3	0.70	1.30	1	1.4	2	2.6	17	1.1	9	2.2	2.2	6.3	2.5	3.2	18.9	0.6 2	.0 1	0.40	1.0 1	2.8 3	.0 2	.8 18	B.O 1	.9 1	.0 2	2.3 0.	8 0.	5 0	.2 <(0.1 1	1.2	0.6	0.5	0.6	0.40	0.50	0.20	0 0	20 0.3
issolved Organic Carbon			-	-	6	-	-	5	-		-	6			-	12	-	-			12			4	.00				3			1	8				1 3.	74 3	3.59		3.00	1	1	1	7.00	5	_
uoride (Electrode)			-		0.1	-	-	0.20) -	-	-	0.2			-	0.1	-	-			< 0.1			0	.20			0	.1			0	.2			0	.2				0.2	1	1	-	0.10	5	
otal Phosphorus (TP)	0.05(7)	0.025(7)	0.09	0.11	< 0.01	0.12	0.1	1 0.1	3 0.1	0.08	0.03	0.13	0.22	0.74	1.23	0.33	1.83	1.07	1.07	1.03	0.39	0.48	2.08	0.09 1	39	0.02 0	26 2	24 0	31 0.	35 1.	59 0	16 0	10 0	.27 0.1	13 0.0	09 0.	05 0.	09 0	J.25	0.26	0.13	0.1	0.12	0.11	0.04	4 0	05 0.0

 Note:
 Trigger value is an indicative interim working level only (IML)

 marineffreth water ecosystems
 1. Trigger value is an indicative interim working level only (IML)

 Poccar of this monitoring report nc = no comment
 NA = not available

 N. Trigger value for codes of Nitroger (NOc) for broad rotem in NSW.

 S. Trigger value for codes of Nitroger (NOc) for marine ecosystems in NSW

 S. Trigger value for codes of Nitroger (NOc) for marine ecosystems in NSW

6. Trigger value for total Nitrogen in marine ecosystems in NSW 7. Trigger value for a 95% proetcion level 8. Guidelinedre water quality and aesthetics: primary contact a. Reference only, not dirtectly applicable to groundwater

Gerroa Waste Dispo	sal Depot (2010	to 20	21)	

Sample ID	ANZEC	C, 2000	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s	MW6s
Field Measurements	Fresh	Marine	21/5/10	17/8/10	30/11/10	23/2/11	24/5/11	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	7/2/14	6/5/14	1/8/14	27/5/15	18/5/17	2018-19	28/5/20	13/8/20	6/11/20	1/2/21
Ground Level (m AHD)			NA												-	-	-	-				NA	Note #	dry				1
Depth to Groundwater (m AHD)			NA												-	-	-	-				NA						
Groundwater depth (m bTOC)			4.69	4.57	4.45	4.48	4.43	4.39	4.71	4.88	4.5	4.7	4.66	4.43	4.35	4.4	4.77	4.94	4.94	4.37	4.77	4.2	4.33			4.77		
Height of Stick up (m)			0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6			0.6		
Groundwater Depth (mbgl)			4.09	3.97	3.85	3.88	3.83	3.79	4.11	4.28	3.9	4.1	4.06	3.83	3.75	3.8	4.17	4.34	4.34	3.77	4.17	3.6	3.73			3.17		
pH (field)	6.5-8.0 (a)	8-8.4 (a)	7.5	7.3	6.8	6.9	7.2	7	7.6	7.3	7.5	7.4	7.6	6.9	6.9	7.1	7.4	7.2			7.3	6.2	6.6			6.7		
Temperature (T deg C)	0.0 0.0 (u)	0 0.1 (u)	-	-	-	-	-	-	-	-	-	7.1	7.0	0.0	-	-	-	-			7.0	0.2	0.0			0.7		
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.52	0.65	0.502	0.37	0.569	0.511	0.504	0.504	0.475	<1	0.396	1.06	0.432	0.474	0.679	0.662			0.659	573	644			881		
Salinity (ppt)	0.120 E.E (u)		-	-	-	-	-	-	-	-	-		0.000	1.00	-	-	-	-			0.000	010	011			001		
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	1.74	2.56	2.63	2.19	2.18	2.94	1.9	1.82	2.29	1.2	2.4	2.58	1.46	1.9	2.13	2.33	2.33	1.85	2	3.48	3.21			3.51		
Dissolved Oxygen (%)			-	-	27.70	-	-	-	-	-	-	11.8			-	-	-	-			20.9							1
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-	-	-	-	-	-	-	-				-	-	-	-										
Redox Potential (mV)			-	-		-	-	-33.80	-	-	-	< 0.1			-	-57	-	-			65					-79.9		
Comments			nc	nc	nc	nc		-	-		nc	nc	nc	nc		-		-										
Sodium			-	-	8	-	-	44	-	-	-	14			-	30	-	-			24					102		-
Potassium				-	6	-	-	8	-	-	-	8				6	-	-			6					2		
Calcium			-	-	80	-	-	41	-	-	-	75			-	75	-	-			124					24		1
Magnesium				-	9	-	-	7	-	-	-	6				7	-	-			10					23		
Chloride			-	-	14	-	-	42	-	-	-	21			-	34	-	-			30					214		
Alkalinity (as CaCO3)			182	263	208	176	130	133	196	226	227	202	237	315	62	217	273	248	<1	182	262	40	80			90		
Bicarbonate			182	263	208	176	130	133	196	226	206	202	237	315	62	217	273	248	248	182	262	40	80			90		
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	21	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1		
Sulphate (SO4)			-	-	26	-	-	40.00	-	-	-	18			-	34	-	-			60					26		
pH (lab)			-	-	-	-	-	-	-	-	-				-	-	-	-		7	7							
Total Dissolved Solids (TDS)			314	350	308	332	280	334	328	342	286	314	372	616	286	309	364	356	356	280	504	320	343			543		
Hardness (as CaCO3)				-	-	-	-	-	-	-	-					-	-	-										
Total Suspended Solids (TSS)			-	-	-	-	-	-	-	-	-				-	-	-	-										
Iron (filtered)	0.3 (1)		-	-	5.59	-	-	3.13	-	-	-	< 0.05			-	1.17	-	-			< 0.05					0.61		
Manganese	1.90		-	-	0.116	-	-	0.06	-	-	-	0.025			-	0.019	-	-			0.03					0.005		1
Nitrate (NO3 as N)	0.7 (7)		0.37	1.71	0.01	1.16	7.48	0.04	< 0.01	0.8	0.01	0.76	3.54	0.11	< 0.01	1.05	0.62	0.05	0.05	0.06	8.3	< 0.01	0.02			0.1		
Nitrite (NO2 as N)			0.01	0.02	< 0.01	< 0.01	0.03	< 0.01	< 0.01	0.31	0.01	0.08	0.32	< 0.01	< 0.01	0.92	0.1	0.04	0.04	< 0.01	0.75	< 0.01	< 0.01			0.03		
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.83	1.8	1.73	0.48	0.23	0.19	0.4	0.25	0.12	0.08	0.2	0.91	0.04	0.29	0.04	0.04	0.04	0.03	0.02	0.09	0.06			0.03		
Total Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	1.5	2.6	2.5	1	2.40	0.60	0.80	2.00	0.9	3.1	1	4.2	1.9	1.1	1	0.6	0.6	1.5	2.0	2.9	4.2			1.1		
Dissolved Organic Carbon	l í	. /	-	-	8	-	-	7	-	-	-	4			-	9	-	-		1	10			1		14	1	1
Fluoride (Electrode)			-	-	0.3	-	-	0.60	-	-	-	0.6			-	0.4	-	-			0					0		
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	0.33	1.04	0.79	0.42	0.68	0.53	3.10	8.81	0.54	0.63	0.4	0.4	0.44	0.12	0.2	0.8	0.8	0.2	0.2	0.4	0.42	1		0.1		

Note:





Note #: Well is seldom sampled due to being dry at time of sampling 1. Trigger value is an indicative interim working level only (IIWL). 2. Ammonia tingger at pH = 8.0, for a 95% protection, corrected for average pH = 7.3. 3. Trigger value for oxides of Nitrogen (NOX) for lowland rivers in NSW. 4. Trigger value for oxides of Nitrogen (NOX) for marine ecosystems in NSW. 5. Trigger value for total Nitrogen in lowland rivers in NSW.

6. Trigger value for total Nitrogen in marine ecosystems in NSW. 7. Trigger value for a 95% protection level. 8. Guidelinefor water quality and aesthetics: primary contact. a. Reference only, not diritectly applicable to groundwater.

Note: Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems Focus of this monitoring report nc = no comment NA = 1 NA = not available

Sample ID	ANZEC	C, 2000	MW6D	MW 6D	MW 6D	MW6D	MW6D	MW 6D	MW6D			MW6D					MW6D			MW6D				MW6D				W6D MW6			MW6D					MW6D			MW6D N					MW6D N		
Field Measurements	Fresh	Marine	21/5/10	17/8/10	30/11/10	23/2/11	24/5/11	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12	21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	7/2/14	6/5/14	1/8/14	17/11/14	26/2/15	27/5/15	24/8/15	4/11/15	16/2/16 31	/5/16 12/8/	16 10/11/1	8 20/2/17	18/5/17	17/8/17	30/11/17	8/2/18	24/5/18	22/8/18	16/11/18	12/2/19	28/5/19 2	28/8/19 2	22/11/19	14/2/20	28/5/20	13/8/20 (8/11/20	1/2/21
Ground Level (m AHD)			NA												-	-	-	-																												
Depth to Groundwater (m AHD)															-			-																												
Groundwater depth (m bTOC)			4.95	4.82	4.19	4.73	4.7	4.65	4.97	5.12	4.77	4.94	4.91	4.69	4.62	4.65	5.04	5.2	5.2	4.64	5.03	5.01	4.94	4.47	4.63	4.71	5 5	5.06 4.64	4.86	4.83	4.56	4.92	5.24	5.20	5.08	5.08	5.08	5.08	5.11	5.3	5.08	4.9	4.9	4.9	4.9	4.9
Height of Stick up (m)			0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7 0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Groundwater Depth (mbgl)			4.25	4.12	3.49	4.03	4	3.95	4.27	4.42	4.07	4.24	4.21	3.99	3.92	3.95	4.34	4.5	4.5	3.94	4.33	4.31	4.24	3.77	3.93	4.01	4.3	4.36 3.94	4.16	4.13	3.86	4.22	4.54	4.5	4.38	4.38	4.38	4.38	4.41	4.6	4.38	4.2	4.91	3.43	4.68	4.53
	6.5-8.0 (a)	8-8.4 (a)	7	7	6.6	6.8	7.1	7.2	7.1	6.9	7	7.1	7.2	7.2	7.2	7.2	7.1	7.5			7.1			7	7.2	7	6.8	6.9 7.1	7.3	6.8	7.0	6.9	7.1	6.2	7.1	7.0	7.1		7.4	7	7	6.9	7.1	7	7.1	7
Temperature (T deg C)																																														
	0.125-2.2 (a)		1.07	1.02	0.868	0.95	0.996	0.943	1.06	0.994	0.875	<1	0.798	0.86	0.867	0.896	0.851	0.476			0.599			0.821	0.801	0.953	0.732 0	.788 0.72	3 0.84	0.841	0.94	1.36	0.863	0.904	0.952	0.927	1.32	1.01	1.13	1.88	1.89	2.01	1.78	1.95	1.72	1.75
Salinity (ppt)	0.5.44.0.(-)	9.0-10.0 (a)	2.61						2.12	1.55		1	4.04	0.07			- 1.88		0.75	4.05			4.0	0.00	0.54	1.17		1.52 2.0		4.00	0.00	0.40	1.05	0.07	0.00	4.50			0.45		4.07	0.04		1.42	4.00	4.000
Dissolved Oxygen (mg/L)	6.5+11.0 (a)	9.0+10.0 (a)	2.01	2.3/	14.10	1.45	2.21	2./1	2.12	1.00	1.45	10.6	1.01	2.07	1.77	1.00	1.00	1.94	2.75	1.00	11.70	3.1	1.9	2.30	2.51	1.47	2.0	1.52 2.0	4.09	1.62	2.96	2.12	4.05	2.67	3.09	4.50			3.15		1.27	0.94	1.74	1.42	1.39	1.02
Dissolved Oxygen (mg/L) Dissolved Oxygen (%) Turbidity (NTU)	6-50 (9)	0.5-10 (a)			14.10							10.0							-		11.70								-	-	-															
Redox Potential (mV)	0.00 (0)	0.0-10 (u)						30.90				<0.1				13					43.00				30.00											126			-	-132.00				-138.00		
Comments			nc	nc	nc	nc					ne	nc	ne	ne	nc	nc	nc	nc																												
Sodium					18			20			-	15	ne	110	-	16	-	-			10				13			11				53				18				91			100	100	93	
Potassium					19			11				10				15					6				6			4				24				4				53				56		
Calcium				-	120			142				120				141					122				139			130				140				136				148				162		-
Magnesium					14			16				11				10					8				11			10				16				10				24				25		
Chloride					24			31				21				14					12				17			19				73				27				156				150		
Alkalinity (as CaCO3)			544	409	441	408	396	399	375	410	388		342	348	386	375	358	208	325	346	248	271	331	292	305	347	318	347 368		352	366		<1	<1	<1	346	528	384			769	841	799		761	717
Bicarbonate			544	409	441	408	396	399	375	410	388	332	342	348	386	375	358	208	325		248	271	331	292	305	347	318	347 344	334	352			340	388	400	346	528	384				841	799	859	761	717
Carbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1 24		<1			340	388	400	<1	<1	<1		<1	<1	<1	<1	<1	<1	-
Sulphate (SO4)					8			27.00			-	33	-1	- 1		107					71	-1		- 1	69	-1		38				29	040	000	400	76				23		- 1		9		
pH (lab)																				7	7	7	7					71				6.9														
Total Dissolved Solids (TDS)			473	504	496	542	534	586	694	636	460	484	508	436	454	496	475	280	438	418	514	497	514	468	522	574	486	496 468	466	493	514	554	522	577	526	486	748	562	580	930	934	764	974	986	890	827
Hardness (as CaCO3)																																														
Total Suspended Solids (TSS)																																														
Iron (filtered)	0.3(1)				9.48			< 0.05				< 0.05				0.07					< 0.05							<0.0	5			0.64				0.51				10.2				12.8		
Manganese	1.90				0.184			0.12				0.122				0.161					0							0.05	0			0.143				0.118	1			0				0		
Nitrate (NO3 as N)	0.7(7)		1.99	9.29	0.14	0.17	0.61	5.61	2.93	0.02	0.03	1.29	3.14	0.48	0.41	0.96	0.02	0.02	0.05	0.16	2.92	1.79	0.06	1.13	0.33	< 0.01	0.26	0.08 3.0	0.04	0.06	0.04	0.24	< 0.01	0.03	0.16	0.48	< 0.01	0.02	<0.01	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02
Nitrite (NO2 as N)	/		<0.01	0.09	<0.01	<0.01	0.02	0.04	0.32	<0.01	<0.01	0.08	0.17	0.21	0.03	0.06	0.04	<0.01	<0.01	0.01	0.08	0.12	0.03	0.06	0.01	< 0.01	<0.01 <	0.01 0.01	0.06	< 0.01	< 0.01	0.01	0.02	< 0.01	0.02	0.10	<0.01	<0.01	<0.01	<0.01	< 0.01	<0.01	<0.01	< 0.01	< 0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2 84 (2)	16.4	10.6	21.8	8.9	13.80	3.24	2.25	10.80	7.62	7.06	7.17	12.8	14.60	11.30	10.40	1.97	9.08		1.79	2.23		3.13	1.38	4.53		4.55 0.14			5.76		3.71	3.85	4.99	2.20	22.7					50.00		52.40		
Total Kieldhal Nitrogen (TKN)	0.5 (5)				26.4		15.20	6.70	9.20	12.40	11.6		12.4	14	16.5	11.30		2.2	9.4		2.8	2.9	4.3	3.20		6.00		4.9 1.2			7.4		4.50	4.5	6.40		22.3		10.20			46.20		49.9		
Dissolved Organic Carbon	(-/	. = (=/			15			11				11				21	-	-	1	1	11	-			8.00			7	-	-	-	20				9	2.56			26.00				33		
Fluoride (Electrode)		1			0.4			0.4				0.4				0.4			1	1	0.4				0.40			0.4				0.4				0.4	2.00	2.40		0.50				0.40		
Total Phosphorus (TP)	0.05 (7)	0.025(7)	2.92	1.00		3.92	4.27		1.45	6.84	4.80		0.88	0.38	2.23	2.52	9.07	2.55	3.86	3.93	2.08	0.62	1.74	2.01		12.00	4.55			4.88	4.89		4.88	3.69	3.32		2.35	2.54			2.62	2.90	2.5	2.9	3.8	2.9
Note:	0.00(1)	0.020(1)	2.82	1.00	0.00	0.92	27	1.35	1.40	0.34	4.00	0.40	0.00	0.30	2.23	2.02	5.07	2.00	5.66	0.00	2.30	0.32	/4	2.01	1.01	.2.30	4.00	0.00	141	4.00	4.65	0.01	00	0.05	0.32	/3	2.30	1.04	0.04	2.40	2.02	2.30	2.0	2.0	0.0	2.0
Exceeds ANZECC (2000) guidelines		35	1	1 Triagon	r voluo in	on indica	tiuo intorio	n working	level only	(IDAR.)				e Trianos	runkun far	total Niltra	gen in mar		otomo in N	ICIM																										
marine/freeh water ecosyste		35							ection con								gen in mar		scens in r	DVF.																										

Note: Exceeds ANZECC (2000) guidelines marine/fresh water ecosystems Focus of this monitoring report nc = no comment NA = not available

Trigger value is an indicative interim working level only (IIWL).
 Armonia trigger at pl+ 8.0, for a 95% protection, corrected for average pH = 7.3.
 Trigger value for oxide of NM:rogen (NOx) for Marine driven in NSW.
 Trigger value for total Ntrogen in Nobiling for marine ecosystem in NSW.
 Trigger value for total Ntrogen in Nobilin Oxiden in NSW.

Trigger value for total Nitrogen in marine ecosystems in NSW.
 Trigger value for a 95% protection level.
 Guidelinefor water quality and aesthetics: primary contact.
 Reference only, not dirtectly applicable to groundwater.

					_	·			-		_			-												· · · ·				-	-															_
Sample ID	ANZECO	C, 2000	MW7S	MW 7S	MW 7S	MW7S	MW75	5 MW 7	S MW75	6 MW75	S MW7S	MW75	MW7S	MW7S	MW7S	MW75	MW7S	MW7S	MW7S M	/7S MW	75 MW	V7S MW	7S MW7	5 MW7S	MW7S	MW7S	MW7S	MW7S	WW7S	MW7S M	W7S M	W7S M	W7S	MW7S	MW7S	MW7s	MW7s	MW7s	MW7s	MW7s	MW7s	MW7s	MW7s	MW7s I	MW7s	MW7:
Field Measurements	Fresh	Marine	21/5/10	17/8/10	30/11/10	23/2/11	24/5/1	1 24/8/1	1 3/11/11	1 1/2/12	2 31/5/12	2 10/8/1	21/11/12	18/2/13	31/5/13	30/8/1	27/11/13	7/2/14	7/2/14 6/	(14 1/8)	14 17/1	1/14 26/2	15 27/5/1	5 24/8/15	4/11/15	16/2/16	31/5/16	12/8/16 1	0/11/16	20/2/17 18	/5/17 17	/8/17 30	(11/17	8/2/18	4/5/18	22/8/18	16/11/18	12/2/19	28/5/19	28/8/19	22/11/19	14/2/20	28/5/20	13/8/20 #	6/11/20	1/2/21
Ground Level (m AHD)																																														
Depth to Groundwater (m AHD)																-																														
			4 57	4 4 4	4.09	4.32	4.04	4.24	4.50	4.76	4.38	4.54	4.56	4.00	4.23	4.26	4.68	4.84	4.84 4	25 4.6	54 4.6	67 4.5	5 4.06	1.9	4.32	4.7	4.70	4.24	4.47	4.39 4	47 4	1.54 4	1.85	4.83	4.68	4.68	4.68	4.68	4.72	4.44	47	4.54	4.54	4.54	4.54	1.54
Groundwater depth (m bTOC)																																														
Height of Stick up (m)			0.53			0.53	0.53				0.53	0.53			0.53	0.53	0.53				53 0.5							0.53	0.53	0.53 0								0.53	0.53				0.53		0.53	
Groundwater Depth (mbgl)			4.04	3.91	3.56	3.79	3.78	3.71	4.05	4.23	3.85	4.01	4.03	3.79	3.7	3.73	4.15	4.31	4.31 3	72 4.1	11 4.1	14 4.0	2 3.53	1.37	3.79	4.17	4.17	3.71	3.94	3.86 3	.64 4	1.01 4	1.32	4.3	4.15	4.73	5.78	4.68	4.68	4.68	4.68	4.68	4.52	3.03	4.27	4.65
oH (field)	6.5-8.0 (a)	8-8.4 (a)	7.5	7.6	7.2	7.4	7.8	7	7.9	7.6	7.9	7.7	7.9	7.5	7.4	7.4	7.8	7.8		7.	4		6.8	8.1	7.1	7.3	7.7	7.0	7.8	6.9	7.0 7	7.7	7.7	7.6	7.7	7.7	7.7	7.7	8.1	7.5	7.7	7.5	7.8	7.2	7.5	7.6
Temperature (T deg C)			-	-	-	-	-	-	-		-				-	-	-	-																							-					
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		0.9	1.01	0.836	0.55	0.604	1 0.393	2 0.702	0.584	4 0.522	<1	0.671	0.467	0.442	0.381	0.518	0.58		0.3	65		0.31	0.463	0.423	0.579	0.475	0.451	0.58	0.617 0.	464 0.	.723 0	.614	0.535	0.544	0.576	0.608	0.63	0.714	0.794	0.691	0.893	0.796	0.734	0.649	0.584
Salinity (ppt)			-	-	-	-	-	-	-		-				-	-	-	-																												
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	2.9	2.99	1.36	2.38	2.33	2.83	1.52	2.57	1.81	1.4	2.07	1.65	2.12	1.77	2.03	1.97	1.97 2	15 1.	5 2.	.3 2.1	7 3.22	3.24	1.82	3.9	1.95	1.94	3.87	2.82 3	20 2	2.60 3	3.15	2.60	3.22	4.34			4.33	5	3.49	2.91	3.99	2.15	5.88	3.2
Dissolved Oxygen (%)				-	14.30	-		-				13.9			-	-	-	-		15	.3																									-
Turbidity (NTU)	6-50 (a)	0.5-10 (a)		-	-	-		-							-	-	-	-										-17.0			-6	62.2							(I				(I			
Redox Potential (mV)					-	-		10.5	- 0			<0.1			-	-39	-			8	3			-75												121			1 1	-65.1			(T	-24		
Comments			nc	nc	nc	nc					nc				nc	nc	nc	nc																							_					
Sodium				-	109	-		34			-	44			-	40	-	-		33				41				32				72				43			1	60			120	81	702	
Potassium				-	11	-		2			-	6			-	4	-	-		6				3				3				4				4			1	4			1	<1		
Calcium					67			31				56				24				56	3			42				48				54				52				66			i!	30		
fagnesium				-	9	-		6			-	7			-	5	-	-		7				6				7				6				7			1	9			1	14		
Chloride					166	-		56				82				48				59				34				49				121				54				122				153		
Alkalinity (as CaCO3)			200	177	204	151	154		166	172	147	152	180	132	141	109	153	143	143 1		4 14			140	133	170	180	150		152		154	<1	<1	<1	176	176	173	161	162		239	228			175
Bicarbonate			200	177		151	154		166	172	136	152	180	132	141	109	153	143	143 1	13 14				140	133	170	180	150				154 .	172	189	195	176	176	173	161	162		239	228		130	
Carbonate (as CaCO3)			<1	<1		<1	<1	<1	<1	<1	11	<1	<1	<1	<1	<1	<1	<1	<1 1	13 <	1 <	1 <1	<1	<1	<1	<1	<1	<1		<1	<1 .	<1 ·	172	189	195	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO4)					39	-		10				14			-	9	-	-		8				12				13				15				11				21				18		
oH (lab)						-																.8 6.1						7.0				7.7														
otal Dissolved Solids (TDS)			538	528	530	362	256	238	418	328	274	334	398	240	238	201	282	312	312 1	38 33	0 39	99 43	3 248	267	357	434	316	235		409 2	264 3	382 3	395	313	283	322	358	411	340	412	378	525	431	396	432	331
Hardness (as CaCO3)						-											-																								_					
otal Suspended Solids (TSS)			-	-	-		-	-			-				-	-		-																					1 1				1 1			
ron (filtered)	0.3 (1)		-	-	0.16		-	1.22			-	0.4			-	0.66		-		0.1				0.42				0.17				0.05				0.14			1 1	0.6			1 1	0.22		
Manganese	1.90				0.02	-		0.01				0.014			-	0.01	-			0.0	13			0.01				0.010			0.	.011				0.012			1 1	0.02			(T	0.003		
	0.7 (7)		0.01		0.02			0.04		0.12	< 0.01		< 0.01		< 0.01		<0.10		<0.01 <0				0.04			0.02		< 0.01		0.15 0		0.01 <		<0.01					< 0.01					0.02		
litrite (NO2 as N)			< 0.01			< 0.01		< 0.0		0.02	< 0.01	< 0.01			< 0.01		<0.10		0.02 <0									< 0.01		0.06 <		0.01 0		<0.01		< 0.01					< 0.01			< 0.01		
		2.84 (2)			2.56	1.34	1.3			2.03			2.74		1.91				1.64 0		12 0.5							0.38		0.34 0				0.49				0.44			0.32			< 0.01		
Fotal Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	0.8	2.6	4.5	1.6	2.2	0.4	2	3.3	2.6	2.8	3.5	1.4	2.6	1.5	2	1.8	1.8 1	00 1.	6 0.	.7 1.0	6 0.8	0.8	1.3	1.2	1.4	0.5		1.6	1.3 (0.6	0.8	0.9	0.8				1.00	1.00	0.5	0.9	0.8	0.3	0.8	0.4
Dissolved Organic Carbon					9	-		6	-	-		6		1	-	8	-	-		7				5	1			4				7				5	3.49	3.72	1 7	5			1 7	8		
luoride (Electrode)			-	-	<0.1	-	-				-	0.1			-	<0.1		-		<0				0.1				<0.1				:0.1				<0.1				0.1	-			0.2		
Total Phosphorus (TP)		0.025(7)																																										0.04		0.44

1/1

 Total Phosphorus (TP)
 0.05 (7)
 0.025 (7)
 0.2

 Note:
 Exceeds ANZECC (2000) guidelines marine/flesh water ecosystems
 35

 Focus of this monitoring report nc = no comment
 NA = not available

1. Trigger value is an indicative interim working level only (IWL).
 2. Ammonia trigger at pH = 0.8, for a 36% protection, corrected for average pH = 7.3.
 3. Trigger value for coldes of Natiogen (No.) for homit encorptional fivers in NSW.
 4. Trigger value for coldes of Natiogen (No.) for homit encorption in No.
 5. Trigger value for coldes of Natiogen (No.) for homit encorptions in NSW.
 5. Trigger value for coldes of Natiogen (No.) for homit encorptions in NSW.

ample ID	ANZEC	C, 2000	MW7D	MW 7D	MW 7D	MW7D	MW70	MW 7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D MW70	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D MW	7D MW	7D MW7	D MW7	D MW70	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D	MW7D M	W7
ield Measurements	Fresh	Marine	24/5/40	47/8/40	2014/40	22/244	24/5/4		2/44/44	41214.2	24/5/40	40/0/40	24/44/42	40/0/40	24/5/42	20/0/42		70044	6/5/14 1/8/14	47/44/4	an inite	07/F/4 F	24/0/45		400040	24/5/46	40/0/40	40/44/46	20/2/47 40/	47 47(0)		47 80.44	0.04/5/4	2218148	4014414	40000	2017/40	20/0/40	22/44/40	4410100	28/5/20	12/9/20	6/11/20 1	12121
Fround Level (m AHD)	Fresh	marine		1//6/10	30/11/10	23/2/11	24/0/1	1 240/11	3/11/11	1/2/12	31/0/12	10/6/12	20/10/12	16/2/13	31/0/13	30/6/13	2//11/13	112/14	6/0/14 1/0/14	1/11/14	26/2/16	21/0/10	24/0/10	4/11/15	NA	31/0/10	12/0/10	10/11/16	20/2/17 16/5	11/ 1//6	17 30/11	0/2/10	0 24(0/1)	22/0/10	16/11/14	6 12/2/15	20/0/19	20/0/19	22/11/19	14/2/20	20/3/20	13/0/20	0/11/20 1	12/21
, , , , , , , , , , , , , , , , , , , ,			NA				-	_										-		-												-	_			_	-						+	
epth to Groundwater (m AHD)			NA														-								NA																			
roundwater depth (m bTOC)			4.76	4.59	4.25	4.46	4.46	4.41	4.72	4.88	4.53	4.7	4.67	4.46	4.38	4.4	4.8	4.98	4.39 4.78	4.79	4.69	4.21	4.5	4.45	4.8	4.83	4.40	4.03	4.55 4.3	34 4.6	9 5	4.97	4.84	4.84	4.84	4.84	4.88	2.26	4.85	4.68	4.68	4.68	4.68	4.68
eight of Stick up (m)			0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6 0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6 0.	6 0.6	6 0.E	i 0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
roundwater Depth (mbgl)			4.16	3.99	3.65	3.86	3.86	3.81	4.12	4.28	3.93	4.1	4.07	3.86	3.78	3.8	4.2	4.38	3.79 4.18	4.19	4.09	3.61	3.9	3.85	4.2	4.23	3.8	3.43	3.95 3.1	4 4.0	9 4.4	4.37	4.24	4.88	4.94	4.89	4.89	4.89	4.89	4.89	4.67	3.18	4.43	4.46
	6.5-8.0 (a)	8-84(a)	74	74	6.9	71	7.5	74	7.5	74	75	72	74	7.5	74	74	74	75	77			74	74	7.3	7.3	74	72	73	72 7	4 7.3	7 4	6.5	7.3	7.3	73	7.3	7.6	71	71	71	7.2	7.2	7.2	71
emperature (T deg C)	0.0 0.0 (0)	0 0// (L)																														-										-	1	
ectrical Conductivity (mS/cm)	0 125-2 2 (a)		0.96	0.86	0.712	0.68	0.634	0 649	0.694	0.625	0.661	<1	0.645	0.622	0.526	0.528	0.547	0.476	0.435			0.426	0.483	0.499	0.443	0.471	0.44	0.481	0.452 0.5	15 0.5	12 0.4F	i5 0.50	3 0.527	0.496	0.554	0.661	0.714	1.09	1.14	1.21	11	1 15	1.09 1	1 129
alinity (ppt)					-	-					-				-		-	-													-		-									-		
	8.5-11.0 (a)	0.0-10.0 (9)	179	2.59	1 71	2.08	2.53	24	1.67	1.61	1 75	0.8	2.92	2.89	1.54	1.56	22	1 0.4	144 19	2.9	3.6	3.4	2.06	1.95	31	2.91	2.05	3.81	1.42 3.3	30 2.4	6 31	1 2.75	3 72	3.88			3.78	9	1.29	0.63	1.54	1.13	1.73	3.22
issolved Oxygen (%)	0.0-11.0 (u)	0.0-10.0 (u	-	-	18.00	-	2.00		-	-	-	7.9	2.02	2.00	1.04	-		-	19.2		0.0	0.4	2.00	1.00	0.1	2.01	2.00	0.01	1.42 0.1	10 2.4	0 0.1	1 2.10	0.72	0.00			0.10		1.2.0	0.00	1.54	1.10	1.10	J.44
	6-50 (a)	0.5-10 (a)			-	-					-				-			-																										
edox Potential (mV)					-	-	-	23.50			-	< 0.1				-28		-	73.5				66				16.0			-10	4			129				-121				-137		
omments			nc	nc	nc	nc	-	-		-	nc	nc	nc	nc	nc	nc	nc	nc																										
odium					24	-		14	•	-		16				17			12				9				8			10				10				44				60		
otassium			•		16			6	•		•	6				6			4				4				4			4				4				24				27		_
alcium				-	90	-		95		-	-	98			-	76		-	70				75				71			75	;			71				103				101		
agnesium					10	-		9				9				7			6				7				6			8				6				18				16		
hloride					20	-		14			-	41				16	-	-	8				9				14			16				28				73				64		
kalinity (as CaCO3)			299	348	307	250	226		246	262	231	247	247	228	203	250		208	220 178				214	215	182	203	214	209	195 20					188	216		286	388	435	486	516	486		492
carbonate				348	307				246		212			228		250		208	220 178								205													486			480	492
arbonate (as CaCO3)			<1	<1	<1	<1	<1		<1	<1	19	<1	<1	<1	<1	<1	<1	<1	<1 <1	<1	<1	<1	<1	<1	<1	<1	6	<1	<1 <			3 227	238	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
ulphate (SO4) H (lab)					15	-		44			-	24			-	18		-	72 77	5.9	6.5		7				8			7				6		_		12				21	+	
. (•	•	-	-				•	-				-		-	-																		_							+	
otal Dissolved Solids (TDS)			449	358	408	408	276	402	432	352	364	402	406	346	338	298	307	280	238 280	292	237	249	300	337	382	290	218	306	285 28	15 24	8 318	3 319	296	289	328	424	334	552	584	510	574	596	574	584
ardness (as CaCO3)						-		-	-		-						-	-													_		_			_							+	
tal Suspended Solids (TSS)			•	•		-				•	-				-		-	-																		_							+	
on (filtered)	0.3 (1)		•	•	5.8 0.106			0.07	•	•	-	< 0.05			-	0.09	-	-	<0.05				<0.05				0.06			<0.0				0.33		_		8.73				3.38		
anganese	1.90			- 0.05	0.106				<0.01		0.06				- 0.16			-	<0.01 1.19								0.045	0.56											<0.01	< 0.01			<0.01	
trate (NO3 as N) trite (NO2 as N)	0.7 (7)			0.05	0.12	1.06 0.05		0.16		0.06	< 0.06			0.46	0.16	0.49			<0.01 1.19				<0.01			<0.01			<0.01 0.0			1 0.02				< 0.01		<0.01	<0.01	<0.01			<0.01	
mmonia (NH3 as N)	1.88 (2)	0.04.(0)	0.04	0.04	0.00	0.05	7.99		40.01	4.00	2.61	1.94		1.93	2.82			1.97	1.91 0.2		1.48	<0.01	0.54	0.03	×0.01	1.00	0.70	<0.01	<0.01 <0.	01 0.0			1 0.00	<0.01	0.91	2.08	2.36	20.50			21.00		17.40 1	
ital Kieldhal Nitrogen (TKN)			21.9	20.0	21.7	10.2		4.50	4.17	1.90									2.10 0.60			0.96		1.04	1.02		0.70	0.13	0.99 0.1				0.09	0.15									17.40 1	
ssolved Organic Carbon	0.5 (5)	U. 12 (6)	32.7	35.7	28.4	14.5	9.60	4.50	4.80	4.80	3.60	2.40	2	2.2	ა. 90	2.60	3	4	2.10 0.60	1.60	1.60	1.30	4	∠.30	1.40	1.3	0.9	U.7	1.2 1.	0.0	0.9	U 1.3	1.30	0.4	3.38		3.00	15.10	16.50	21.20	∠1.80	18.30	10.30 1	.1.20
uoride (Electrode)					13			0.3	<u> </u>		-	0.2			-	0.2		-	0.2	-			4				0.2			0.2			_	4	3.38	2.93		9				14	+	
uoride (Electrode) ital Phosphorus (TP)	0.05 (7)	0.025 (7)	. 0.22			-	0.26	0.3	5.74	2.26	- 1.00	0.2	0.09	0.17	-	1.66		2 5 5	0.89 0.37	0.20	1.07	0.71	0.10	0 14	1.60	1.62	0.02	2.24	1 02 1	0.3	0 27	2 2 05	1 4 2	0.2	0.71	1 17	1 20	0.74	0.90	0.96	0.91		0.00	0.00
otal Phosphorus (TP) ote:	0.03(7)	0.025(7)	0.33	0.5	1.52	0.44	J.26	J.61	0./4	3.30	1.00	0.30	0.06	v.1/	0.00	1.00	0.40	2.00	0.00 0.37	0.30	1 1.07	v./1	0.19	0.14	1.00	1.02	0.93	3.34	1.00 1.4	1.9	0 Z.I.	2 2.03	1.43	0.29	1 0.71	1 1.17	1 1.20	0./4	0.00	0.00	v.01	1 0.00	1 0.00	9.09
Exceeds ANZECC (2000) gui	idelines	35	1					rim workin											systems in NSV	<i>I</i> .														_										
marine/fresh water ecosys	tems			2. Ammo	inia trigge	er at pH =	8.0, for	a 95% pro	tection, co	prrected for	or average	e pH = 7.3	3.	7. Trigge	r value fo	r a 95% p	roetction le	vel.	many contact																									

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ample ID	ANZEC	2000	MW9	MW 9	MW 9	MW9	MW9	MW 9	MW9	MW9	MW9	MW9 N	ewn	MW9	MW9	ewn	MW9	MW9 N	W9 M	NN RN	9 MW9	MW9	e wwe	MW9	MW9	ewn	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	MW9	A MW) MW	/9 MV	w9	MW9
eld Measurements		Marine							-	-			-		-			-	-	-													20/11/17	_								_			-		
	Fresh	Marine		17/8/10	30/11/10	23/2/11		24/8/11							31/5/13 3		7/11/13		/2/14 6/5				5 27/5/15		4/11/15 1		31/5/16	12/8/16				17/8/17	30111717	012/10	24/5/18		16/11/18	12/2/19		28/8/19	22/11/19				20 6/11		
round Level (m AHD)			1.37	1.37	1.37	1.37	1.37	1.37		1.37				1.37						37 1.3				1.37			1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37					1.37
epth to Groundwater (m AHD)			0.53	0.55	0.95	0.63	0.52	0.48	0.47	0.39	0.52	0.47	0.88	1.03	0.53	0.4	0.49	0.38 (0.38 0.	67 0.8	3 0.54	0.56	0.66	-0.01	0.49	0.52	0.62	0.5	0.53	0.63	0.65	0.53	0.32	0.39	0.68	0.45	0.35	0.6	0.76	0.94	0.49	0.72	0.79	1.1	6 0.7	.76	1.04
roundwater depth (m bTOC)			1.79	1.77	1.37	1.69	1.8	1.84	1.85	1.93	1.8	1.85	1.44	1.29	1.79	1.92	1.83	1.94	1.94 1.	65 1.4	9 1.78	1.76	1.66	2.33	1.83	1.8	1.70	1.82	1.79	1.69	1.67	1.79	2	1.93	1.64	1.87	1.97	1.72	1.56	1.38	1.83	1.6	1.53	1.1	6 1.5	.56	1.28
eight of Stick up (m)			0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95 (0.95 0.	95 0.9	5 0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.9	5 0.9	.95	0.95
roundwater Depth (mbgl)			0.84	0.82	0.42	0.74	0.85	0.89	0.9	0.98	0.85	0.9	0.49	0.34	0.84	0.97	0.88	0.99 (0.99 0	7 0.5	4 0.83	0.81	0.71	1.38	0.88	0.85	0.75	0.87	0.84	0.74	0.72	0.84	1.05	0.98	0.69	0.92	1.02	0.77	0.61	0.43	0.88	0.65	0.58	0.2	1 0.6	.61	0.33
H (field)	6.5-8.0 (a)	8-8.4 (a)	5.9	6	6.3	6.5	6.7	6.8	6.8	6.3	6.7	6.3	6.5	6.7	6.4	6.2	6.4	6.2		5.	7		6.4	6.7	6.5	6.3	5.9	6.5	6.2	6.2	6.5	6.3	6.3	6.4	6.1	6.1	6.1	6.2	6.4	6.2	6.2	6.2	6.3	6.7	6.	3.7	6.4
emperature (T deg C)					-	-	-			-						-																							-						-		
lectrical Conductivity (mS/cm)	0.125-2.2 (a)		21.7	16.6	1.4	8.66	7.39	4.91	6.23	13	6.41	11 !	9.32	12.7	6.39	1.08	10.2	18.9		23.	4		9.12	7.69	4.61	9.52	31.4	9.45	13.4	21	10.6	17.2	24.9	37.4	33.1	32.6	27.4	23.1	24.9	28.4	27.1	22.6	27	9.0	7 9.0	.09	17
alinity (ppt)																																															_
ssolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	4.74	5.42	3.36	8.68	2.24	2.89	2.14	2.89			1.73	1.68	3.71	1.97	2.14	1.9	1.9 3.	69 4.1		3.3	3.61	1.8	1.92	1.9	4.41	5.40	2.60	3.27	3.40	3.46	2.65	0.52	4.54	4.32			4.6	11	4.48	5.44	6.46	3.5	9 7.2	27	5.05
issolved Oxygen (%)					35.60							12.5								45.	9																		L								
urbidity (NTU)	6-50 (a)	0.5-10 (a)																										14.0				17.5							<u> </u>								
edox Potential (mV)								101				<0.1				38				24	3			130												165			<u> </u>	83.1				-23	3		
omments			nc	nc	nc	nc	-						nc	nc			nc	nc																					I								
odium					759			904				2330				190				537				1350				1780				2740				5360			<u> </u>	4930			553	150		_	
otassium			-		33	-	-	37	-	-		101			-	13		-		17				60				66				87				182			<u> </u>	168				59			
alcium					34			31				147				6				38				69				78				161				267			<u> </u>	230				56		_	
agnesium hloride			-		67	-	-	77	-	-		392				14		-		77				165				177				396				670			<u> </u>	672				14			
			-		912		-	1410				4620				275		-		836				1960				3120								10200			<u> </u>	10300				274		_	
kalinity (as CaCO3)			85	61	288	129	118	147		78	174									7 39							64	84	90	112	156	98	<1	<1	<1	42	59	78	68	38	65	63					63
icarbonate			85	61	288	129	118	147	116	78	174									7 39			142	135			64	84	90	112	156	98	90	81	50	42	59	78	68	38	65	63					63
arbonate (as CaCO3)			<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1			<1	<1	<1 <	1 <1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	90	81	50	<1	<1	<1	<1	<1	<1	<1	<1			<1	<1
ulphate (SO4)					33		-	258				679				37				145				384				415				731				1540			I	1600				36	1		
H (lab)																				.1 5.3								6.5				6.3							<u> </u>								
otal Dissolved Solids (TDS)			15600	10900	3270	6560	3900	2920	3660	9530	4000	7670 6	8540	8220	3320	671	7530	13100 1	3100 62	40 209	00 8190	6730	3580	5160	2870	6840 :	21500	5220	8350	14000	6910	10900	18100	24600	22700	21900	17900	15600	14700	19500	17800	11700	1680	0 549	0 572	20 *	11800
ardness (as CaCO3)																																							L								
otal Suspended Solids (TSS)							-																																I								
on (filtered)	0.3 (1)				4.64			0.57				0.11				0.68				0.0				0.26				0.25				0.67				0.22			L	< 0.05				1.2			
anganese	1.90				0.015	-	-	0.002			-	0.005			- 1	0.004				0.0				0.004				0.004				0.017				0.012			1	0.013				0.0	1		
itrate (NO3 as N)	0.7 (7)			1.98	6.83	0.52	0.19										<0.01		0.01 0.				<0.01		< 0.01			0.19		< 0.01	0.02	0.06		0.81		0.24		0.10		1.23	0.52				0.0		0.01
itrite (NO2 as N)			< 0.01	<0.01	< 0.50	0.02	< 0.01	< 0.01	< 0.01	< 0.01	<0.01	< 0.01 <	0.01	< 0.01	<0.01	<0.10	< 0.01	< 0.01 <	0.01 <0			< 0.01	< 0.01		<0.01			< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	<0.01	< 0.01		< 0.01	< 0.01	< 0.01			01 <0.0	.01	< 0.01
mmonia (NH3 as N)	1.88 (2)	2.84 (2)	< 0.10	<0.10	0.84	0.06	0.05	< 0.01	1	<0.10	0.03	0.04 1	0.23	1.08	< 0.01	0.02	0.32			.01 <0.0		0.21	< 0.01	0.01	0.47	0.07	< 0.05	0.03	0.26	1.29	0.19	0.15	0.43	0.54	0.27	0.09	0.13	0.16	0.34	0.12	0.03	0.08					0.24
otal Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12(6)	0.8	2.7	94.1	1.6	2.40	1.70	2.60	1.00	1.9	1.8	2.4	2.8	3.1	3.1	1.6	1.1	1.10 0.	40 1.0	0 2.10	2.60	2.40	4.90	2.20	1.40	2.0	1.4	4.0	4.1	22.3	1.9	13.70	11.8	5.30	<0.5	2.1	1.9	1.60	1.20	2.30	2.30	1.70	3.3	0 6.1	.10	4.60
ssolved Organic Carbon					430			51				17				64				14				0.3				24				34				11	3.80	4.76		11				35			
uoride (Electrode)					0.5			0.4				0.2				0.2				0.1				29				0.2				0.2				0.2			1	0.2				0.4	,		
otal Phosphorus (TP)	0.05(7)	0.025(7)	<0.01	0.83	<2.00	0.07	0.12	0.07	0.22	0.08	0.14	0.05	0.17	0.23	0.34	0.24	0.09	0.06 (0.06 0.	05 0.0	7 0.22	0.20	0.13	0.31	0.16	0.03	0.20	0.09	0.45	0.23	1.78	0.13	1.21	0.94	0.41	0.48	0.26	0.14	0.13	0.24	0.28	0.24	< 0.0	5 0.3	0 0.6	.60	0.40
Exceeds ANZECC (2000) guid marine/fresh water ecosyste Focus of this monitoring report nc = no comment		35]		2. Ammor 3. Trigger	ia trigger value for	at pH = I oxides o	ive interim 8.0, for a 95 f Nitrogen () f Nitrogen ()	% protectic NOx) for lor	on, corres wland riv	ted for ave ers in NSW	1.	7.3.		7. Trigger v	alue for a for water	95% pros quality a	en in marin etction level ind aestheti	l. cs: primary	contact.																											

GW-1 Summary Groundwater (MW-9)

mple ID	ANZEC	C, 2000	MW10	MW 10	MW 10	MW10	MW10	MW 10	MW10	MW10 N	1W10 N	W10 MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	MW10	0 MW10	MW
d Measurements	Fresh	Marine	21/5/10	17/8/10	30/11/10	23/2/11	24/5/11	24/8/11	3/11/11	1/2/12 3	1/5/12 1	N8/12 21/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	6/5/14	1/8/14	17/11/14	26/2/15	27/5/15	4/11/15	16/2/16	31/5/16	12/8/16	10/11/16	20/2/17	18/5/17	17/8/17	30/11/17	8/2/18	24/5/18	22/8/18	16/11/18	12/2/19	28/5/19	28/8/19	22/11/19	14/2/20	28/5/20	13/8/20	0 6/11/20	1/2/2
ound Level (m AHD)			1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475 1	.475 1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.475	1.47
pth to Groundwater (m AHD)			0.295	0.295	0.785	0.395	0.295	NA	0.185	0.035 (0.275 0	.225 0.605	0.765	0.365	0.195	0.235	0.105	0.415	0.475	0.355	0.305	0.365	0.235	0.335	0.355	0.255	0.635	0.335	0.385	0.285	0.075	0 115	0.435	0.175		0.035	0.545	0.415	0.225	0.415	0.475	1.045	0.475	0.75
oundwater depth (m bTOC)			2.14		1.65	2.04	2.14					2.21 1.83	1.67	2.07	2.24	2.2		2.02	1.96	2.08	2.13	2.07		2.1	2.08	2.18		2.10	2.05	2.15	2.36	2.32	2	2.26		2.40	1.89	2.02		2.02	1.96	1.39		
					0.96	0.96		0.96				0.96 0.96	0.96		0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
eight of Stick up (m)																																			0.96									
roundwater Depth (mbgl)			1.18		0.69	1.08	1.18	NA				1.25 0.87	0.71	1.11			1.37	1.06	1	1.12	1.17		1.24			1.22		1.14	1.09	1.19	1.4	1.36	1.04	1.3			0.93	1.06				0.43		0.72
H (field)	6.5-8.0 (a)	8-8.4 (a)	4	4.1	5.8	5	5.4		5.3	4.9	5.2	4.7 5	5.1	5	5.4	5.3	5.1		4.2			5.5	5.6	5.1	4.8	5.2	5.1	5.2	5.8	5.2	5	4.8	4.7	5.0		5.2	5.3	4.7	4.9	4.8	5.2	5.3	5.5	5.2
emperature (T deg C)			-				-							-																									<u> </u>					
lectrical Conductivity (mS/cm)	0.125-2.2 (a)		29	6.45	3.06	8.94	5.12		5.7	14.8	6.3	12 15.2	13.1	6.64	6.72	14.4	28.2		22.7			8.54	4.57	8.06	33.7	10.2	12.2	14.6	4.21	16.9	28.3	39.2	39.7	37.8		27.1	34	31.7	33	32.8	28.9	3.03	6.43	16
alinity (ppt)			-				-	-	-		-			-			-																						1					
issolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	4.69	4.93	4.7	9.61	6.1		4.16	3.05		2.4 2.03	3.43	2.01	3.02	2.38	3.89	3.06	2.7	3.5	4.2	3.29	3.14	2.9	4.24	5.00	2.89	2.32	5.30	5.54	3.25	3.76	4.35	4.62			6.97	11	4.71	3.81	7.74	3.9	5.86	2.8
issolved Oxygen (%)			-	-	50.30	-	-	-	-	-		24.9		-		-	-		30.3																				1					
urbidity (NTU)	6-50 (a)	0.5-10 (a)	-																																									
edox Potential (mV)			-				-	-	-			<0.1		-	161		-		318							172				150				184				154	1			116		
omments			nc	nc	nc	nc					nc			nc	nc	nc	nc																						<u> </u>					
dium			-		406				-			390			1100				5060							1860				2700				6600				5650	<u> </u>			474		
otassium			-		20			-	-			102			48		-		156							61				86				224				194	<u> </u>			21	_	
alcium			-		7	-	-	-	-			114		-	44		-		265							78				127				291				251	<u> </u>			14	_	
lagnesium			-		13	-	-	-	-			336		-	136		-		699							209				363				816				723	<u> </u>			44	_	
hloride			-		449	-	-	-	-			1730		-	1760		-		7760							3420				4980				11800				11300	<u> </u>			817	_	
Ikalinity (as CaCO3)			<1	<1	28	3	10		6	2	6	4 1	<1	5	9	10	4	<1	<1	2	3	16	16	8	2	6	<1	<1	24	7	<1	<1	<1	2		9	4	6	4	4	6	10	12	
icarbonate			<1	<1	28	3	10		6	2	6	4 1	<1	5	9	10	4	<1	<1	2	3	16	16	8	2	6	<1	<1	24	7	3	2	<1	2		9	4	6	4	4	6	10	12	
arbonate (as CaCO3)			<1	1	<1	<1	<1	-	<1			<1 <1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	4	<1	3	2	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
ulphate (SO4)			-		42	-	-	-	-		-	642		-	304		-		1410	5 10						439				736				1920				1810	<u> </u>	<u> </u>	<u> </u>	138	_	
H (lab)			-			-	-		-	-				-	•		-																					<u> </u>	<u> </u>	<u> </u>	<u> </u>		_	
otal Dissolved Solids (TDS)			20500	10100	1810	5740	2700		3440	10500	3980	280 10700	7550	3870	3760	10800	19400	7970	16900	12200	8070	3530	3370	6310	22000	6220	8160	10600	2640	10700	19700	23700	27600	26000		18800	23600	20500	23400	21800	18000	1490	3660	1130
ardness (as CaCO3)			-		-	-	-	-	-	-				-	•		-																						<u> </u>				_	
otal Suspended Solids (TSS)			-		-	-	-	-	-	-				-	-		-																						<u> </u>			_	_	
on (filtered)	0.3 (1)		-		10.4	-	-	-	-	-).28		-	0.54		-		0.27							0.25				0.90				0.14				7.19	<u> </u>			1.68		
langanese	1.90		-	-	0.003	-	-	-	-	-		.015		-	0.014	-	-		0.02							0.009				0.015				< 0.010				0.017	L			< 0.001		
itrate (NO3 as N)	0.7 (7)		0.2	0.3	1.36	0.44	0.05	-	0.15			0.25 <0.01		< 0.01			0.16		0.72					0.09	0.31	0.10	0.02		<0.01		0.04		0.24				0.07	<0.01		0.17		<0.01		
trite (NO2 as N)				< 0.01	<0.50	0.02	< 0.01	-				0.01 <0.01	0.02		<0.01	<0.01	< 0.01	< 0.01	< 0.01					<0.01	<0.01	<0.01		< 0.01	<0.01	< 0.01			< 0.01	< 0.01		< 0.01		< 0.01		< 0.01		<0.01		
nmonia (NH3 as N)		2.84 (2)						-		<0.10).02 <0.10			0.06										<0.05						0.1		< 0.01					0.32		0.12		<0.01		
tal Kjeldhal Nitrogen (TKN)	0.5 (5)	0.12 (6)	2.2	6.2	59.3	1.2	2.6	-	5.2	8		10 1.4	1.4	3.1		0.3	<0.2	1.00		11.4	17.3	3.2	2.5	1.7	2.9		2.6	9.0	10.4		8.8	5.0	5.2			9.4	10.9	1	1.4	1.9	10.3	2.2	4	2.3
ssolved Organic Carbon			-		430		-	-				12		-	24		-		14							15				23				10		4.90		11	<u> </u>			31	_	_
uoride (Electrode)			-		< 0.1	-	-	-	-			0.2		-	<0.1		-		0.30							<0.1				0.2				0.3				0.2		<u> </u>	4	< 0.1		+
tal Phosphorus (TP)	0.05 (7)	0.025(7)	0.15	0.52	<1.00	0.03	0.14	-	0.46	0.8	0.3	0.03	0.04	0.21	0.45	< 0.01	<0.02	0.09	0.16	1.08	1.67	0.26	0.14	0.06	0.26	0.17	0.17	0.82	0.70	0.59	0.65	0.37	0.39	< 0.05		1.21	1.18	0.13	0.52	0.28	0.82	0.15	0.33	0.14

exceeds ANZECC (2000) guidelines 36 marine/fresh water ecosystems Focus of this monitoring report nc = no comment NA = not available

1. Trigger value is an indicative interim working bever only (IIVL).
 6. Trigger value for total Nicopen in matrixe ecosystems in NSV.
 5. Trigger value for coldes of Nicopen (Nico) for matrixe ecosystems in NSV.
 5. Trigger value for coldes of Nicopen (Nico) for matrixe ecosystems in NSV.

Sample ID	ANZEC	C, 2000	MW11	MW 11	MW 11	MW11	MW11	MW 11	MW11	MW11	MW11	MW11 I	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	MW11	. MW11	MW11	i MW11	1 MW
ield Measurements	Fresh	Marine	21/5/10	17/8/10	30/11/10	23/2/11	24/5/11	24/8/11	3/11/11	1/2/12	31/5/12	10/8/12 2	1/11/12	18/2/13	31/5/13	30/8/13	27/11/13	7/2/14	6/5/14	1/8/14	17/11/14	26/2/15	27/5/15	24/8/15	4/11/15	16/2/16	31/5/16	12/8/16	10/11/16	20/2/17	18/5/17	17/8/17	30/11/17	8/2/18	24/5/18	22/8/18	16/11/18	12/2/19	28/5/19	28/8/19	22/11/19	14/2/20	28/5/20	13/8/20	J 6/11/2	0 1/2
Fround Level (m AHD)																																1 695														
enth to Groundwater (m AHD)			0 405	0.485	0.955	0 495	0 405	0.375	0.345	0 265	0.375	0.385	0 785	0.965	0.505	0.315	0.375	0.265	0.635	0 705	0 445	0.515	0.575	0.325	0.375	0.355	0.525	0.405	0.825	0.335	0.635	0.415	0.555	0 285	0.585	0.355	0.255	0.375	0.455	0.805	0.405	0.655	0 705	1 295	0.725	5 10
roundwater depth (m bTOC)			2 25	2 17	17	2 16	2 25	2.28	2.31	2.39	2.28	2 27	1.87	1.69	2 15	2.34	2.28	2.39	2.02	1.95	2 21	2 14	2.08	2.33	2.28	2.3	2 13	2 25	1.83	2.32	2.02	2 24	2 10	2 37	2.07	2.30	2 4 0	2.28	22	1.85	2 25	2	1.95	1.36	1.93	11
eight of Stick up (m)			0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0'
			1.29	1.21	0.74	1.2	1.29	1.32	1.35	1.43	1.32	1.31	0.91	0.73	1.19	1.38	1.32	1.43	1.06	0.99					1.32			1.29		1.36		1.28	1.14	1.41	1.11	1.34	1.44	1.32	1.24	0.89	1.29	1.04	0.99	0.4	0.97	0.
(field)	6.5-8.0 (a)	8-8.4 (a)	5.1	5.2	5.7	6.1	6.2	6.3	6.4	6	6.1	5.4	5.7	6.2	5.5	6.2	5.7	5.6		5.2			5.9	6.4	6.1	5.6	4.9	5.6	5.8	5.3	5.6	5.2	6.2	4.6	5.4	6.2	6.2	6.3	6.6	5.6	6.7	6.1	6	7.4	6.8	6
mperature (T deg C)			-				-			-								-																						-			1		-	-
ctrical Conductivity (mS/cm)	0 125-2 2 (a)		18.6	16.2	0 178	6.12	4.05	1.67	3.83	6.26	34	8	12.1	7 05	73	1080	4 73	8 28		15.5	4.62	7.85	42	1 73	1.59	6.37	22.6	9	6.89	117	11	13.8	3.03	33.1	27.2	15	12.6	10.2	11.5	23.3	5.77	15.1	19.7	18	3.98	7
			-	-	-	-	-	-	-	-	-				-	-		-															0.00					-				-			-	-
	8.5-11.0 (a)	9.0-10.0 (a)	2.41	3.32	5.13	9.66	2.66	1.56	6.61	2.58	2.16		1.8	1.63	2.05	1.97	2.25	2.15		3.1			2.11	1.8	1.99	2	2.97	2.02	2.23	3.6	2.62	4.45	4.43	3.47	3.41	4.53			4.74	19	3.54	6.7	5.04	2.75	3.77	4.
					53.30							12.4						-		33.5																										
	6-50 (a)	0.5-10 (a)	-				-			-						-		-																												
			-				-	111		-						38		-		206				-30				65.0				144				179				89.5				107		
mments			nc	nc		nc		-	-		nc		nc	nc	nc		nc	nc																												
dium			-				-		-									-																												
																13																														
			-		10				-							6		-																												
			-		15				-							14		-						23																						_
			-			-	-			-							-	-		6060																										_
					51	103	102	93	60		79	28				53				7							5																			
					51	103	102	93	60	64	79	28				53				7							5																			
			<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	20	<1		<1	<1	36			<1	<1		<1	<1	<1			<
			-		30		-	121		-		471				37		-																		524				1320				53		_
			-			-	-			-						-	-	-																												_
			-			-	-			-						-	-	-																												_
			-	-		-	-	-	-	-						-	-	-																						_						_
			-		6.2	-	-			-								-																												_
anganese			-	-	0.005	-	-		-	-					-			-																									_			_
	0.7 (7)		0.06	0.17	0.93	0.48	< 0.01			<0.01						<0.10				0.09																										
			< 0.01	< 0.01	<0.50	0.01	< 0.01			<0.01						<0.10				<0.01																										
															0.07																															
	0.5 (5)	0.12 (6)				3.2	4.30				3		2.7	2.3	6				2.5		3.7	4.9	5.6		2.2	1.7	2.5		5.3	17.4	6.1		15.7	9.4	11.4						7.3	5.9	4.4		3.9	3.
AX2 C2 OM Invi Invi Invi Invi Invi Invi Invi																																														
Image and bits Image and bits <																																														
	0.05(7)	0.025 (7)	0.11	0.52	<1.00	0.31	0.25	0.44	0.25	0.12	0.07	0.3	0.06	0.06	0.32	0.2	0.07	0.47	0.14	0.16	0.29	0.32	0.16	0.31	0.07	0.06	0.16	0.42	0.40	1.52	0.47	0.35	1.18	0.64	0.60	0.09	0.32	0.19	0.35	0.14	0.19	0.15	<0.05	0.16	0.21	<0.1

GW-1 Summary Groundwater (MW-11)

Exceeds ANZECC (2000) guidelines 35 marine/fresh water ecosystems Focus of this monitoring report nc = no comment NA = not available

Trigger value for indicative interim working level only (IMA).
 Toger value for indicative interim working level only (IMA).
 Toger value for totals for Notal Nitogen in marine ecceptions in NSW.
 Toger value for totals Nitogen (No) for marine ecceptions in NSW.
 Toger value for totals Nitogen (No) for marine ecceptions in NSW.

Sample ID	ANZECO	. 2000	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1	ML-1														
Field Measurements	Fresh	Marine	10/07/03	22/10/03	2/02/04	13/05/04	13/07/04	26/10/04	16/02/05	29/06/05	30/08/05	23/11/05	27/02/06	31/05/06	31/08/06	28/11/06	27/02/07	23/05/07	22/08/07	21/11/07	22/02/08	29/05/08	25/08/08	19/11/08	2008-2016	2016-2018	28/05/19	28/08/19	22/11/19	14/02/20	28/5/20	13/8/20	6/11/20	1/2/21
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.93	7.85	7.58	7.59	7.15	4.31	7.41	6.42	7.13	7.42	7.2	6.45	6.29	6.27	6.9	7.68	5.82	7.09	6.91	6.49	6.5	7.1	No Access	No access	No access		6.8	6.1	4.6	6.5	6.6	6.4
Temperature			12.75	21.66	22.54	17.36	13.33	19.15	18.89	13.65	16.71	19.18	23.57	11.57	15.92	22.4	22.48	11.93	13.53	23.93	20.87	15.26	15.1	20.5		(Cleary Bros.								
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		1.2	40	13	36.7	13.6	0.4	4.2	4.5	1.941	11.12	36.76	45	9.616	25.73	10.63	10.93	1.388	12.93	1.292	3.591	3.7	9.67		Land) No samples			41.7	1.28	3.38	0.15	1.96	32.8
Eh (ORP) (mV)	0.120 2.2 (u)		-67	nm	nm	nm	nm	nm	nm	-23	nm	nm	nm	nm	nm	nm	nm	76		taken			31.0	1.20	0.00	83.9	1.00	02.0						
Salinity (ppt)			0.65	25.53	7.48	23.16	7.93	0.21	2.22	2.4	0.99	6.35	23.27	29.03	5.43	15.73	6.03	6.23	0.7	7.43	0.7	2.37	2.5	nm								00.0		
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9 0-10 0 (a)		6.2	3.8	2	0.5	0.8	5.1	7.8	8.97	8.26	2.34	5.83	14.29	6.81	4.67	7.88	8.93	5.69	5.36	5.25	7.9	nm					316	11	3.79	4.91	2.72	1.48
Dissolved Oxygen (%)	5.5 · · · · (4)		45	82.4	42.6	24.1	5.7	8.3	55.2	64.9	92.8	92.7	31.5	64.4	149.4	86	54.4	74.2	86.1	70.5	60.2	64.9	79	55										
Turbidity (NTU)	6-50 (a)	0.5-10 (a)		29.3	28	24.8	22.3	13.8	12.4	10.8	10.7	1.9	12.1	17.5	40.3	3.9	15.6	4	47	5.3	25.5	3.9	4.9	nm										
Laboratory Analyses																																		
Sodium (ICP)			156	9695	2890	8881	2325	41	733	686	396	218	6700	8600	1200	<1	1600	1500	160	2100	150	1200	520	1300							112	17	119	
Potassium (ICP)			8.3	362	122	374	115	8.8	32	33	22	9.4	240	400	83	2.7	76	80	10	96	9.4	53	25	54								3		
Calcium (ICP)			34	212	106	207	115	13	44	46	45	98	280	150	83	330	65	81	29	81	33	130	50	73								4		
Magnesium (ICP)			28	-	318	994	305	9.4	93	97	50	28	830	940	160	0.06	200	220	32	280	26	160	63	160								3		
Chloride							-	-	-		-	-	-		-		-	-	-	-	-	-	-	-										
Alkalinity (as CaCO3)			235	120	130	119	120	18	75	9.2	74	30	157	100	91	98	53	91	-	120	69	<2	64	90					134	21	<1	17	50	76
Sulphate (SO4)			-	-	-	-	-	-	-	-			-	-	-	0.013	-	-	-	-	-	-	-	-										
pH			-	-	-	-	-	-	-	-		-	-		-	-	-		-	-	-	-		7										
Redox Potential (mV)			-	-	-		-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	160										
Total Dissolved Solids (TDS)			12692	32132	6716	19936	8866	220	2304	2404	2032	7664	26108	32000	5600	31000	6600	7500	728	7500	840	2400	2100	6400					28200	527	2040	88	1150	23300
Total Suspended Solids (TSS)			-	47	5	11	14	31	6	18	9	22	22	66	21	93	19	22	11	-	-	-	-	-										
Metals (mg/L)														i		-		-																
Iron (ICP)	0.3 (1)		0.21	0.12	0.18	< 0.002	0.28	3.5	0.072	0.29	0.06	0.33	0.03	2.1	2.7	0.14	0.08	0.41	0.39	0.51	2.5	1.5	0.47	0.7								0.54		
Manganese (ICP)	1.90		0.15	0.028	0.02	0.02	0.027	0.49	0.007	0.29	<0.01	0.06	0.084	0.03	0.1	0.03	0.05	0.1	0.16	0.037	0.14	0.14	0.08	0.06								0.011		
Nutrients (mg/L)																																		-
Nitrate (NO3 as N)	0.7 (7)		0.03	0.49	0.08	0.19	0.06	0.1	0.04	0.069	<0.04	<0.04	<0.04	0.14	<0.04	0.14	0.16	0.06	0.11	0.07	<0.04	-	-	0.05					0.03	<0.01	0.05	0.1	0.01	0.03
Nitrite (NO2 as N)			<0.02	0.09	<0.02	0.09	< 0.02	<0.02	<0.02	0.016	0.015	0.028	0.022	0.011	0.004	0.06	0.012	0.004	0.03	0.031	0.012	-	-	0.01					0.06	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.05	0.61	1.4	1.5	2.2	<0.02	0.71	<0.02	0.21	0.45	2.1	0.4	1.3	0.49	0.05	0.69	<0.10	1.3	0.31	1.5	0.22	<1					0.47	0.15	0.1	0.03	0.15	0.37
Total Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12 (6)	0.38	0.92	1.6	1.6	2.9	1.1	0.94	0.62	0.86	0.94	3.1	1.1	2.3	2.7	0.83	1.4	0.57	1.7	1.3	2.2	0.93	0.8					<0.5	2.3	0.6	0.6	0.6	1.4
Total Organic Carbon (TOC)			6	1	1	<1	3	27	18	9	7	3	<1	NR	8	<1	5		8	11	16	10	10	-										
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	0.02	< 0.002	< 0.002	0.11	0.05	0.24	0.004	0.023	< 0.002	< 0.005	0.019	< 0.005	0.015	0.013	0.049	0.005	0.39	0.015	<0.05	0.01	< 0.005	<0.05					0.16	0.26	<0.01	0.1	0.02	<0.05
Biological (CFU/100 ml)	r		-		-	-							r					1						-										⊢
Enterococcus	35 (8)	35 (8)	<1	12	400	4 (app)	40	90	90	<1	38	120	36	30 (app	20 (app)	20 (app)	1500 (app)	72 (app)	<2	20	102	33	2 (app)	18 (app)										
Thermotolerant (Faecal) coliforms	150 (8)	150 (8)	<1	4	14 (app)	6 (app)	12 (app)	250	20 (app)	2	72	30	16	12 (app	20 (app)	<2	1800(app)	12 (app)	<2	128	24	23	10	20										

Exceeds ANZECC (2000) guidelines 0.054

Focus of this monitoring report nm = not measured (app) = approximately NR = no result

Notes:

Trigger value is an indicative interim working level only (IWL).
 Amonoia trigger value pecified at pit = 8.0, for a 95% protection level, is corrected for an average pit = 7.3.
 Trigger value for oxides of Ntrogen (NOx) of to velocit rivers in NSW.
 Trigger value for oxides of Ntrogen (NOx) of to relative accouptems in NSW.
 Trigger value for total Ntrogen in Noviand rivers in NSW.

6. Trigger value for total Nitrogen in marine ecceystems in NSW. 7. Trigger value for a 95% Protection level 8. Guidelinefor water quality and aesthetics: Primary Contact a. Reference only, not diritectly applicable to groundwater.

Table SW-1: Summary Analytical Results for Surface Water (ML-2)

Gerroa Waste Disposal Depot (2016 to 2021)

Sample ID	ANZECC, 2000	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2	ML-2
Field Measurements	Fresh Marine	31/5/16	12/8/16	10/11/16	20/2/17	18/5/17	17/8/17	29/11/17	8/2/18	24/5/18	22/8/18	16/11/18	12/2/19	28/5/19	28/8/19	22/11/19	14/2/20	28/5/20	13/8/20	6/11/20	1/2/21
pH (field)	6.5-8.0 (a) 8-8.4 (a)	6.9	6.8	7.1	7.2	7.1	6.7	7.3	7.2	7.1	7.2	7.0	7.4	7.3	7.5	6.9	6.3	4.9	6.4	7.1	6.6
Temperature																					
Electrical Conductivity (mS/cm)	0.125-2.2 (a)	43.2	5.24	47.3	30.1	15.3	29.1	30.8	41.8	47.2	43.6	34.8	45.4	43.6	51.2	46	2.91	5.43	0.449	22	34.7
Eh (ORP) (mV)			1.0				132				229								144		
Salinity (ppt)																					
Dissolved Oxygen (mg/L)	8.5-11.0 (a) 9.0-10.0 (a)	4.82	5.66	4.73	4.87	6.38	4.90	3.21	3.25	3.25	5.72			6.76	3.43	2.87	0.87	4.47	5.08	5.59	3.2
Dissolved Oxygen (%)																					
Turbidity (NTU)	6-50 (a) 0.5-10 (a)																				
Laboratory Analyses																					
Sodium (ICP)			922				4750				7660				11200			112	64		
Potassium (ICP)			35				180				272				412				5		
Calcium (ICP)			63				246				316				427				6		
Magnesium (ICP)			104				525				914				1360				8		
Chloride																					
Alkalinity (as CaCO3)		118	110	109	139	136	120	<1	<1	<1	111	114	116	106	102	128	24	<1	15	111	105
Sulphate (SO4)		118		109	139	136		153	145	121											
pH		<1		<1	<1	<1		153	145	121											
Redox Potential (mV)																					
Total Dissolved Solids (TDS)		33200	3070	33100	19400	9970	18800	21200	15800	27200	28600	24300	35800	27800	38000	31000	1480	3140	245	13800	24800
Total Suspended Solids (TSS)																					
Metals (mg/L)																					
Iron (ICP)	0.3 (1)		1.07				0.88				0.18				0.14				0.65		
Manganese (ICP)	1.90		0.042				0.028				0.012				0.019				0.012		
Nutrients (mg/L)																					
Nitrate (NO3 as N)	0.7 (7)	0.13	0.16	0.06	<0.01	0.02	0.31	0.01	<0.01	0.06	0.15	0.02	0.02	0.06	0.01	<0.01	<0.01	<0.01	0.1	0.06	0.06
Nitrite (NO2 as N)		<0.01	0.02	<0.01	<0.01	0.04	0.04	0.04	<0.01	0.01	0.02	<0.01	<0.01	0.04	<0.01	<0.01	< 0.01	<0.01	<0.01	0.02	<0.01
Ammonia (NH3 as N)	1.88 (2) 2.84 (2)	0.11	1.16	0.16	0.78	1.21	0.32	0.16	<0.05	<0.10	0.17	0.65	0.29	0.26	0.12	0.03	0.27	0.13	0.06	0.51	<0.01
Total Kjeldahl Nitrogen (TKN)	0.5 (5) 0.12 (6)	0.5	1.9	<0.5	1.0	2.3	0.5	0.8	<0.5	<0.5	<0.5	0.7	<0.5	0.5	<1.0	<0.5	2	0.6	0.7	0.9	0.8
Total Organic Carbon (TOC)												3.45	7.59								
Total Phosphorus (TP)	0.05 (7) 0.025 (7)	0.06	0.04	<0.05	0.09	0.04	<0.05	< 0.05	<0.05	<0.05	<0.05	0.04	0.20	<0.05	0.16	0.24	0.24	<0.01	0.09	0.08	<0.05
Biological (CFU/100 ml)																					
Enterococcus	35 (8) 35 (8)		28				44				~5										
Thermotolerant (Faecal) coliforms	150 (8) 150 (8)		18				~94				~1										

Exceeds ANZECC (2000) guidelines 0.054

1. Trigger value is an indicative interim working level only (IIWL).

Focus of this monitoring report nm = not measured (app) = approximately NR = no result

Trigger value for inclusive initial in volving lave Unit (invt.).
 Ammonia trigger value at pH = 6, 95% protection, corrected are pH=7.3.
 Trigger value for oxides of Nitrogen (NOX) for invine in NSW.
 Trigger value for total Nitrogen (NOX) for marine ecosystems in NSW.

6. Trigger value for total Nitrogen in marine ecosystems in NSW.

Trigger value for a 95% proetcion level.
 Guidelinefor water quality and aesthetics: primary contact.
 Reference only, not dirtectly applicable to groundwater.

Gerroa	Waste	Disposal	Depot	(2003 to 2021)	

Sample ID	ANZEC	C, 2000	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3	ML-3
Field Measurements	Fresh	Marine	22/10/03	2/02/04	13/05/04	13/07/04	26/10/04	2004-2014	2015-2016	2016-2018	28/05/19	28/08/19	22/11/19	14/02/20	28/5/20	13/8/20	6/11/20	1/2/2*
pH (field)	6.5-8.0 (a)	8-8.4 (a)	7.63	7.42	7.65	7.26	4.25	No access	No access	No access	No Access	No Access	6.7	6.1	4.6	6.4	6.4	6.4
Temperature			20.5	21.34	13.03	13.16	18.75	(Cleary Bros.	(Cleary Bros.	(Cleary Bros.								
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		13.1	5.3	3.1	8.5	0.4	Land) - no samples taken	Land) - no samples taken	Land) - no samples taken			34.4	0.882	2590	110	1780	2820
Eh (ORP) (mV)	0.120-2.2 (a)		nm	nm	nm	nm	nm	18/02/2009; 19/05/2009;	31/05/2013; 30/08/2013;				04.4	0.002	2000	118	1700	2020
Salinity (ppt)			7.53	2.85	1.62	4.72	0.21	27/08/2009; 2	27/11/2013 an							110		
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	4.6	4.5	2.2	0.8	1.2						1.34	1.09	3.89	4.87	5.57	1.7
Dissolved Oxygen (%)			52.9	41.1	24	7.6	12.2											
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	30.1	27.1	21.5	20.6	15.1	1										
Laboratory Analyses								1										
Sodium (ICP)			-	-	-	-	-	1								12		
Potassium (ICP)																3		
Calcium (ICP)					-		-									4		
Magnesium (ICP)				-												2		
Chloride				-	-	-												
Alkalinity (as CaCO3)													118	33	<1	13	43	73
Sulphate (SO4)				-	-	-												
pH			-	-	-	-	-											
Redox Potential (mV)			-	-	-	-	-											
Total Dissolved Solids (TDS)			-		-	-	-						22800	602	1390	82	982	1600
Total Suspended Solids (TSS)			-	-	-	-	-											
Metals (mg/L)	1	1		1	1		1											
Iron (ICP)	0.3 (1)				-		-									0.57		
Manganese (ICP)	1.90			-	-	-	-									0.01		_
Nutrients (mg/L)						r	r											
Nitrate (NO3 as N)	0.7 (7)		-	-	-	-	-	4			L		<0.01	<0.01	0.04	0.1	<0.01	<0.0
Nitrite (NO2 as N)			-	-	-	-	-	4			L		<0.01	<0.01	<0.01	<0.01	<0.01	<0.0
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.08	0.04	0.08	0.07	0.03	4			L		0.16	0.17	0.06	0.02	0.14	0.34
Total Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12 (6)	-	-	-	-	-	4					<0.5	2.3	0.6	0.6	0.6	1.1
Total Organic Carbon (TOC)			-		-	-	-	4										
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	-	-	-	-	-	4					0.32	0.36	<0.01	0.1	0.02	0.13
Biological (CFU/100 ml)		1			1		1	4										-
Enterococcus	35 (8)	35 (8)	10	390	72	60	140											-
Thermotolerant (Faecal) coliforms	150 (8)	150 (8)	16	32 (app)	50	18 (app)	220	1										

Exceeds ANZECC (2000) guidelines 0.054 Notes:

1. Trigger value is an indicative interim working level only (IIWL).
 Focus of this monitoring report
 2. Ammonia trigger value specified at pH = 8.0, 95% protection level, corrected pH = 7.3.

 nm = not measured (app) = approximately NR = no result
 3. Trigger value for oxides of Nitrogen (NOx) for lowland rivers in NSW.
 4. Trigger value for oxides of Nitrogen (NOx) for marine ecosystems in NSW. 5. Trigger value for total Nitrogen in lowland rivers in NSW.

6. Trigger value for total Nitrogen in marine ecosystems in NSW.

7. Trigger value for a 95% Proetction level

8. Guidelinefor water quality and aesthetics: Primary Contact

a. Reference only, not dirtectly applicable to groundwater.

Sample ID	ANZEC	C. 2000	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4	ML-4
Field Measurements	Fresh	Marine	10/07/03	22/10/03	2/02/04	13/05/04	13/07/04	26/10/04	16/02/05	29/06/05	30/08/05	23/11/05	27/02/06	31/05/06	31/08/06	28/11/06	27/02/07	23/05/07	22/08/07	21/11/07	22/02/08	29/05/08	25/08/08	19/11/08	2008-2019	22/11/19	14/02/20	28/5/20	13/8/20	6/11/20	1/2/21
pH (field)	6.5-8.0 (a)	8-8.4 (a)	6.99	7.66	7.77	7.7	17.24	4.26	7.33	6.48	7.22	7.67	7.43	6.58	6.42	6.04	6.76	7.6	5.86	7.19	6.94	6.64	6.8	7.07	No access	6.7	6.2	4.7	6.4	6.5	6.3
Temperature			12.7	19.99	21.72	12.68	12.43	18.66	19	13.77	16.62	18.86	22.14	12.58	15.36	20.6	22.61	14.2	13.56	23.26	20.85	14.86	14.3	20							
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		1.2	13.3	5.4	3.2	8.1	0.4	2.7	4.4	1.98	5.547	10.24	15.62	5.126	13.68	10.9	24.37	1.381	9.749	1.825	1.533	1.7	5.49		40.2	1.04	3.09	0.125	1.9	30.3
Eh (ORP) (mV)			-67	nm	nm	nm	nm	nm	nm	-172	nm	89					102		+												
Salinity (ppt)			0.63	7.63	2.93	1.7	4.48	0.21	1.44	2.33	1.01	3.01	5.79	9.15	2.77	7.92	6.19	14.84	0.7	5.49	1.01	0.97	1.1	nm							
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	5.1	4	4.1	2.5	0.6	0.5	4.6	7.4	9.48	8.26	5.06	6.3	14.45	7.36	5.02	4.71	8.19	5.31	4.88	5.11	8.2	nm		1.86	1.29	3.82	4.9	2.41	1.87
Dissolved Oxygen (%)			46.5	46.1	47.6	23.3	6.6	4.9	50.3	71.6	97.9	90.4	60	62.7	146.8	85.8	58.3	46.2	79	64.2	54.9	63.2	81	46							-
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	17.3	28.8	28.4	22.7	20.4	14.7	26	32.8	10.5	1	3.2	20.2	31.6	2.8	14.4	5.6	4.7	0	30.5	1.1	4.6	nm							
Laboratory Analyses					r	1							r			r	r		r	1		1		r							
Sodium (ICP)			152	2612	1080	584	1589	40	461	677	219	907	3600	2500	670	3	1700	3600	150	1500	230	440	200	740					14		
Potassium (ICP)			8	103	48	26	57	9.3	23	33	13	38	230	130	39	0.75	75	160	10	70	14	20	11	30					3		
Calcium (ICP)			34	121	62	50	90	13	38	47	39	66	180	67	59	160	66	120	29	70	36	100	40	67					4		
Magnesium (ICP)			28	-	119	76	174	9.2	61	95	34	122	450	290	85	0.008	210	500	32	210	36	64	34	96					3		
Chloride			-	-	-			-	-		-	-	-	-			-				-	-	-	-							
Alkalinity (as CaCO3)			282	93	108	83	95	14	60	11.5	71	49	119	15	63	83	52	100		90	97	<2	61	80		124	16	<1	12	45	72
Sulphate (SO4)																0.017						-									
pH			6.5								-											-		7.2							
Redox Potential (mV)			-	-	-			-			-	-	-				-		-			-	-	170							
Total Dissolved Solids (TDS)			744	8944	3480	1892	5176	160	1532	2496	1232	4236	13124	9400	3100	17000	6700	17400	602	6400	1000	1100	990	3100		26100	603	1920	86	1030	18000
Total Suspended Solids (TSS)				48		2	7	40	15	36	8	12	9	56	18	43	16	13	15												
Metals (mg/L)																															
Iron (ICP)	0.3 (1)		0.23	2.9	0.39	0.27	0.2	3.4	0.095	0.1	0.05	0.28	0.05	3.2	2.4	< 0.04	0.06	0.36	0.4	0.22	2.9	0.68	0.43	1.3					0.62		
Manganese (ICP)	1.90		0.15	0.096	0.007	0.04	0.032	0.48	<0.001	0.29	<0.01	0.06	0.053	0.1	0.1	0.03	0.05	0.06	0.16	0.017	0.12	0.04	0.09	0.08					0.011		
Nutrients (mg/L)		1																													
Nitrate (NO3 as N)	0.7 (7)		0.04	0.03	0.12	<0.02	0.08	0.04	0.02	0.075	< 0.04	<0.04	< 0.04	1.4	< 0.04	190	0.16	0.09	0.1	0.05	< 0.04			0.05		< 0.01	< 0.01	0.04	0.1	< 0.01	< 0.01
Nitrite (NO2 as N)	0.7 (1)		<0.04	<0.02	<0.02	0.02	<0.02	<0.04	<0.02	0.019	0.01	0.003	0.008	0.016	0.003	4600	0.012	0.007	0.02	0.011	0.04			<0.03		0.02	<0.01	<0.04	<0.01	<0.01	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.04	0.02	<0.02	<0.02	0.02	<0.02	0.21	<0.019	<0.01	0.003	0.008	0.016	0.003	<0.1	0.012	1.5	0.02	<0.02	1.7	<0.10	0.27	<1		0.52	0.18	0.06	0.02	0.15	0.34
	0.5 (5)	2.04 (2)	0.04	0.02	0.75	0.48	0.06	2.1	0.21	0.66	0.62	0.05	1.3	0.29	1.4	0.75	0.83	2.3	0.37	0.49	2.9	0.53	0.27	0.8		0.52	2.2	0.6	0.02	0.15	1.1
Total Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12(0)	0.3/	0.15	0.75	0.40	0.7	2.1	10	00.00	10	6	1.3	NR	1.4	3	0.63	2.3	0.44	0.49	2.9	10		0.0		v.0	4.4	0.0	0.0	3.6	1.1
Total Organic Carbon (TOC) Total Phosphorus (TP)	0.05(7)	0.025 (7)	<0.002	0.049	3 0.036	8 <0.002	<0.002	0.3	10	9 0.04	<0.002	<0.005	2 0.029	0.098	10	3 0.017	0.036	0.008	0.44	0.019	0.05	<0.005	10	<0.05	4	0.22	0.31	<0.01	0.09	0.02	< 0.05
1 1 1	0.05 (7)	0.025 (7)	~u.002	0.049	0.036	×0.002	×0.002	0.3	0.021	0.04	~0.002	~0.005	0.029	0.098	0.01	0.017	0.036	0.008	0.44	0.019	0.05	×0.005	×0.005	×0.05	1	0.22	0.31	×0.01	0.09	0.02	<0.05
Biological (CFU/100 ml)	1	1	-			-		-					1			1				1					1						+
Enterococcus	35 (8)	35 (8)	<1	10	320	60	72	100	180	<1	52	160	100	80	60	30 (app)	1800(ap)	230	<2	32	70	18	8 (app)	14 (app)	4						<u> </u>
Thermotolerant (Faecal) coliforms	150 (8)	150 (8)	<1	15	28 (app)	44	20 (app)	240	24 (app)	<1	64	25	60	112	30 (app)	14 (app)	2000	12 (app)	<2	16 (app)	16 (app)	15	13	16 (app)							

Exceeds AVZECC (2000) guidelines 0.654 Focus of this monitoring report rm = nd measured (app) = approximately NR = no result. 1. Trigger value is an indicative interim working level only (IWL). 2. Ammonia trigger value of this Mitogen (NOX) of rowand rivers in NSW. 3. Trigger value for coaldes of Mitogen (NOX) of rowand rivers in NSW. 3. Trigger value for total Mitogen in Iowand rivers in NSW.

6. Trigger value for total Nitrogen in marine ecosystems in NSW. 7. Trigger value for a 95% protection level. 8. Guidelinefor water quality and aesthelics: primary contact a. Reference only, not directly applicable to groundwate

Sample ID	ANZEC	2000	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5	ML-5
Field Measurements	Fresh	Marine	27/11/13	7/2/14	6/5/14	18/8/14	17/11/14	26/2/15	27/5/15	24/8/15	4/11/15	16/2/16	31/5/16	12/8/16	10/11/16	20/2/17	18/5/17	17/8/17	29/11/17	8/2/18	24/5/18	22/8/18	16/11/18	12/2/19	28/5/19	28/8/19	22/11/19	14/2/20	28/5/20	13/8/20	6/11/20	1/2/21
oH (field)	6.5-8.0 (a)	8-8.4 (a)	7.2		6.5	6.7	6.4	6.1	6.9	7.3	7.1	6.8	6.6	6.9	7.0	7.0	7.0	67	71	7.0	6.8	7.0	6.7	6.8	6.9	7	6.8	6.4	47	62	6.7	6.5
lemperature																																
Electrical Conductivity (mS/cm)	0.125-2.2 (a)		4.26	-	26.8	12.9	26.8	0.357	1.21	2.38	1.82	9.9	36.6	1.22	47.1	14.4	10.6	17.3	14.9	40.2	44.4	39.5	19.4	32.7	36.9	48.8	41	1.42	3.85	0.223	2.44	35.6
Electrical Conductivity (ms/cm)	0.123-2.2 (a)		4.20		20.0	208	20.0	0.337	1.21	2.30	1.02	9.9	30.0	1.22	47.1	14.4	10.0	17.5	14.9	40.2	44.4	204	19.4	32.7	30.9	40.0	41	1.42	3.03	104	2.44	33.0
Salinity (ppt)			-	-		200																204				30.1				104		
Dissolved Oxygen (mg/L)	8.5-11.0 (a)	9.0-10.0 (a)	6.65		5.55	6.2	5.6	5.3	5.2	7.34	3.83	5.1	3.43	4.87	3.43	5.48	5.15	5.37	3.09	2.66	2.92	4.29			5.57	3.36	2.39	1.02	4.11	4.8	3.75	2.06
Dissolved Oxygen (%)	0.0 1.10 (0)					63.3					0.00							0.07	0.00	1 2.00												
Turbidity (NTU)	6-50 (a)	0.5-10 (a)	-	-																												
Laboratory Analyses																																
Sodium (ICP)			-	-		2980				379				162				2580		1		7900				10400				29		1
Potassium (ICP)				-		138				19				10				108				290				387				3		
Calcium (ICP)			-	-		154				42				33				155				336				406				5		
Magnesium (ICP)			-	-		363				49				24				318				924				1250				4		
Chloride			-	-																												
Alkalinity (as CaCO3)			112		138	105	157	15	60	134	134	102	118		106	121	159		195	168	118	121	107	124	118	102	174	20	<1	13	65	76
Sulphate (SO4)			-	-																												
pH			-	-									6.6		7.0	7.0	7.0		7.1	7.0	6.8											
Redox Potential (mV)			-	-						95				38.0				118														
Total Dissolved Solids (TDS)			2510		21400	8160	18500	281	538	1370	1270	6860	24000		25800	8900	6540		8840	20600	31300	27500	12000	26200	25500	36500	28800	736	2180	135	1330	15500
Total Suspended Solids (TSS)				-						T											Т											
Metals (total, mg/L)																																
Iron (ICP)	0.3 (1)		-	-		0.6				2.09				1.15				0.32				0.23				<0.10				0.62		
Manganese (ICP)	1.90		-	-		0.04				0.032				0.052				0.034				0.020				0.035				0.011		
Nutrients (mg/L)																																
Nitrate (NO3 as N)	0.7 (7)		0.05	0.02	0.01	0.15	0.03	0.05	0.04	0.22	0.06	<0.01	0.14	0.21	0.04	0.02	<0.01	0.35	0.08	0.01	0.11	0.37	0.03	0.05	0.12	0.09	0.01	<0.01	0.02	0.1	0.01	<0.01
Nitrite (NO2 as N)			0.02	0.15	0.1	0.04	0.24	<0.01	0.01	0.02	0.02	0.02	0.01	<0.01	<0.01	< 0.01	0.05	0.05	0.17	0.03	0.03	0.07	0.02	0.03	0.08	<0.01	0.09	<0.01	<0.01	< 0.01	0.02	<0.01
Ammonia (NH3 as N)	1.88 (2)	2.84 (2)	0.52	2.6	1.73	0.68	3.5	0.07	0.83	2.39	1.65	1.24	0.20	1.63	0.27	1.20	2.82	0.85	1.68	1.26	<0.10	1.06	2.72	0.77	0.75	0.07	1.93	0.18	0.12	0.04	0.61	0.34
fotal Kjeldahl Nitrogen (TKN)	0.5 (5)	0.12 (6)	0.6	2.7	2	1.2	4.3	1.6	1.7	2.6	2.7	2.5	0.5	2.4	1.4	1.9	4.2	1.1	2.4	1.9	<0.5	<1.0	3.2	1.1	0.9	<1.0	2.1	2.0	0.6	0.7	1.0	1.0
Total Organic Carbon (TOC/ DOC)			-	-															1				2.75	4.23								
Total Phosphorus (TP)	0.05 (7)	0.025 (7)	0.01	0.03	0.22	0.05	0.09	0.2	0.11	0.06	0.03	0.03	0.10	0.04	0.06	0.07	0.06	<0.02	0.08	< 0.05	0.05	<0.05	0.02	0.06	<0.05	0.31	0.32	0.27	0.02	0.11	0.03	0.05
Biological (CFU/100 ml)	1								1	1	1	1	1	1	1			1		1	1		I									+
Enterococcus	35 (8)	35 (8)	-	-		130				240				18				~8		1		~1										<u> </u>
l'hermotolerant (Faecal) coliforms	150 (8)	150 (8)	-	-		220				1100				21				~6	1	1		<1				1						1

Exceeds ANZECC (2000) guidelines 0.054

Trigger value is in indicative interim working level only (IIWL).
 Ammonia trigger value at pH =8, 95% protection.corrected ave pH=7.3.
 Trigger value for oxides of Nitrogen (NOx) for mainer ecosystems in NSW.
 A Trigger value for oxides of Nitrogen (NOx) for mainer ecosystems in NSW.
 Trigger value for total Nitrogen in lowland rivers in NSW.

6. Trigger value for total Nitrogen in marine ecosystems in NSW. Trigger value for a 95% proetcion level.
 Guidelinefor water quality and aesthetics: primary contact.
 a. Reference only, not dirtectly applicable to groundwater.

Focus of this monitoring report nm = not measured (app) = approximately NR = no result

Gerroa SW tables lab DP 11-3-21

Table 6: Groundwater and Surface Water Monitoring - 2020 to 2021 (EPL)



			G	roundwater	Wells & Blu	ie Angle Cre	ek				
Analytes	28/05/20	13/08/20	6/11/20	1/02/21	5/03/20	17/06/20	9/09/20	18/12/20	8/01/21	Detection Limit	Method Reference
			Р	hysical Pro	operties						
pH	Х	Х	Х	Х						0.01 pH unit	pH meter and probe/APHA4500-HB
Electrical Conductivity	Х	Х	Х	Х						0.01 mS/cm	Conductivity meter and probe
Dissolved Oxygen	Х	Х	Х	Х						0.0001	DO meter and probe
Redox (Orp)		Х								1 mV	Platinum electrode probe
Temperature										1 °C	Temperature meter and probe
Total Dissolved Solids	Х	Х	Х	Х						5 mg/L	Determined gravimetrically by drying (APHA 2540 C)
Suspended Solids										2 mg/L	APHA2540D
Turbidity										1 NTU	Turbidmeter
				Nutrien	nts						
Ammonia-nitrogen	Х	Х	Х	Х	Х	Х	Х	Х	Х	0.01 mg/L	FIA
Total Phosphorus	Х	Х	Х	Х						2 μg/L	FIA
Nitrate-nitrogen	Х	Х	Х	Х						10 µg/L	FIA
Nitrite-nitrogen	Х	Х	Х	Х						1 μg/L	FIA
Total Kjeldhal Nitrogen	Х	Х	Х	Х						50 µg/L	FIA
				Hydro-che	mical						
Calcium		Х								0.5 mg/L	USEPA 6010 A
Chloride		Х								0.5 mg/L	Titrated with mercuric nitrate using diphenol-carbazonel/xylene cyanol FF indicator
Fluoride		Х								0.1 mg/L	APHA4500-FC
Magnesium		Х								0.02 mg/L	USEPA 6010 A
Sulphate										1 mg/L	ICID/MS
Sodium		Х								0.05 mg/L	USEPA 6010 A
Bicarbonate/Alkalinity		Х	Х	Х						0.5 mg/L	APHA2340C
Potassium		Х								0.05 mg/L	USEPA 6010 A
			Or	ganic Conta	aminants						
Dissolved Organic Carbon		Х								0.50 mg/L	APHA 5310C
Total Organic Carbon										0.1 mg/L	APHA 5310C
-			Inor	ganic Cont	taminants	0		<u>n</u>		ž	
Iron		Х								1 μg/L	USEPA 6010 A
Manganese		Х								1 μg/L	USEPA 6010
			Biol	ogical Cont	taminants					-	
Thermotolerant (Faecal) coliforms MF										1cfu/100 ml	WMM 009 (~AS 4276.7 - 1995)
Enterococcus MF										1cfu/100 ml	WMM 013 (~AS 4276.9 - 1995)

Table 7: Gerroa Landfill Assessment- Ammonia Trends at Key Wells (9)



	Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	22/8/18	17/1/19	4/4/19	28/5/19	12/7/19	28/8/19	18/9/19	17/10/19	22/11/19	14/2/20	5/3/20	28/5/20	13/8/20	9/9/20	6/11/20	18/12/20	8/1/21	1/2/21
Well L	ocation	LOR	Fresh	Marine	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D	MW 1D
Ammor	nia as N	mg/L	1.88 (2)	2.84 (2)	13.0	8.18	8.58		15.0	15.5	20.5	27.3	34	24.9	35	27.8	30.9	44.1	27.8	23.3	21.1	32.5	16.4	22
	Wate	er Qual	ity Trend								\	ariable to	Rising Am	monia Trer	nd & above	Guideline	s (recently	decreasing)					

NOTE:	
(2) Ammonia trigger at pH = 8.0, for	or a 95% protection, corrected for average pH = 7.3.

Note

Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	22/8/18	17/10/18	16/11/18	6/12/18	17/1/19	12/2/19	4/4/19	28/5/19	12/7/19	28/8/19	18/9/19	17/10/19	22/11/19	14/2/20	5/3/20	28/5/20	13/8/20	9/9/20	6/11/20	18/12/20	8/1/21	1/2/21
Well Location	LOR	Fresh	Marine	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3	MW 3
Ammonia as N	mg/L	1.88 (2)	2.84 (2)	0.29	8.55	0.21	0.34	0.64	0.35	0.33	0.30	0.39	0.34	0.35	0.38	0.41	0.32	0.37	0.42	0.3	0.44	0.22	0.25	0.3	0.43	0.31	0.35
Wat	ter Qua	lity Trend																			Generally	stable & belov	w guidelines				

Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	22/8/18	17/10/18	16/11/18	6/12/18	17/1/19	12/2/19	4/4/19	28/5/19	12/7/19	28/8/19	18/9/19	17/10/19	22/11/19	14/2/20	5/3/20	28/5/20	13/8/20	9/9/20	6/11/20	18/12/20	8/1/21	1/2/21
Well Location	LOR	Fresh	Marine	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5	MW 5
Ammonia as N	mg/L	1.88 (2)	2.84 (2)	0.07	0.05	0.02	1.44	0.08	0.07	0.48	0.06	0.08	0.03	<0.01	0.08	0.05	0.04	0.05	0.04	0.02	0.07	<0.01	0.02	<0.01	0.18	0.02	<0.01
Wat	er Qua	lity Trend													Generally	y Stable & I	Below Guid	delines									

Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	22/8/18	17/1/19	16/11/18	6/12/18	17/1/19	12/2/19	4/4/19	28/5/19	12/7/19	28/8/19	18/9/19	17/10/19	22/11/19	14/2/20	5/3/20	28/5/20	13/8/20	9/9/20	6/11/20	18/12/20	8/1/21	1/2/21
Well Location	LOR	Fresh	Marine	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D	MW 6D				
Ammonia as N	mg/L	1.88 (2)	2.84 (2)	6.40	4.97	2.20	7.69	7.02	8.45	5.78	7.02	5.05	8.74	4.87	40	44.4	36.3	57	50	44.5	56	52.4	41.5	36.2	42.5	37.2	36.4
Wa	ter Qua	ity Trend												Variabl	le to Rising	Ammonia	trend & ab	ove Guidel	ines								

Date	ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	22/8/18	17/1/19	16/11/18	17/1/19	12/2/19	4/4/19	28/5/19	12/7/19	28/8/19	18/9/19	17/10/19	22/11/19	14/2/20	5/3/20	28/5/20	13/8/20	9/9/20	6/11/20	18/12/20	8/1/21	1/2/21
Well Location LOR	Fresh	Marine	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D	MW 7D				
Ammonia as N mg/L	1.88 (2)	2.84 (2)	1.58	0.74	0.15	0.63	0.91	1.72	2.08	1.32	2.36	0.8	20.5	17.9	13.7	20	21.4	14.8	21	18.3	19.2	17.4	18.1	18.5	16.8
Water Qua	lity Trend											:	Stable to ris	sing Ammo	nia trend 8	above gui	delines								

Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	22/8/18	17/1/19	16/11/18	17/1/19	12/2/19	4/4/19	28/5/19	12/7/19	28/8/19	18/9/19	17/10/19	22/11/19	14/2/20	18/12/20	5/3/20	28/5/20	13/8/20	9/9/20	6/11/20	8/1/21	1/2/21
Well Location	LOR	Fresh	Marine	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11	MW 11				
Ammonia as N	mg/L	1.88 (2)	2.84 (2)	3.17	6.05	5.35	5.79	2.26	2.24	2.14	1.60	2.2	1.9	1.15	47.4	5.3	4.24	4.01	1.31	5.79	2.55	17	2.15	1.34	0.97	0.43
Wat	er Qua	lity Trend												Generall	/ variable	& above/be	elow guide	lines								

Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	17/10/18	6/12/18	17/1/19	4/4/19	12/7/19	18/9/19	14/2/20	17/10/19	5/3/20	28/5/20	17/6/20	9/9/20	18/12/20	8/1/21	1/2/21
Well Location	LOR	Fresh	Marine	MW 12	MW12	MW12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12	MW 12
Ammonia as N	mg/L	1.88 (2)	2.84 (2)	29.8	24.5	27.5	31.7	23.0	34.4	33.1	44	57	35.9	46.9	57.7	55.9	37.5	42.3	38.9	46.7
Wat	er Qua	litv Trend								Generally	Stable to ir	ncreasing t	rend & abo	ve auidelin	es					

Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	17/10/18	6/12/18	17/1/19	4/4/19	12/7/19	18/9/19	14/2/20	17/10/19	5/3/20	28/5/20	17/6/20	9/9/20	18/12/20	8/1/21	1/2/21
Well Location	LOR	Fresh	Marine	MW 13	MW13	MW13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13	MW 13
Ammonia as N	mg/L	1.88 (2)	2.84 (2)	26.7	24.8	32.8	32.8	26.1	26.0	24.7	46.8	36.5	62	43.6	54.7	52.3	26.6	46.6	34.6	83.5
Water Quality Trend Generally rising ammonia trend & above guidelines (variable)																				

Date		ANZECC 2000	ANZECC 2000	15/6/18	12/7/18	17/10/18	6/12/18	17/1/19	4/4/19	12/7/19	18/9/19	14/2/20	17/10/19	5/3/20	28/5/20	17/6/20	9/9/20	18/12/20	8/1/21	1/2/21
Well Location	LOR	Fresh	Marine	MW 14	MW14	MW14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14	MW 14
Ammonia as N	mg/L	1.88 (2)	2.84 (2)	1.83	27.2	39.4	46.3	34.0	40.9	54.9	81.4	83	96.5	81.1	97.7	95.3	73.1	84.4	69.9	40.4
Wat	ter Qua	lity Trend							Generally	Increasing	ammonia	rend & abo	ove guidelin	ies (recent	ly decreasi	ng)				



Appendix A





CERTIFICATE OF ANALYSIS

Work Order	EW2003642	Page	: 1 of 11		
Client		Laboratory	Environmental Division NSV	N South Coast	
Contact	: MS JULIE MILEVSKI	Contact	: Aneta Prosaroski		
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North	Wollongong 2500	
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary Pl, North Nowra Australia NSW Australia	2541	
Telephone	: +61 02 4232 0557	Telephone	: +61 2 4225 3125		
Project	: Gerroa Landfill	Date Samples Received	: 13-Aug-2020 13:50	AMPUL.	
Order number	: 126590	Date Analysis Commenced	: 13-Aug-2020		
C-O-C number	:	Issue Date	24-Aug-2020 12:29		NATA
Sampler	: Duncan McIntosh			Hac-MRA	NATA
Site	: Gerroa Landfill				
Quote number	: WO/026/19			and an and a second second	Accreditation No. 825
No. of samples received	: 21			Accred	ited for compliance with
No. of samples analysed	: 21				ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ashesh Patel	Senior Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

Page	: 2 of 11
Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, 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 insufficient 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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

- ø = ALS is not NATA accredited for these tests.
- ~ = Indicates an estimated value.
- Analytical work for this work order will be conducted at ALS Sydney.
- EK057G: LOR raised for Nitrite, Nitrate and NOx on sample 2 due to sample matrix.
- ED041G: LOR raised for Sulfate on sample 2 due to sample matrix.
- TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EK055G/EK061G: It has been noted that Ammonia is greater than TKN for sample 6, however this difference is within the limits of experimental variation.
- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- ORP (Oxidation Reduction Potential) performed by ALS Wollongong via in-house method EA075FD and EN67 PK.
- Sampling and groundwater depth measurements completed by ALS Wollongong via inhouse sampling method EN/67.11 Groundwater Sampling.
- Sampling completed by ALS Wollongong in accordace with in-house sampling method EN/67.6 Rivers and Streams.
- Dissolved oxygen (DO) performed by ALS Wollongong via in-house method EA025FD and EN67 PK.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	MW1D	MW1S	MW3	MW4	MW5
	Ci	lient sampli	ng date / time	13-Aug-2020 10:00	13-Aug-2020 10:10	13-Aug-2020 10:40	13-Aug-2020 08:15	13-Aug-2020 10:55
Compound	CAS Number	LOR	Unit	EW2003642-001	EW2003642-002	EW2003642-003	EW2003642-004	EW2003642-005
				Result	Result	Result	Result	Result
A005FD: Field pH								
pH		0.1	pH Unit	7.3	6.5	7.4	7.0	7.6
A010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)		1	µS/cm	1580	482	413	807	655
A015: Total Dissolved Solids dried	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	812	522	276	420	464
A075FD: Field Redox Potential								
Redox Potential		0.1	mV	-129	-44.6	-132	22.9	-71.2
D037P: Alkalinity by PC Titrator			, , , , , , , , , , , , , , , , , , , ,					1
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	452	70	176	288	155
Total Alkalinity as CaCO3		1	mg/L	452	70	176	288	155
D041G: Sulfate (Turbidimetric) as S	04 2- by DA		_					
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	56	<10	<1	24	32
D045G: Chloride by Discrete Analys			Ū					
Chloride	16887-00-6	1	mg/L	234	111	25	59	86
D093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	79	24	61	117	82
Magnesium	7439-95-4	1	mg/L	38	8	5	11	8
Sodium	7440-23-5	1	mg/L	116	61	12	25	31
Potassium	7440-09-7	1	mg/L	36	2	3	5	3
EG020F: Dissolved Metals by ICP-MS			, , , , , , , , , , , , , , , , , , , ,					
Manganese	7439-96-5	0.001	mg/L	0.018	0.013	0.049	0.074	0.004
Iron	7439-89-6	0.05	mg/L	4.26	10.6	3.58	0.70	0.26
K040P: Fluoride by PC Titrator			-					
Fluoride	16984-48-8	0.1	mg/L	0.2	0.3	0.2	0.2	0.1
K055G: Ammonia as N by Discrete								
Ammonia as N	7664-41-7	0.01	mg/L	27.8	<0.01	0.22	0.04	<0.01
K057G: Nitrite as N by Discrete Ana								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.10	<0.01	0.41	<0.01
		0.01		-0.01		-0.01	V.T1	.0.01
K058G: Nitrate as N by Discrete An Nitrate as N		0.01	mg/L	<0.01	<0.10	<0.01	6.32	<0.01
1111 815 83 14	14797-55-8	0.01	iiig/∟	-0.01	\$0.10	\$0.01	0.32	~0.01

Page	: 4 of 11
Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW1S	MW3	MW4	MW5
	Clie	ent sampli	ng date / time	13-Aug-2020 10:00	13-Aug-2020 10:10	13-Aug-2020 10:40	13-Aug-2020 08:15	13-Aug-2020 10:55
Compound	CAS Number	LOR	Unit	EW2003642-001	EW2003642-002	EW2003642-003	EW2003642-004	EW2003642-005
				Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (N	IOx) by Discrete Analy	yser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.10	<0.01	6.73	<0.01
EK061G: Total Kjeldahl Nitrogen By	Discrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	27.9	4.3	0.5	1.8	0.2
EK062G: Total Nitrogen as N (TKN +	- NOx) by Discrete Ana	alyser						
^ Total Nitrogen as N		0.1	mg/L	27.9	4.3	0.5	8.5	0.2
EK067G: Total Phosphorus as P by	Discrete Analyser							
Total Phosphorus as P		0.01	mg/L	0.21	0.28	0.12	0.19	0.04
EN055: Ionic Balance								
Ø Total Anions		0.01	meq/L	16.8	4.53	4.22	7.92	6.19
Ø Total Cations		0.01	meq/L	15.0				
ø Total Cations		0.01	meq/L		4.56	4.05	7.96	6.18
ø Ionic Balance		0.01	%	5.61				
Ø Ionic Balance		0.01	%		0.34	2.02	0.26	0.11
EP002: Dissolved Organic Carbon (DOC)							
Dissolved Organic Carbon		1	mg/L	19	124	11	5	7
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	1.11	2.35	1.08	4.80	1.52
QWI-EN 67.11 Sampling of Groundw	/aters							
Depth		0.01	m	2.21	2.24	2.53	3.12	2.28

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Analytical Results

Aatrix: WATER Client sample ID ix: WATER) Client sampling date / time			MW6D	MW6S	MW7D	MW7S	MW9
			13-Aug-2020 08:50	13-Aug-2020 09:05	13-Aug-2020 11:15	13-Aug-2020 11:25	13-Aug-2020 13:10
CAS Number	LOR	Unit	EW2003642-006	EW2003642-007	EW2003642-008	EW2003642-009	EW2003642-010
			Result	Result	Result	Result	Result
	0.1	pH Unit	7.0	6.7	7.2	7.2	6.7
	1	µS/cm	1950	881	1150	734	9070
t 180 ± 5 °C							
	10	mg/L	986	543	596	396	5490
	0.1	mV	-138	-79.9	-137	-24.0	-23.3
DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
3812-32-6	1	mg/L	<1	<1	<1	<1	<1
71-52-3	1	mg/L	859	90	486	105	187
	1	mg/L	859	90	486	105	187
4 2- by DA							
14808-79-8	1	mg/L	9	26	21	18	363
er							
	1	mg/L	150	214	64	153	2740
7440-70-2	1	mg/L	162	24	101	30	56
7439-95-4	1	mg/L	25	23	16	14	149
7440-23-5	1	mg/L	100	102	60	81	1500
7440-09-7	1	mg/L	56	2	27	<1	59
7439-96-5	0.001	mg/L	0.138	0.005	0.057	0.003	0.010
7439-89-6	0.05	mg/L	12.8	0.61	3.38	0.22	1.26
16984-48-8	0.1	mg/L	0.4	0.3	0.3	0.2	0.4
	0.01	mg/L	52.4	0.03	18.3	<0.01	0.25
	0.01	mg/L	<0.01	0.03	<0.01	<0.01	<0.01
	0.01	ma/l	<0.01	0.14	<0.01	0.02	<0.01
	CAS Number t 180 ± 5 °C 180 ± 5 °C DMO-210-001 3812-32-6 71-52-3 04 2- by DA 14808-79-8 04 2- by DA 14808-79-8 04 2- by DA 14808-79-8 04 2- by DA 14808-79-8 16887-00-6 7440-70-2 7440-70-2 7440-9-7 16984-48-8 nalyser 7664-41-7 lyser	CAS Number LOR 0.1 0.1 1 t 180 ± 5 °C t 180 ± 5 °C t 180 ± 5 °C 0.1 DMO-210-001 1 3812-32-6 1 T1-52-3 1 1 42- by DA 16887-00-6 1 97 1 7440-70-2 1 7440-70-2 1 7440-70-2 1 7440-70-7 1 7439-95-4 1 7439-96-5 0.001 7439-96-5 0.001 7439-98-6 0.05 16984-48-8 0.1	CAS Number LOR Unit 0.1 pH Unit 0.1 pH Unit 1 μS/cm 10 mg/L 0.1 mV 10 mg/L 0.1 mV 1 mg/L 1	CAS Number LOR Unit EW2003642-006 Result Result 0.1 pH Unit 7.0 1 pS/cm 1950 10 mg/L 986 0.1 mV -138 0.1 mV -138 0.1 mg/L <1	CAS Number LOR Unit EW2003642-006 EW2003642-007 Result Result Result Result 0.1 pH Unit 7.0 6.7 1 μ S/cm 1950 881 10 mg/L 986 543 0.1 mg/L 986 543 0.1 mg/L 1 41 3812-32-6 1 mg/L <1	CAS Number LOR Unit EW2003642-006 EW2003642-007 EW2003642-008 Result Result Result Result Result Result 0.1 pH Unit 7.0 6.7 7.2 1 µS/cm 1950 881 1150 1 mg/L 986 543 596 0.1 mg/L 986 543 596 0.1 mg/L 41 <1	CAS Number LOR Unit EW2003642.006 EW2003642.007 EW2003642.008 EW2003642.008 Result Result Result Result Result Result Result 0.1 pH Unit 7.0 6.7 7.2 7.2 1 μ S/cm 1950 881 1160 734 10 mg/L 985 543 596 396 0.1 my/L 138 -999 -137 -24.0 DOC-210-001 1 mg/L <1

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)	Clien			MW6D	MW6S	MW7D	MW7S	MW9
	Clie	ent sampli	ng date / time	13-Aug-2020 08:50	13-Aug-2020 09:05	13-Aug-2020 11:15	13-Aug-2020 11:25	13-Aug-2020 13:10
Compound	CAS Number	LOR	Unit	EW2003642-006	EW2003642-007	EW2003642-008	EW2003642-009	EW2003642-010
				Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (N	NOx) by Discrete Anal	yser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01	0.17	<0.01	0.02	<0.01
EK061G: Total Kjeldahl Nitrogen By	/ Discrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	49.9	1.1	18.3	0.3	3.3
EK062G: Total Nitrogen as N (TKN +	+ NOx) by Discrete An	alyser						
^ Total Nitrogen as N		0.1	mg/L	49.9	1.3	18.3	0.3	3.3
EK067G: Total Phosphorus as P by	Discrete Analyser							
Total Phosphorus as P		0.01	mg/L	2.85	0.10	0.88	0.04	0.30
EN055: Ionic Balance								
Ø Total Anions		0.01	meq/L	21.6	8.38	12.0	6.79	88.6
Ø Total Cations		0.01	meq/L	19.7		11.0		
ø Total Cations		0.01	meq/L		7.58		6.17	81.8
Ø lonic Balance		0.01	%	4.68		4.35		
Ø Ionic Balance		0.01	%		5.00		4.75	3.98
EP002: Dissolved Organic Carbon (DOC)							
Dissolved Organic Carbon		1	mg/L	33	14	14	8	35
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	1.42	3.51	1.13	2.15	3.59
QWI-EN 67.11 Sampling of Groundw	vaters							
Depth		0.01	m	3.43	3.17	3.18	3.03	1.16

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	MW10	MW11	MW12	MW13	MW14
	Client sampling date / time			13-Aug-2020 13:30	13-Aug-2020 01:30	13-Aug-2020 09:25	13-Aug-2020 09:45	13-Aug-2020 10:25
Compound	CAS Number	LOR	Unit	EW2003642-011	EW2003642-012	EW2003642-013	EW2003642-014	EW2003642-015
				Result	Result	Result	Result	Result
EA005FD: Field pH								
pН		0.1	pH Unit	5.3	7.4	7.2	7.3	7.2
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)		1	μS/cm	3030	1800	2020	1580	2460
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	1490	908	948	728	1150
EA075FD: Field Redox Potential								
Redox Potential		0.1	mV	116	107	-116	-124	-121
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	10	396	635	516	785
Total Alkalinity as CaCO3		1	mg/L	10	396	635	516	785
ED041G: Sulfate (Turbidimetric) as S	O4 2- by DA							
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	138	53	53	70	52
ED045G: Chloride by Discrete Analys	ser							
Chloride	16887-00-6	1	mg/L	817	332	292	179	348
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	14	60	107	78	91
Magnesium	7439-95-4	1	mg/L	44	32	47	47	54
Sodium	7440-23-5	1	mg/L	474	197	142	102	175
Potassium	7440-09-7	1	mg/L	21	43	51	45	77
EG020F: Dissolved Metals by ICP-MS	;							
Manganese	7439-96-5	0.001	mg/L	<0.001	0.006	0.021	0.015	0.019
Iron	7439-89-6	0.05	mg/L	1.68	0.32	7.82	4.45	7.09
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	0.3	0.1	0.2	0.2
EK055G: Ammonia as N by Discrete A								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	17.0	36.8	27.8	69.9
EK057G: Nitrite as N by Discrete Ana								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete An								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	14191-00-0	0.01	iiig/L	-0.01	-0.01	-0.01	-0.01	-0.01

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW11	MW12	MW13	MW14
	Clie	ent sampli	ng date / time	13-Aug-2020 13:30	13-Aug-2020 01:30	13-Aug-2020 09:25	13-Aug-2020 09:45	13-Aug-2020 10:25
Compound	CAS Number	LOR	Unit	EW2003642-011	EW2003642-012	EW2003642-013	EW2003642-014	EW2003642-015
				Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (N	Ox) by Discrete Analy	yser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By	Discrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	2.2	19.0	40.1	29.4	70.1
EK062G: Total Nitrogen as N (TKN +	NOx) by Discrete Ana	alyser						
^ Total Nitrogen as N		0.1	mg/L	2.2	19.0	40.1	29.4	70.1
EK067G: Total Phosphorus as P by	Discrete Analyser							
Total Phosphorus as P		0.01	mg/L	0.15	0.16	0.22	0.24	0.22
EN055: Ionic Balance								
Ø Total Anions		0.01	meq/L	26.1	18.4	22.0	16.8	26.6
Ø Total Cations		0.01	meq/L			19.3	15.3	23.6
ø Total Cations		0.01	meq/L	25.5	15.3			
Ø Ionic Balance		0.01	%			6.59	4.68	6.06
Ø Ionic Balance		0.01	%	1.25	9.16			
EP002: Dissolved Organic Carbon (I	DOC)							
Dissolved Organic Carbon		1	mg/L	31	25	23	22	34
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	3.90	2.75	1.52	1.39	1.07
QWI-EN 67.11 Sampling of Groundw	vaters							
Depth		0.01	m	1.39	1.36	1.93	2.16	1.65

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			ML-2	ML-3	ML-4	ML-5
	Cl	ient sampli	ing date / time	13-Aug-2020 12:20	13-Aug-2020 14:20	13-Aug-2020 12:45	13-Aug-2020 12:30	13-Aug-2020 13:20
Compound	CAS Number	LOR	Unit	EW2003642-016	EW2003642-017	EW2003642-018	EW2003642-019	EW2003642-020
				Result	Result	Result	Result	Result
EA005FD: Field pH								
pH		0.1	pH Unit	6.5	6.4	6.4	6.4	6.2
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)		1	μS/cm	150	449	110	125	223
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	88	245	82	86	135
A075FD: Field Redox Potential								
Redox Potential		0.1	mV	83.9	144	118	102	104
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	17	15	13	12	13
Total Alkalinity as CaCO3		1	mg/L	17	15	13	12	13
ED093T: Total Major Cations								
Calcium	7440-70-2	1	mg/L	4	6	4	4	5
Magnesium	7439-95-4	1	mg/L	3	8	2	3	4
Sodium	7440-23-5	1	mg/L	17	64	12	14	29
Potassium	7440-09-7	1	mg/L	3	5	3	3	3
G020T: Total Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	0.011	0.012	0.010	0.011	0.011
Iron	7439-89-6	0.05	mg/L	0.54	0.65	0.57	0.62	0.62
EK055G: Ammonia as N by Discrete A	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.03	0.06	0.02	0.02	0.04
EK057G: Nitrite as N by Discrete Ana								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	< 0.01
		0.01						0.01
EK058G: Nitrate as N by Discrete An Nitrate as N	14797-55-8	0.01	mg/L	0.10	0.10	0.10	0.10	0.10
			mg/E	0.10	0.10	0.10	0.10	0.10
K059G: Nitrite plus Nitrate as N (NC			mg/l	0.10	0.10	0.10	0.40	0.40
Nitrite + Nitrate as N		0.01	mg/L	0.10	0.10	0.10	0.10	0.10
EK061G: Total Kjeldahl Nitrogen By I	Discrete Analyser	0.1			A =			
Total Kjeldahl Nitrogen as N		0.1	mg/L	0.6	0.7	0.6	0.6	0.7
EK062G: Total Nitrogen as N (TKN +								
Total Nitrogen as N		0.1	mg/L	0.7	0.8	0.7	0.7	0.8

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			ML-1	ML-2	ML-3	ML-4	ML-5
	Cli	ent samplii	ng date / time	13-Aug-2020 12:20	13-Aug-2020 14:20	13-Aug-2020 12:45	13-Aug-2020 12:30	13-Aug-2020 13:20
Compound	CAS Number	LOR	Unit	EW2003642-016	EW2003642-017	EW2003642-018	EW2003642-019	EW2003642-020
				Result	Result	Result	Result	Result
EK067G: Total Phosphorus as P by Dis	crete Analyser							
Total Phosphorus as P		0.01	mg/L	0.10	0.09	0.10	0.09	0.11
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	4.91	5.08	4.87	4.90	4.80

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Work Order	: EW2003642
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER		Clie	ent sample ID	Blank	 	
(Matrix: WATER)			,			
	CI	ient sampli	ng date / time	12-Aug-2020 11:35	 	
Compound	CAS Number	LOR	Unit	EW2003642-021	 	
				Result	 	
ED093F: Dissolved Major Cations						
Calcium	7440-70-2	1	mg/L	<1	 	
Magnesium	7439-95-4	1	mg/L	<1	 	
Sodium	7440-23-5	1	mg/L	<1	 	
Potassium	7440-09-7	1	mg/L	<1	 	
EG020F: Dissolved Metals by ICP-MS						
Manganese	7439-96-5	0.001	mg/L	<0.001	 	
Iron	7439-89-6	0.05	mg/L	<0.05	 	



CERTIFICATE OF ANALYSIS

Work Order	EW2001185	Page	: 1 of 4	
Client		Laboratory	: Environmental Division NS	W South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North	Wollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary PI, North Nowr Australia NSW Australia	a 2541
Telephone	: +61 02 4232 0444	Telephone	: 02 42253125	
Project	: Gerroa Landfill Ammonia Testing	Date Samples Received	: 05-Mar-2020 09:54	ANUTUR.
Order number	: 126591	Date Analysis Commenced	: 06-Mar-2020	
C-O-C number	:	Issue Date	: 10-Mar-2020 16:38	
Sampler	: Duncan McIntosh			HAC-MRA NATA
Site				
Quote number	: WO/015/18			Accreditation No. 825
No. of samples received	: 9			Accredited for compliance with
No. of samples analysed	: 9			ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



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 performed, 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 insufficient 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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• Analytical work for this work order will be conducted at ALS Sydney.



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW 3	MW 5	MW 6D	MW 7D
Client sampling date / time				05-Mar-2020 09:30	05-Mar-2020 09:50	05-Mar-2020 10:00	05-Mar-2020 08:50	05-Mar-2020 10:10
Compound	CAS Number	LOR	Unit	EW2001185-001	EW2001185-002	EW2001185-003	EW2001185-004	EW2001185-005
				Result	Result	Result	Result	Result
EK055G: Ammonia as N by Discr	ete Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	30.9	0.30	0.02	44.5	14.8



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW 12	MW 13	MW 14	
	Cl	ient sampli	ng date / time	05-Mar-2020 10:30	05-Mar-2020 09:10	05-Mar-2020 09:20	05-Mar-2020 09:40	
Compound	CAS Number	LOR	Unit	EW2001185-006	EW2001185-007	EW2001185-008	EW2001185-009	
				Result	Result	Result	Result	
EK055G: Ammonia as N by Discre	te Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	5.79	46.9	43.6	81.1	



CERTIFICATE OF ANALYSIS

Work Order	EW2002506	Page	: 1 of 6	
Client		Laboratory	Environmental Division NSW	V South Coast
Contact	: MS JULIE MILEVSKI	Contact	: Aneta Prosaroski	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North V	Nollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary Pl, North Nowra Australia NSW Australia	2541
Telephone	: +61 02 4232 0557	Telephone	: +61 2 4225 3125	
Project	: Gerroa Landfill Quarterly	Date Samples Received	: 28-May-2020 14:28	ANUUL.
Order number	: 126590	Date Analysis Commenced	28-May-2020	
C-O-C number	:	Issue Date	11-Jun-2020 13:59	
Sampler	: Duncan McIntosh			Hac-MRA NATA
Site	: Gerroa Landfill			
Quote number	: WO/026/19			Accreditation No. 825
No. of samples received	: 17			Accredited for compliance with
No. of samples analysed	: 17			ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW

Page	: 2 of 6
Work Order	: EW2002506
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill Quarterly



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, 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 insufficient 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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

- ø = ALS is not NATA accredited for these tests.
- ~ = Indicates an estimated value.
- Analytical work for this work order will be conducted at ALS Sydney.
- EK067G: LOR raised for TP on samples 10 and 12 due to sample matrix.
- It has been noted that Ammonia is greater than TKN for various samples, however this difference is within the limits of experimental variation.
- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- Sampling and sample data supplied by ALS Wollongong.
- Sampling and groundwater depth measurements completed by ALS Wollongong via inhouse sampling method EN/67.11 Groundwater Sampling.
- Sampling completed as per FWI-EN001 Groundwater Sampling.
- Dissolved oxygen (DO) performed by ALS Wollongong via in-house method EA025FD and EN67 PK.
- Field tests completed on day of sampling/receipt.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	MW1D	MW1S	MW3	MW4	MW5
	Clie	ent sampli	ng date / time	28-May-2020 10:45	28-May-2020 10:30	28-May-2020 10:15	28-May-2020 08:20	28-May-2020 10:00
Compound	CAS Number	LOR	Unit	EW2002506-001	EW2002506-002	EW2002506-003	EW2002506-004	EW2002506-005
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	7.4		7.6	7.0	7.8
EA010FD: Field Conductivity								
Electrical Conductivity (Non		1	µS/cm	1600		805	837	429
Compensated)								
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	931		551	468	240
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	542		213	371	173
Total Alkalinity as CaCO3		1	mg/L	542		213	371	173
EK055G: Ammonia as N by Discrete	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	44.1		0.44	0.11	0.07
EK057G: Nitrite as N by Discrete Ana	llyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01		<0.01	0.02	<0.01
EK058G: Nitrate as N by Discrete An	alyser							
Nitrate as N	14797-55-8	0.01	mg/L	<0.01		0.01	0.09	0.01
EK059G: Nitrite plus Nitrate as N (NC	() () () () () () () () () () () () () (vser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01		0.01	0.11	0.01
EK061G: Total Kjeldahl Nitrogen By D)iscrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	43.2		1.1	0.9	0.5
EK062G: Total Nitrogen as N (TKN + I	NOx) by Discrete An	alvser	_					1
 ^ Total Nitrogen as N 		0.1	mg/L	43.2		1.1	1.0	0.5
EK067G: Total Phosphorus as P by D	iscrete Analyser		5					
Total Phosphorus as P		0.01	mg/L	0.16		0.11	0.91	0.11
EN67 PK: Field Tests								
Field Observations		0.01			DRY			
		0.01						1
EP025FD: Field Dissolved Oxygen Dissolved Oxygen		0.01	mg/L	1.81		4.03	5.10	4.29
		0.01	ing/L	1.01		4.00	5.10	4.23
FWI-EN/001: Groundwater Sampling -		0.01	m	2.90		4.46	4.69	3.90
Depth		0.01	m	3.80		4.16	4.68	3.90



Sub-Matrix: WATER (Matrix: WATER)		Cli	ent sample ID	MW6D	MW6S	MW7D	MW7S	MW9
	Cli	ient sampli	ng date / time	28-May-2020 09:00	28-May-2020 08:35	28-May-2020 09:40	28-May-2020 09:20	28-May-2020 13:00
Compound	CAS Number	LOR	Unit	EW2002506-006	EW2002506-007	EW2002506-008	EW2002506-009	EW2002506-010
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	7.1		7.2	7.8	6.3
EA010FD: Field Conductivity								
Electrical Conductivity (Non		1	µS/cm	1780		1100	796	27000
Compensated)								
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	974		574	431	16800
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	799		516	228	62
Total Alkalinity as CaCO3		1	mg/L	799		516	228	62
EK055G: Ammonia as N by Discrete	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	56.0		21.0	0.22	<0.01
EK057G: Nitrite as N by Discrete Ana	lyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01		<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete An	alyser							
Nitrate as N	14797-55-8	0.01	mg/L	<0.01		<0.01	<0.01	0.31
EK059G: Nitrite plus Nitrate as N (NC	() () by Discrete Ana	lvser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01		<0.01	<0.01	0.31
EK061G: Total Kjeldahl Nitrogen By D)iscrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	52.3		21.8	0.8	1.7
EK062G: Total Nitrogen as N (TKN + I	NOx) by Discrete An	alvser	1					
^ Total Nitrogen as N		0.1	mg/L	52.3		21.8	0.8	2.0
EK067G: Total Phosphorus as P by D	liscrete Analyser		5					
Total Phosphorus as P		0.01	mg/L	2.52		0.81	0.21	<0.05
EN67 PK: Field Tests			5					
Field Observations		0.01			DRY			
		0.0.						1
EP025FD: Field Dissolved Oxygen Dissolved Oxygen		0.01	mg/L	1.74		1.54	3.99	6.46
		0.01	ing/E			1.07	0.00	0.40
FWI-EN/001: Groundwater Sampling -		0.01	m	4.04		4.67	4.52	1.53
Depth		0.01	ш	4.91		4.67	4.52	1.53



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	MW10	MW11	ML-1	ML-2	ML-3
	Cli	ient sampli	ng date / time	28-May-2020 13:15	28-May-2020 12:45	28-May-2020 11:40	28-May-2020 13:45	28-May-2020 12:05
Compound	CAS Number	LOR	Unit	EW2002506-011	EW2002506-012	EW2002506-013	EW2002506-014	EW2002506-015
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	5.2	6.0	4.6	4.9	4.6
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)		1	μS/cm	28900	19700	3380	5430	2590
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	18000	13800	2040	3140	1390
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	6	77	<1	<1	<1
Total Alkalinity as CaCO3		1	mg/L	6	77	<1	<1	<1
EK055G: Ammonia as N by Discrete	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.14	2.55	0.10	0.13	0.06
EK057G: Nitrite as N by Discrete Ana	alyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete An	alyser							
Nitrate as N	14797-55-8	0.01	mg/L	0.54	0.04	0.05	<0.01	0.04
EK059G: Nitrite plus Nitrate as N (NC	Dx) by Discrete Ana	lyser						
Nitrite + Nitrate as N		0.01	mg/L	0.54	0.04	0.05	<0.01	0.04
EK061G: Total Kjeldahl Nitrogen By [Discrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	10.3	4.4	0.6	0.6	0.6
EK062G: Total Nitrogen as N (TKN +	NOx) by Discrete An	alyser						
^ Total Nitrogen as N		0.1	mg/L	10.8	4.4	0.6	0.6	0.6
EK067G: Total Phosphorus as P by D	iscrete Analys <u>er</u>							
Total Phosphorus as P		0.01	mg/L	0.82	<0.05	<0.01	<0.01	<0.01
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	7.74	5.04	3.79	4.47	3.89
FWI-EN/001: Groundwater Sampling	- Depth							
Depth		0.01	m	1.96	1.95			



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	ML-4	ML-5	 	
	Cli	ent samplii	ng date / time	28-May-2020 11:50	28-May-2020 13:05	 	
Compound	CAS Number	LOR	Unit	EW2002506-016	EW2002506-017	 	
				Result	Result	 	
EA005FD: Field pH							
рН		0.1	pH Unit	4.7	4.7	 	
EA010FD: Field Conductivity							
Electrical Conductivity (Non Compensated)		1	μS/cm	3090	3850	 	
EA015: Total Dissolved Solids dried at	t 180 ± 5 °C						
Total Dissolved Solids @180°C		10	mg/L	1920	2180	 	
ED037P: Alkalinity by PC Titrator							
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	 	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	 	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	<1	 	
Total Alkalinity as CaCO3		1	mg/L	<1	<1	 	
EK055G: Ammonia as N by Discrete A	nalyser						
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.12	 	
EK057G: Nitrite as N by Discrete Anal	yser						
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	 	
EK058G: Nitrate as N by Discrete Ana	lyser						
Nitrate as N	14797-55-8	0.01	mg/L	0.04	0.02	 	
EK059G: Nitrite plus Nitrate as N (NO)	x) by Discrete Ana	lyser					
Nitrite + Nitrate as N		0.01	mg/L	0.04	0.02	 	
EK061G: Total Kjeldahl Nitrogen By Di	iscrete Analyser						
Total Kjeldahl Nitrogen as N		0.1	mg/L	0.6	0.6	 	
EK062G: Total Nitrogen as N (TKN + N	Ox) by Discrete An	alyser					
^ Total Nitrogen as N		0.1	mg/L	0.6	0.6	 	
EK067G: Total Phosphorus as P by Di	screte Analyser						
Total Phosphorus as P		0.01	mg/L	<0.01	0.02	 	
EP025FD: Field Dissolved Oxygen							
Dissolved Oxygen		0.01	mg/L	3.82	4.11	 	



CERTIFICATE OF ANALYSIS

Work Order	EW2002507	Page	: 1 of 2	
Client		Laboratory	Environmental Division NSW South Coast	
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North Wollongong 2500	
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary PI, North Nowra 2541 Australia NSW Australia	
Telephone	: +61 02 4232 0444	Telephone	: 02 42253125	
Project	: Gerroa Landfill Ammonia Testing	Date Samples Received	: 28-May-2020 14:31	
Order number	: 126591	Date Analysis Commenced	: 01-Jun-2020	
C-O-C number	:	Issue Date	: 02-Jun-2020 16:18	
Sampler	: Duncan McIntosh		Hac-MR/	
Site	:			
Quote number	: WO/015/18			Accreditation No. 825
No. of samples received	: 3		Ad	credited for compliance with
No. of samples analysed	: 3			ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

 \sim = Indicates an estimated value.

• Analytical work for this work order will be conducted at ALS Sydney.

Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			MW 12	MW 13	MW 14		
Client sampling date / time			28-May-2020 11:15	28-May-2020 11:05	28-May-2020 10:35			
Compound	CAS Number	LOR	Unit	EW2002507-001	EW2002507-002	EW2002507-003		
				Result	Result	Result		
EK055G: Ammonia as N by Discrete A	EK055G: Ammonia as N by Discrete Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	57.7	54.7	97.7		



CERTIFICATE OF ANALYSIS

Work Order	EW2002807	Page	: 1 of 4	
Client		Laboratory	: Environmental Division NS	SW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North	n Wollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary Pl, North Nowr Australia NSW Australia	ra 2541
Telephone	: +61 02 4232 0444	Telephone	: 02 42253125	
Project	: Gerroa Landfill Ammonia Testing	Date Samples Received	: 17-Jun-2020 14:10	ANUUL.
Order number	: 126591	Date Analysis Commenced	: 20-Jun-2020	
C-O-C number	:	Issue Date	: 23-Jun-2020 11:21	NATA
Sampler	: Duncan McIntosh			HAC-MRA NATA
Site	:			
Quote number	: WO/015/18			Accreditation No. 825
No. of samples received	: 9			Accredited for compliance with
No. of samples analysed	: 9			ISO/IEC 17025 - Testing

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This Certificate of Analysis contains the following information:

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- Analytical Results

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



General Comments

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Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• Analytical work for this work order will be conducted at ALS Sydney.



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW 3	MW 5	MW 6D	MW 7D	
Client sampling date / time			17-Jun-2020 12:15	17-Jun-2020 12:00	17-Jun-2020 11:50	17-Jun-2020 11:30	17-Jun-2020 11:40		
Compound	CAS Number	LOR	Unit	EW2002807-001	EW2002807-002	EW2002807-003	EW2002807-004	EW2002807-005	
				Result	Result	Result	Result	Result	
EK055G: Ammonia as N by Disc	EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	37.2	0.34	0.04	50.2	20.8	



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW 12	MW 13	MW 14		
Client sampling date / time			17-Jun-2020 12:50	17-Jun-2020 12:35	17-Jun-2020 12:25	17-Jun-2020 12:10			
Compound	CAS Number	LOR	Unit	EW2002807-006	EW2002807-007	EW2002807-008	EW2002807-009		
				Result	Result	Result	Result		
EK055G: Ammonia as N by Discre	EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	5.91	55.9	52.3	95.3		



CERTIFICATE OF ANALYSIS

Work Order	EW2004057	Page	: 1 of 4	
Client		Laboratory	: Environmental Division N	SW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, Nort	th Wollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary PI, North Now Australia NSW Australia	vra 2541
Telephone	: +61 02 4232 0444	Telephone	: 02 42253125	
Project	: Gerroa Landfill Ammonia Testing	Date Samples Received	: 09-Sep-2020 12:42	ANUTUR.
Order number	: 126591	Date Analysis Commenced	14-Sep-2020	
C-O-C number	:	Issue Date	15-Sep-2020 18:59	
Sampler	: Duncan McIntosh			Hac-MRA NATA
Site	:			
Quote number	: WO/015/18			Accreditation No. 825
No. of samples received	: 9			Accredited for compliance with
No. of samples analysed	: 9			ISO/IEC 17025 - Testing

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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

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Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• Analytical work for this work order will be conducted at ALS Sydney.



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW 3	MW 5	MW 6D	MW 7D	
Client sampling date / time			09-Sep-2020 09:50	09-Sep-2020 09:30	09-Sep-2020 09:20	09-Sep-2020 09:00	09-Sep-2020 09:10		
Compound	CAS Number	LOR	Unit	EW2004057-001	EW2004057-002	EW2004057-003	EW2004057-004	EW2004057-005	
				Result	Result	Result	Result	Result	
EK055G: Ammonia as N by Discr	EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	23.3	0.25	0.02	41.5	19.2	



Sub-Matrix: WATER (Matrix: WATER)		Client sample ID			MW 12	MW 13	MW 14		
Client sampling date / time			09-Sep-2020 10:30	09-Sep-2020 10:10	09-Sep-2020 10:00	09-Sep-2020 09:40			
Compound	CAS Number	LOR	Unit	EW2004057-006	EW2004057-007	EW2004057-008	EW2004057-009		
				Result	Result	Result	Result		
EK055G: Ammonia as N by Discret	EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	2.15	37.5	26.6	73.1		



CERTIFICATE OF ANALYSIS

Work Order	EW2004986	Page	: 1 of 6	
Client		Laboratory	: Environmental Division NSW	V South Coast
Contact	: MS JULIE MILEVSKI	Contact	: Aneta Prosaroski	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North V	Nollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary Pl, North Nowra Australia NSW Australia	2541
Telephone	: +61 02 4232 0557	Telephone	: +61 2 4225 3125	
Project	: Gerroa Landfill	Date Samples Received	: 06-Nov-2020 10:16	ANUTUR.
Order number	: Post Purchase	Date Analysis Commenced	: 06-Nov-2020	
C-O-C number	:	Issue Date	: 13-Nov-2020 16:31	
Sampler	: Duncan McIntosh			Hac-MRA NATA
Site	: Gerroa Landfill			
Quote number	: WO/026/19			Accreditation No. 825
No. of samples received	: 17			Accredited for compliance with
No. of samples analysed	: 17			ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Glenn Davies	Environmental Services Representative	Laboratory - Wollongong, NSW

Page	: 2 of 6
Work Order	: EW2004986
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



General Comments

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Where moisture determination has been performed, 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 insufficient 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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Analytical work for this work order will be conducted at ALS Sydney.
- EK061:LOR raised due to sample matrix.
- TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- Sampling and groundwater depth measurements completed by ALS Wollongong via inhouse sampling method EN/67.11 Groundwater Sampling.
- Sampling completed by ALS Wollongong in accordace with in-house sampling method EN/67.6 Rivers and Streams.
- Dissolved oxygen (DO) performed by ALS Wollongong via in-house method EA025FD and EN67 PK.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.

Page	: 3 of 6
Work Order	: EW2004986
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	MW1D	MW1S	MW3	MW4	MW5
	Clie	Client sampling date / time			06-Nov-2020 10:30	06-Nov-2020 10:00	06-Nov-2020 08:30	06-Nov-2020 09:40
Compound	CAS Number	LOR	Unit	EW2004986-001	EW2004986-002	EW2004986-003	EW2004986-004	EW2004986-005
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	7.4	6.4	7.4	7.2	8.0
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)		1	μS/cm	1380	315	543	483	402
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	706	361	328	298	250
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	407	76	180	240	119
Total Alkalinity as CaCO3		1	mg/L	407	76	180	240	119
EK055G: Ammonia as N by Discrete A	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	21.1	0.14	0.30	0.11	<0.01
EK057G: Nitrite as N by Discrete Ana	lyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Ana	alyser							
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NC	() () by Discrete Anal	lyser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By D	Discrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	23.3	2.9	0.5	1.2	0.2
EK062G: Total Nitrogen as N (TKN + I	NOx) by Discrete An	alyser						
^ Total Nitrogen as N		0.1	mg/L	23.3	2.9	0.5	1.2	0.2
EK067G: Total Phosphorus as P by D	iscrete Analyser							
Total Phosphorus as P		0.01	mg/L	0.19	0.33	0.10	0.98	0.05
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	1.29	4.14	1.67	4.90	1.86
FWI-EN/001: Groundwater Sampling -	Depth							
Depth		0.01	m	3.17	3.21	3.55	3.90	3.46

Page	: 4 of 6
Work Order	: EW2004986
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	MW6D	MW6S	MW7D	MW7S	MW9
	Clie	Client sampling date / time			06-Nov-2020 08:40	06-Nov-2020 09:10	06-Nov-2020 09:15	06-Nov-2020 12:15
Compound	CAS Number	LOR	Unit	EW2004986-006	EW2004986-007	EW2004986-008	EW2004986-009	EW2004986-010
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	7.1		7.2	7.5	6.7
EA010FD: Field Conductivity								
Electrical Conductivity (Non		1	µS/cm	1720		1090	649	9090
Compensated)								
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	890		574	432	5720
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	761		480	130	128
Total Alkalinity as CaCO3		1	mg/L	761		480	130	128
EK055G: Ammonia as N by Discrete A	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	36.2		17.4	0.16	0.01
EK057G: Nitrite as N by Discrete Ana	llyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01		<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Ana	alvser							
Nitrate as N	14797-55-8	0.01	mg/L	<0.01		<0.01	<0.01	0.07
EK059G: Nitrite plus Nitrate as N (NC	(x) by Discrete Anal	vser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01		<0.01	<0.01	0.07
EK061G: Total Kjeldahl Nitrogen By D)iscrete Analyser		1					
Total Kjeldahl Nitrogen as N		0.1	mg/L	37.2		18.3	0.8	6.1
EK062G: Total Nitrogen as N (TKN + N	NOv) by Discrete An	alveor	, i i i i i i i i i i i i i i i i i i i					
^ Total Nitrogen as N		0.1	mg/L	37.2		18.3	0.8	6.2
EK067G: Total Phosphorus as P by D		••••						
Total Phosphorus as P		0.01	mg/L	3.76		0.88	0.64	0.60
EN67 PK: Field Tests								
Field Observations		0.01		<u></u>	DRY			
		0.01						
EP025FD: Field Dissolved Oxygen Dissolved Oxygen		0.01	mg/L	1.39		1.73	5.88	7.27
		0.01	IIIg/L	1.39		1./3	5.00	1.21
FWI-EN/001: Groundwater Sampling -		0.01		4.00		4.42	4.07	4.50
Depth		0.01	m	4.68		4.43	4.27	1.56

Page	5 of 6
Work Order	: EW2004986
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)		Clie	ent sample ID	MW10	MW11	ML-1	ML-2	ML-3
	Cli	ent sampli	ng date / time	06-Nov-2020 12:25	06-Nov-2020 12:00	06-Nov-2020 11:20	06-Nov-2020 12:50	06-Nov-2020 11:30
Compound	CAS Number	LOR	Unit	EW2004986-011	EW2004986-012	EW2004986-013	EW2004986-014	EW2004986-015
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	5.5	6.8	6.6	7.1	6.4
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)		1	µS/cm	6430	3980	1960	22000	1780
EA015: Total Dissolved Solids dried a	t 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	3660	2260	1150	13800	982
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	12	142	50	111	43
Total Alkalinity as CaCO3		1	mg/L	12	142	50	111	43
EK055G: Ammonia as N by Discrete A	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.02	1.34	0.15	0.51	0.14
EK057G: Nitrite as N by Discrete Ana	lyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	0.02	<0.01
EK058G: Nitrate as N by Discrete Ana	alyser							
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	0.01	0.06	<0.01
EK059G: Nitrite plus Nitrate as N (NO	x) by Discrete Anal	lyser						
Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.01	0.01	0.08	<0.01
EK061G: Total Kjeldahl Nitrogen By D	iscrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	4.0	3.9	0.6	0.9	0.6
EK062G: Total Nitrogen as N (TKN + N	NOx) by Discrete An	alyser						
^ Total Nitrogen as N		0.1	mg/L	4.0	3.9	0.6	1.0	0.6
EK067G: Total Phosphorus as P by D	iscrete An <u>alyser</u>							
Total Phosphorus as P		0.01	mg/L	0.33	0.21	0.02	0.08	0.02
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	5.86	3.77	2.72	5.59	5.57
FWI-EN/001: Groundwater Sampling -	Depth							
Depth		0.01	m	1.96	1.93			

Page	: 6 of 6
Work Order	: EW2004986
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



Sub-Matrix: WATER (Matrix: WATER)	Client sample ID			ML-4	ML-5					
	Client sampling date / time			06-Nov-2020 11:40	06-Nov-2020 12:10					
Compound	CAS Number	LOR	Unit	EW2004986-016	EW2004986-017					
				Result	Result					
EA005FD: Field pH										
рН		0.1	pH Unit	6.5	6.7					
EA010FD: Field Conductivity										
Electrical Conductivity (Non Compensated)		1	µS/cm	1900	2440					
EA015: Total Dissolved Solids dried at 180 ± 5 °C										
Total Dissolved Solids @180°C		10	mg/L	1030	1330					
ED037P: Alkalinity by PC Titrator										
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1					
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1					
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	45	65					
Total Alkalinity as CaCO3		1	mg/L	45	65					
EK055G: Ammonia as N by Discrete Ar	nalyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.15	0.61					
EK057G: Nitrite as N by Discrete Analy	/ser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.02					
EK058G: Nitrate as N by Discrete Anal	yser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	0.01					
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ana	lyser								
Nitrite + Nitrate as N		0.01	mg/L	<0.01	0.03					
EK061G: Total Kjeldahl Nitrogen By Dis	screte Analyser									
Total Kjeldahl Nitrogen as N		0.1	mg/L	0.6	1.0					
EK062G: Total Nitrogen as N (TKN + N	Ox) by Discrete An	alyser								
^ Total Nitrogen as N		0.1	mg/L	0.6	1.0					
EK067G: Total Phosphorus as P by Dis	crete Analyser									
Total Phosphorus as P		0.01	mg/L	0.02	0.03					
EP025FD: Field Dissolved Oxygen										
Dissolved Oxygen		0.01	mg/L	2.41	3.75					



CERTIFICATE OF ANALYSIS

Work Order	EW2005765	Page	: 1 of 4	
Client		Laboratory	Environmental Division NS	W South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North	Wollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary PI, North Nowra Australia NSW Australia	a 2541
Telephone	: +61 02 4232 0444	Telephone	: 02 42253125	
Project	: Gerroa Landfill Ammonia Testing	Date Samples Received	: 18-Dec-2020 15:00	ANUTU.
Order number	: 126591	Date Analysis Commenced	: 22-Dec-2020	
C-O-C number	:	Issue Date	: 30-Dec-2020 22:24	NATA
Sampler	: Duncan McIntosh			Hac-MRA NATA
Site	:			
Quote number	: WO/015/18			Accreditation No. 825
No. of samples received	: 9			Accredited for compliance with
No. of samples analysed	: 9			ISO/IEC 17025 - Testing

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This Certificate of Analysis contains the following information:

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- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

 \emptyset = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• Analytical work for this work order will be conducted at ALS Sydney.



Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW 1D	MW 3	MW 5	MW 6D	MW 7D
		Samplii	ng date / time	18-Dec-2020 12:50	18-Dec-2020 12:40	18-Dec-2020 12:30	18-Dec-2020 13:25	18-Dec-2020 12:20
Compound	CAS Number	LOR	Unit	EW2005765-001	EW2005765-002	EW2005765-003	EW2005765-004	EW2005765-005
				Result	Result	Result	Result	Result
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	32.5	0.43	0.18	42.5	18.1



Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW 11	MW 12	MW 13	MW 14	
Sampling date / time				18-Dec-2020 13:25	18-Dec-2020 13:10	18-Dec-2020 12:55	18-Dec-2020 12:45	
Compound	CAS Number	LOR	Unit	EW2005765-006	EW2005765-007	EW2005765-008	EW2005765-009	
				Result	Result	Result	Result	
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.31	42.3	46.6	84.4	



CERTIFICATE OF ANALYSIS

Work Order	EW2100114	Page	: 1 of 4	
Client		Laboratory	: Environmental Division N	ISW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, Nor	th Wollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary Pl, North Nov Australia NSW Australia	
Telephone	: +61 02 4232 0444	Telephone	: 02 42253125	
Project	: Gerroa Landfill Ammonia Testing	Date Samples Received	: 08-Jan-2021 15:06	ANHUR.
Order number	: 126591	Date Analysis Commenced	: 15-Jan-2021	
C-O-C number	:	Issue Date	: 19-Jan-2021 08:59	NATA
Sampler	: Duncan McIntosh			Hac-MRA NATA
Site	:			
Quote number	: WO/015/18			Accreditation No. 825
No. of samples received	: 9			Accredited for compliance with
No. of samples analysed	: 9			ISO/IEC 17025 - Testing

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- Analytical Results

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW



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LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

• Analytical work for this work order will be conducted at ALS Sydney.



Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW 1D	MW 3	MW 5	MW 6D	MW 7D
		Samplii	ng date / time	08-Jan-2021 13:10	08-Jan-2021 13:00	08-Jan-2021 12:55	08-Jan-2021 13:45	08-Jan-2021 12:45
Compound	CAS Number	LOR	Unit	EW2100114-001	EW2100114-002	EW2100114-003	EW2100114-004	EW2100114-005
				Result	Result	Result	Result	Result
EK055G: Ammonia as N by Discret	te Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	16.4	0.31	0.02	37.2	18.5



Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW 11	MW 12	MW 13	MW 14	
		Samplii	ng date / time	08-Jan-2021 14:00	08-Jan-2021 13:30	08-Jan-2021 13:17	08-Jan-2021 13:05	
Compound	CAS Number	LOR	Unit	EW2100114-006	EW2100114-007	EW2100114-008	EW2100114-009	
				Result	Result	Result	Result	
EK055G: Ammonia as N by Discret	te Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.97	38.9	34.6	69.9	



CERTIFICATE OF ANALYSIS

Work Order	EW2100391	Page	: 1 of 7	
Client		Laboratory	: Environmental Division NS	W South Coast
Contact	: MS JULIE MILEVSKI	Contact	: Aneta Prosaroski	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, North	Wollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary PI, North Nowra Australia NSW Australia	a 2541
Telephone	: +61 02 4232 0557	Telephone	: +61 2 4225 3125	
Project	: Gerroa Landfill	Date Samples Received	: 01-Feb-2021 12:30	ANUTU.
Order number	: 126590	Date Analysis Commenced	: 01-Feb-2021	
C-O-C number	:	Issue Date	: 09-Feb-2021 16:26	
Sampler	: Duncan McIntosh, Tom Roose			Hac-MRA NATA
Site	: Gerroa Landfill			
Quote number	: WO/026/19			Accreditation No. 825
No. of samples received	: 17			Accredited for compliance with
No. of samples analysed	: 17			ISO/IEC 17025 - Testing

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Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Robert DaLio	Sampler	Laboratory - Wollongong, NSW

Page	: 2 of 7
Work Order	: EW2100391
Client	: KIAMA COUNCIL
Project	: Gerroa Landfill



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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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Analytical work for this work order will be conducted at ALS Sydney.
- EK067G: LOR raised for TP on various samples due to sample matrix.
- EK059G: LOR raised for NOx on sample 12 due to sample matrix.
- TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EK055G: It has been noted that Ammonia is greater than TKN on sample 1, however this difference is within the limits of experimental variation.
- pH performed by ALS Wollongong via in-house method EA005FD and EN67 PK.
- Electrical conductivity performed by ALS Wollongong via in-house method EA010FD and EN67 PK.
- Sampling and groundwater depth measurements completed by ALS Wollongong via inhouse sampling method EN/67.11 Groundwater Sampling.
- Sampling completed by ALS Wollongong in accordace with in-house sampling method EN/67.6 Rivers and Streams.
- Dissolved oxygen (DO) performed by ALS Wollongong via in-house method EA025FD and EN67 PK.
- All field analysis performed by ALS Wollongong were completed at the time of sampling.



Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW1D	MW1S	MW3	MW4	MW5
		Sampli	ng date / time	01-Feb-2021 09:33	01-Feb-2021 09:48	01-Feb-2021 09:11	01-Feb-2021 10:23	01-Feb-2021 09:00
Compound	CAS Number	LOR	Unit	EW2100391-001	EW2100391-002	EW2100391-003	EW2100391-004	EW2100391-005
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	7.3		7.4	7.2	8.0
EA010FD: Field Conductivity								
Electrical Conductivity (Non		1	μS/cm	1430		709	461	287
Compensated)								
EA015: Total Dissolved Solids dried a	nt 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	706		470	272	191
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	398		162	198	114
Total Alkalinity as CaCO3		1	mg/L	398		162	198	114
EK055G: Ammonia as N by Discrete A	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	22.0		0.35	0.14	<0.01
EK057G: Nitrite as N by Discrete Ana	llyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01		<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Ana	alvser							
Nitrate as N	14797-55-8	0.01	mg/L	0.01		0.01	0.03	0.03
EK059G: Nitrite plus Nitrate as N (NO	x) by Discrete Anal	vser						
Nitrite + Nitrate as N		0.01	mg/L	0.01		0.01	0.03	0.03
EK061G: Total Kjeldahl Nitrogen By D)iscrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	20.7		0.8	1.1	0.3
EK062G: Total Nitrogen as N (TKN + N	NOx) by Discrete An	alvser						
 ^ Total Nitrogen as N 		0.1	mg/L	20.7		0.8	1.1	0.3
EK067G: Total Phosphorus as P by D	iscroto Analysor							
Total Phosphorus as P		0.01	mg/L	0.18		0.09	1.07	0.05
EN67 PK: Field Tests								
Field Observations		0.01			DRY			
								1
EP025FD: Field Dissolved Oxygen Dissolved Oxygen		0.01	mg/L	2.31		2.47	4.19	2.81
		0.01	iiig/L	2.31		2.41	4.13	2.01
FWI-EN/001: Groundwater Sampling - Depth		0.01	m	3.35		3.79	4.40	4.30
Depth		0.01	ш	3.35		3./9	4.40	4.30



Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW6D	MW6S	MW7D	MW7S	MW9
		Sampli	ng date / time	01-Feb-2021 10:31	01-Feb-2021 10:36	01-Feb-2021 08:38	01-Feb-2021 08:43	01-Feb-2021 11:45
Compound	CAS Number	LOR	Unit	EW2100391-006	EW2100391-007	EW2100391-008	EW2100391-009	EW2100391-010
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	7.0		7.1	7.6	6.4
EA010FD: Field Conductivity								
Electrical Conductivity (Non		1	µS/cm	1750		1129	584	17000
Compensated)								
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	827		584	331	11800
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1		<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1		<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	717		492	175	63
Total Alkalinity as CaCO3		1	mg/L	717		492	175	63
EK055G: Ammonia as N by Discrete	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	36.4		16.8	0.12	0.24
EK057G: Nitrite as N by Discrete Ana	llyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01		<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete An	alyser							
Nitrate as N	14797-55-8	0.01	mg/L	0.02		0.01	<0.01	0.01
EK059G: Nitrite plus Nitrate as N (NC	x) by Discrete Anal	yser						
Nitrite + Nitrate as N		0.01	mg/L	0.02		0.01	<0.01	0.01
EK061G: Total Kjeldahl Nitrogen By D)iscrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	39.0		17.2	0.4	4.6
EK062G: Total Nitrogen as N (TKN + I	NOx) by Discrete An	alyser						
^ Total Nitrogen as N		0.1	mg/L	39.0		17.2	0.4	4.6
EK067G: Total Phosphorus as P by D	iscrete Analyser							
Total Phosphorus as P		0.01	mg/L	2.86		0.89	0.14	0.40
EN67 PK: Field Tests								
Field Observations		0.01			DRY			
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	1.82		3.22	3.20	5.05
FWI-EN/001: Groundwater Sampling -	Denth							
Depth		0.01	m	4.53		4.46	4.65	1.28
		0.0.		7.00	1		-100	



Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW10	MW11	ML-1	ML-2	ML-3
		Sampli	ng date / time	01-Feb-2021 11:52	01-Feb-2021 11:38	01-Feb-2021 11:26	01-Feb-2021 12:06	01-Feb-2021 11:17
Compound	CAS Number	LOR	Unit	EW2100391-011	EW2100391-012	EW2100391-013	EW2100391-014	EW2100391-015
				Result	Result	Result	Result	Result
EA005FD: Field pH								
рН		0.1	pH Unit	5.2	6.4	6.4	6.6	6.4
EA010FD: Field Conductivity								
Electrical Conductivity (Non Compensated)		1	µS/cm	16000	7650	32800	34700	28200
EA015: Total Dissolved Solids dried a	at 180 ± 5 °C							
Total Dissolved Solids @180°C		10	mg/L	11300	5310	23300	24800	16000
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	4	68	76	105	73
Total Alkalinity as CaCO3		1	mg/L	4	68	76	105	73
EK055G: Ammonia as N by Discrete A	Analyser							
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.43	0.37	<0.01	0.34
EK057G: Nitrite as N by Discrete Ana	lyser							
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.10	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete An	alyser							
Nitrate as N	14797-55-8	0.01	mg/L	0.01	<0.10	0.03	0.06	<0.01
EK059G: Nitrite plus Nitrate as N (NC	0x) by Discrete Ana	lyser						
Nitrite + Nitrate as N		0.01	mg/L	0.01	<0.10	0.03	0.06	<0.01
EK061G: Total Kjeldahl Nitrogen By D	Discrete Analyser							
Total Kjeldahl Nitrogen as N		0.1	mg/L	2.3	3.4	1.4	0.8	1.1
EK062G: Total Nitrogen as N (TKN + I	NOx) by Discrete An	alyser						
^ Total Nitrogen as N		0.1	mg/L	2.3	3.4	1.4	0.9	1.1
EK067G: Total Phosphorus as P by D	iscrete Analyser							
Total Phosphorus as P		0.01	mg/L	0.14	<0.20	<0.05	<0.05	0.13
EP025FD: Field Dissolved Oxygen								
Dissolved Oxygen		0.01	mg/L	2.87	4.12	1.48	3.20	1.77
FWI-EN/001: Groundwater Sampling -	Depth							
Depth		0.01	m	1.68	1.64			



			Sample ID	ML-4	ML-5	 	
		Samplii	ng date / time	01-Feb-2021 11:07	01-Feb-2021 11:34	 	
Compound	CAS Number	LOR	Unit	EW2100391-016	EW2100391-017	 	
				Result	Result	 	
EA005FD: Field pH							
рН		0.1	pH Unit	6.3	6.5	 	
EA010FD: Field Conductivity							
Electrical Conductivity (Non Compensated)		1	µS/cm	30300	35600	 	
EA015: Total Dissolved Solids dried at 18	0 ± 5 °C						
Total Dissolved Solids @180°C		10	mg/L	18000	15500	 	
ED037P: Alkalinity by PC Titrator							
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	 	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	 	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	72	76	 	
Total Alkalinity as CaCO3		1	mg/L	72	76	 	
EK055G: Ammonia as N by Discrete Anal	yser						
Ammonia as N	7664-41-7	0.01	mg/L	0.34	0.34	 	
EK057G: Nitrite as N by Discrete Analyse	er 👘						
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	 	
EK058G: Nitrate as N by Discrete Analys	er						
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	 	
EK059G: Nitrite plus Nitrate as N (NOx) b	by Discrete Anal	lyser					
Nitrite + Nitrate as N		0.01	mg/L	<0.01	<0.01	 	
EK061G: Total Kjeldahl Nitrogen By Discr	ete Analyser						
Total Kjeldahl Nitrogen as N		0.1	mg/L	1.1	1.0	 	
EK062G: Total Nitrogen as N (TKN + NOx)) by Discrete An	alyser					
^ Total Nitrogen as N		0.1	mg/L	1.1	1.0	 	
EK067G: Total Phosphorus as P by Discr	ete Analyse <u>r</u>						
Total Phosphorus as P		0.01	mg/L	<0.05	0.05	 	
EP025FD: Field Dissolved Oxygen							
Dissolved Oxygen		0.01	mg/L	1.87	2.06	 	



Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(WATER) ED037P: Alkalinity by PC Titrator

(WATER) EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser

(WATER) EK061G: Total Kjeldahl Nitrogen By Discrete Analyser

(WATER) EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser

(WATER) EK058G: Nitrate as N by Discrete Analyser

(WATER) EK057G: Nitrite as N by Discrete Analyser

(WATER) EK055G: Ammonia as N by Discrete Analyser

(WATER) EK067G: Total Phosphorus as P by Discrete Analyser

(WATER) EA015: Total Dissolved Solids dried at 180 ± 5 °C



CERTIFICATE OF ANALYSIS

Work Order	EW2100392	Page	: 1 of 2	
Client		Laboratory	: Environmental Division	NSW South Coast
Contact	: MR PAUL CZULOWSKI	Contact	: Glenn Davies	
Address	: 11 MANNING STREET	Address	: 1/19 Ralph Black Dr, No	rth Wollongong 2500
	KIAMA NSW, AUSTRALIA 2533		4/13 Geary PI, North Nov Australia NSW Australia	
Telephone	: +61 02 4232 0444	Telephone	: 02 42253125	
Project	: Gerroa Landfill Ammonia Testing	Date Samples Received	: 01-Feb-2021 12:36	WIIII.
Order number	: 126591	Date Analysis Commenced	: 03-Feb-2021	
C-O-C number	:	Issue Date	: 05-Feb-2021 15:00	
Sampler	: Duncan McIntosh, Tom Roose			Hac-MRA NATA
Site	:			
Quote number	: WO/015/18			Accreditation No. 825
No. of samples received	: 3			Accredited for compliance with
No. of samples analysed	: 3			ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, 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 insufficient 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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

 \sim = Indicates an estimated value.

• Analytical work for this work order will be conducted at ALS Sydney.

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	MW 12	MW 13	MW 14	
		Samplir	ng date / time	01-Feb-2021 10:07	01-Feb-2021 10:00	01-Feb-2021 09:25	
Compound	CAS Number	CAS Number LOR U		EW2100392-001	EW2100392-002	EW2100392-003	
				Result	Result	Result	
EK055G: Ammonia as N by Discrete A	Analyser						
Ammonia as N	7664-41-7	0.01	mg/L	46.7	83.5	40.4	



Appendix **B**



Appendix B: Climate Data for Gerroa Landfill (2002 to 2021)	
Station: Bombo Headland	

Year	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Graph	<u>ilii</u>	111	dat	III	dat 👘	<u>da</u>	<u>da</u>	<u>da</u>	ilit	<u>ilii</u>	ılıl	<u>ilil</u>	<u>da</u>
<u>2001</u>												11.2	
<u>2002</u>	99.6	288.2	125.4	62.8	52.4	28	18.2	12	9.6	7.2			
<u>2003</u>								41					
<u>2007</u>												87	
<u>2008</u>	55			102	12.6	127.8	86	46.2	69.2	88.4	12.6	99.4	
<u>2009</u>	11.6	87.4	48.6	66.4	0	75.8	53	2.8	21	187.8	56	106.2	716.6
<u>2010</u>	69	201	90.4	54.2	83.6	71.2	111.2	67.4	121	132.2	51	83.8	1136
<u>2011</u>	87.6	59	297.8	78.6	100.2	93	187.4	87.4	52.8	112.6	144.2	50.8	1351.4
<u>2012</u>	61	289	213.2	109.6	11.4	86	64.8	8	19.8	91.6	35.2	53.8	1043.4
<u>2013</u>	170.8	153.2	74.2	183.6	121.8	220.2	69.6	17.8	89	12.8	137.2	85.2	1335.4
2014	26.2	42	306.2	103.8	10.8	34.2	7.8	154.4	52.4	86.8	47.4	159.8	1031.8
<u>2015</u>	208	98.4	53	247.6	44.2	69.8	48	269.4	82.8	46.6	57.2	105.6	1330.6
<u>2016</u>	124.6	25.6	86.6	32.6	9.2	328.4	91.6	91.4	56.4	30.6	25.8	50.8	953.6
2017	18.8	158.8	309.6	76	49.4	54	1.4	35.2	0.4		116.8	46.4	
<u>2018</u>	69	111.6	43	15.6	16.6	172	3.2	54.2	40.4	137.4	88.6	82.4	834
<u>2019</u>	107.2	22.8	159.4	33.8	9.2	119	16.6	45.8	68.4	35	26.8	2	646
<u>2020</u>	44.8	213.4	76.4	36	59.8	35.6	216.2	100.4	24	68	76.2	80.2	1031
<u>2021</u>	166.6	115.6											

2020/2021 1152.8

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Appendix C



Appendix C: (KMC: H24.011.000) **Ammonia levels and 20% trigger factor for Groundwater and 10% trigger factor for Surface Water at Gerroa Landfill**

Sample ID	MW1D	MW1S	MW3	MW4	MW5	MW6D	MW6S	MW7D	MW7S	MW9	MW 10	MW 11	MW 12	MW 13	MW 14	ML-1	ML-2	ML-3	ML-4	ML-5
20% trigger level (mg/L)	164.4	1.32	39.24	21.8	7.07	98.8	27.78	85.32	14.3	4.26	2.85	2.96								
10% tri <u>ş</u>	gger level ((mg/L)														0.836	1.38	0.066	0.23	2.38
22/02/08	130	0.16	-	0.88	0.1	81	3.2	110	3.3	0.34	0.3	0.99				0.31	0.88	-	1.7	-
29/05/08	130	0.18	0.75	0.65	0.10	90	3.3	86	4.7	0.10	0.10	0.12				1.5	3.7	-	0.10	-
25/08/08	140	0.18	0.77	0.65	0.10	110	3.2	86	5.9	0.22	0.73	0.24				0.22	0.44	-	0.27	
19/11/08	93	0.10	0.78	-	0.10	69	2.5	65	3.5	0.10	-	0.10				<1	<1	-	<1	1.6
18/02/09	82	0.02	0.60	-	0.02	72	1.7	81	5.1	0.62	0.25	0.10				Cleary Bros land	1.9	Cleary Bros land	Cleary Bros land	2
19/05/09	61	0.25	0.73	0.79	0.03	45	2.6	62	8.3	0.05	0.08	4.7				-	0.56	-	-	1.2
27/08/09	95	0.42	0.89	0.54	0.02	76	3.0	85	8.4	0.06	0.21	4.8				-	0.41	-	-	2.8
27/11/09	58	1.3	0.8	0.5	0.1	73	1.8	43	4.1	0.2	0.4	2.4				-	1.5	-	-	3.0
26/02/10	37	0.04	0.31	0.24	0.02	36.5	0.6	37.8	3.03	< 0.1	< 0.1	5.36					1.9			2.17
21/05/10	22.6	0.27	0.62	0.38	0.08	16.4	0.83	21.9	0.49	< 0.10	< 0.10	< 0.10				-	< 0.10			1.52
30/11/10	25.7	0.05	0.66	0.22	0.04	21.8	1.73	21.7	2.56	0.84	< 0.10	< 0.10				-	0.08	-	-	0.04
24/02/11	6.67	0.05	0.26	0.91	0.03	8.90	0.48	10.2	1.34	0.06	< 0.10	0.13					0.87	-	-	1.83
24/05/11	2.56	0.04	0.14	1.16	0.03	13.8	0.23	7.99	1.30	0.05	0.03	0.06					2.39			3.12
24/08/11	0.12	0.06	0.42	0.58	0.03	3.24	0.19	4.38	0.16	< 0.01	-	0.03					1.69	-	-	1.60
03/11/11	2.15	0.02	0.29	0.64	0.08	2.25	0.40	4.17	1.93	1.00	0.02	0.03					1.03			0.85
01/02/12	3.16	< 0.01	0.23	0.68	0.02	10.8	0.25	1.98	2.03	< 0.10	< 0.10	0.01				-	1.70	-	-	3.07
31/05/12	0.07	0.05	0.04	0.18	0.03	7.62	0.12	2.61	2.25	0.03	0.02	0.03					1.08			1.73
10/08/12	0.09	< 0.01	0.35	0.10	0.05	7.06	0.08	1.94	2.34	0.04	0.02	0.05					1.09			1.73
21/11/12	0.17	-	0.44	0.15	0.23	7.17	0.20	1.67	2.74	0.23	< 0.10	< 0.10				-	< 0.10	-	-	< 0.10

Sample	MW1D	MW1S	MW3	MW4	MW5	MW6D	MW6S	MW7D	MW7S	MW9	MW	MW	MW	MW	MW	ML-1	ML-2	ML-3	ML-4	ML-5
ID											10	11	12	13	14					
20%	164.4	1.32	39.24	21.8	7.07	98.8	27.78	85.32	14.3	4.26	2.85	2.96								
trigger																				
level																				
(mg/L)																				
10% trig	gger level ((mg/L)														0.836	1.38	0.066	0.23	2.38
18/02/13	0.26	0.13	7.78	0.44	0.55	12.8	0.91	1.93	1.2	1.08	0.58	0.42					< 0.10			< 0.10
31/05/13	2.2	1.9	2.1	16.5	16.8	14.6	0.04	2.82	1.91	< 0.01	0.05	0.07					0.75			0.81
21/06/13	0.01	0.15		0.46	0.04	17.5														
30/08/13	2.88	0.28	0.14	< 0.01	0.06	11.3	0.29	2.43	0.91	0.84	0.06	0.02					3.19			2.6
Re-																	0.01			0.04
sample																				
20/09/13																				
27/11/13	4.13	0.21	0.25	0.37	5.88	10.4	0.04	2.09	1.33	0.32	0.30	0.01					1.00			0.52
07/02/14	2.88		0.11	0.22	0.64	9.08	0.04	1.97	1.64	0.24	0.09	< 0.01					0.44			2.60
06/05/14	1.29	0.31	0.13	0.28	4.47	8.27	0.03	1.91	0.68	< 0.01	0.08	0.06					0.33			1.73
18/08/14	0.02	-	0.17	0.09	1.28	1.79	0.02	0.20	1.12	< 0.01	< 0.01	< 0.01				-	0.68	-	-	0.04
17/11/14	1.30	-	0.32	0.35	1.40	2.23	-	1.36	0.54	0.34	0.13	0.19				-	0.36	-	-	3.50
26/02/15	1.51	-	0.18	0.09	14.5	3.92	-	1.48	1.16	0.21	0.15	0.13				-	0.09	-	-	0.07
27/05/15	< 0.01	0.09	0.15	0.75	0.03	3.13	0.09	0.96	0.59	< 0.01	0.05	< 0.01				-	0.80	-	-	0.83
24/08/15	0.77	-	0.28	0.15	0.02	1.77	-	1.38	0.54	0.02	-	0.01				-	1.50	-	-	2.39
04/11/15	3.78	0.23	0.74	0.26	0.03	4.53	-	1.64	0.80	0.47	0.02	0.02					0.05			1.65
16/02/16	2.43	-	20.9	0.12	< 0.01	3.48	-	1.02	0.7	0.07	< 0.01	< 0.01				-	0.02	-	-	1.24
31/05/16	2.08	-	4.31	0.74	6.93	4.55	-	1.00	1.03	< 0.05	< 0.05	< 0.05				-	0.11	-	-	0.20
12/08/16	0.66	-	0.56	0.16	2.34	0.14	-	0.70	0.38	0.03	< 0.01	0.02				-	1.16	-	-	1.63
10/11/16	12.5	-	1.30	0.11	0.17	3.10	-	0.13	-	0.26	0.15	0.11				-	0.16	-	-	0.27
20/02/17	6.65	-	0.43	0.05	0.15	2.96	-	0.99	0.34	1.29	0.17	0.11				-	0.78-		-	1.20
18/05/17	11	0.31	0.18	0.12	0.04	5.76	0.06	0.98	0.29	0.19	0.18	0.04				-	1.21	No	-	2.82
																		access		
17/08/17	8.22		0.19	0.13	0.03	19.6	-	0.65	0.38	0.15	0.12	0.12				-	0.32	No	-	0.85
																		access		

Sample	MW1D	MW1S	MW3	MW4	MW5	MW6D	MW6S	MW7D	MW7S	MW9	MW	MW	MW	MW	MW	ML-1	ML-2	ML-3	ML-4	ML-5
ID 2004	164.4	1.00	20.24	21.0	7.07	00.0	07.70	05.22	14.2	1.00	10	11	12	13	14					
20%	164.4	1.32	39.24	21.8	7.07	98.8	27.78	85.32	14.3	4.26	2.85	2.96								
trigger																				
level																				
(mg/L)																				
	gger level (mg/L)														0.836	1.38	0.066	0.23	2.38
29/11/17	9.24	-	0.24	0.15	0.12	3.71	-	0.49	0.29	0.43	0.10	0.12				-	0.16	-	-	1.68
8/02/18	13.1	-	0.27	0.10	0.14	3.85	-	0.89	0.49	0.54	0.10	0.27				-	< 0.05	-	-	1.26
01/03/18	9.83	-	0.27	0.07	0.09	7.40		0.83												
(ammoni																				
a only)																				
15/03/18	16.2	-	0.28	0.15	0.08	4.43	-	0.93												
(ammoni																				
a only)																				
05/04/18	12.1	-	0.27	0.09	0.08	12.1	-	1.24												
(ammoni																				
a only)																				
18/04/18	22.8	-	0.3	0.14	0.07	6.71	-	1.35												
24/05/18	15.8	Dry	0.3	0.06	0.08	4.99	Dry	0.89	0.45	0.27	< 0.01	2.23				-	< 0.10	-	-	< 0.10
12/07/18	8.18		8.55		0.05	4.97		0.74				6.05	24.5	24.8	27.2					
22/08/18	8.58	Dry	0.21	0.08	0.02	2.2	Dry	0.15	0.31	0.09	0.16	5.35	17.7	18.6	30.8		0.17			1.06
17/10/18			0.34		1.44	7.69		0.63				5.79	27.5	32.8	39.4					
16/11/18	damaged	Dry	0.64	0.05	0.08	7.02	Dry	0.91	0.4	0.13	Dry	4.12	35.2	37.5	54.7	no	0.65	no	no	2.72
0.6/1.0/1.0					-		-				-		.		16.0	access		access	access	
06/12/18	damaged		0.35		0.07	8.45		1.11				2.26	31.7	32.8	46.3					
17/01/19	Damaged		0.33		0.48	5.78		1.72				2.24	23	26.1	34					
12/02/19	11.7		0.3	0.06	0.06	22.7	DRY	2.08	0.44	0.16	0.38	0.29				no		no	no	0.77
15/03/19	14.0		0.30		0.12	4.43		0.81				0.90	24.7	25.7	32.2	access		access	access	
(ammoni	17.0		0.50		0.12	J.T.J		0.01				0.70	27.7	23.1	52.2					
a only)																				
a only)							l			I	l	l		I		1				

Sample ID	MW1D	MW1S	MW3	MW4	MW5	MW6D	MW6S	MW7D	MW7S	MW9	MW 10	MW 11	MW 12	MW 13	MW 14	ML-1	ML-2	ML-3	ML-4	ML-5
20% trigger level (mg/L)	164.4	1.32	39.24	21.8	7.07	98.8	27.78	85.32	14.3	4.26	2.85	2.96	12	13	14					
	gger level (mg/L)														0.836	1.38	0.066	0.23	2.38
04/04/19	15.0		0.39		0.08	5.05		1.32				1.60	34.4	26.0	40.9					
28/05/19	15.5	Dry	0.34	0.05	0.03	8.74	Dry	2.36	0.45	0.34	0.23	2.20				no access	0.26	no access	no access	0.75
21/06/19	23.1		0.39		0.04	1.37						0.56	29.6	32.7	52.9					
27/08/19	27.3	-	0.42	0.08	0.08	40.0	-	20.5	0.27	0.12	0.32	1.15	43.8	41.8	68.4	-	0.12			0.07
12/07/19	20.5		0.35		< 0.01	4.87		0.80				1.90	33.1	24.7	54.9					
17/10/19	24.9		0.32		0.04	36.3		13.7				5.3	36.5		83.0					
22/11/19	35		0.38	0.10	0.05	57	-	20.0	0.32	0.03	0.05	4.24				0.47	0.03	0.16	0.52	1.93
05/12/19	41.0		0.43		0.09	53.6		19.6				3.29	58.2	55.7	93.6					
31/01/20	26.9	-	0.39	0.10	0.10	35.8	-	17.1				4.52	38.6	38.2	57.9					
14/02/20	27.8	dry	0.37	0.08	0.04	50	-	21.4	0.25	0.08	0.12	4.01	57	62	96.5	0.15	0.27	0.17	0.18	0.18
5/3/20	30.9		0.3		0.02	44.5		14.8				<mark>5.79</mark>	46.9	43.6	81.1					
28/5/20	44.1		0.44	0.11	0.07	56		21	0.22	<0.01	0.14	2.55	57.7	54.7	97.7	0.1	0.13	0.06	0.06	0.12
17/6/20													55.9	52.3	95.3					
13/8/20	27.8	< 0.01	0.22	0.04	<0.01	52.4	0.03	18.3	<0.01	0.25	<0.01	17.0				0.03	0.06	0.02	0.02	0.04
9/9/20	23.3		0.25		0.02	41.5		19.2				2.15	37.5	26.6	73.1					
6/11/20	21.1	0.14	0.3	0.11	<0.01	36.2		17.4	0.16	0.01	0.02	1.34				0.15	0.51	<mark>0.14</mark>	0.15	0.61
18/12/20	32.5		0.43		0.18	42.5		18.1					42.3	46.6	84.4					
8/1/21	16.4		0.31		0.02	37.2		18.5				0.97	38.9	34.6	69.9					
1/2/21	22		0.35	0.14	<0.01	36.4		16.8	0.12	0.24	0.06	0.43	46.7	83.5	40.4	0.37	<0.01	<mark>0.34</mark>	<mark>0.34</mark>	0.34

Note; Summary Information provided by Kiama Council @ March 2020



Appendix D





DOC17/218276

The General Manager Kiama Municipal Council Via e-mail at: council@kiama.nsw.gov.au

Attention: Ms Julie Milevski

07 September 2017

Dear Mr Forsyth

Gerroa Waste Disposal & Recycling Facility Ground and Surface Water Monitoring Results

I refer to the email from Ms Julie Milevski of Kiama Municipal Council (Council) to the Environment Protection Authority (EPA) dated 7 April 2017 providing ground and surface water monitoring results for the Gerroa Waste Disposal & Recycling Facility located at 349 Crooked River Road, Gerroa (the Premises). I apologise for the delay in responding to this matter.

The results have been reviewed and the EPA is seeking further information as below.

MW1D

On 10 November 2016 and 20 February 2017, ammonia levels at this monitoring point were 12.5mg/L and 6.65mg/L respectively. These are the highest recorded results since 2011 results.

MW3

On 31 May 2016 and 10 November 2016, ammonia levels at this monitoring point were 4.31mg/L and 1.30mg/L respectively. It is noted that on 16 February 2016, ammonia was detected as 20.9mg/L however, Council's consultant indicated that this result was an anomaly. Aside from this result, and 7.78mg/L being detected on 18 February 2013, all other results have been below 1.00mg/L.

The EPA is seeking further explanation as to the cause of the suspected elevated ammonia results and whether any remediation action is required. Please provide the requested response in writing to Unit Head Waste Compliance, PO Box 513, WOLLONGONG, NSW, 2520 or by email to <u>waste.operations@epa.nsw.gov.au</u> or by Fax at (02) 4224 4110. The submission must be made by **5pm on 29 September 2017**.

If you have any questions about this matter, please contact Greg Frost on (02) 4224 4113.

Yours sincerely

MATTHEW CORRADIN Unit Head Waste Compliance Environment Protection Authority

PO BOX 513 Wollongong NSW 2520 Level 3, 84 Crown Street, Wollongong NSW 2500 Tel: (02) 4224 4100 Fax: (02) 4224 4110 ABN 43 692 285 758 www.epa.nsw.gov.au



Environmental & Groundwater Consulting

Phone (02) 4234 0829 Mobile 0422 334102

ABN 64 100 859 238 175 Fern Street Gerringong NSW 2534

Client: Kiama Municipal Council

Project: Second Interim Groundwater Report Gerroa Waste Disposal Depot

> Prepared for: Tony Hardy Kiama Municipal Council P.O. Box 75, Kiama, NSW, 2533.

Report: 14 May 2018 Reference: E2W-025 Gerroa R002 (V1)

Authorised by: Earth2Water Pty Ltd

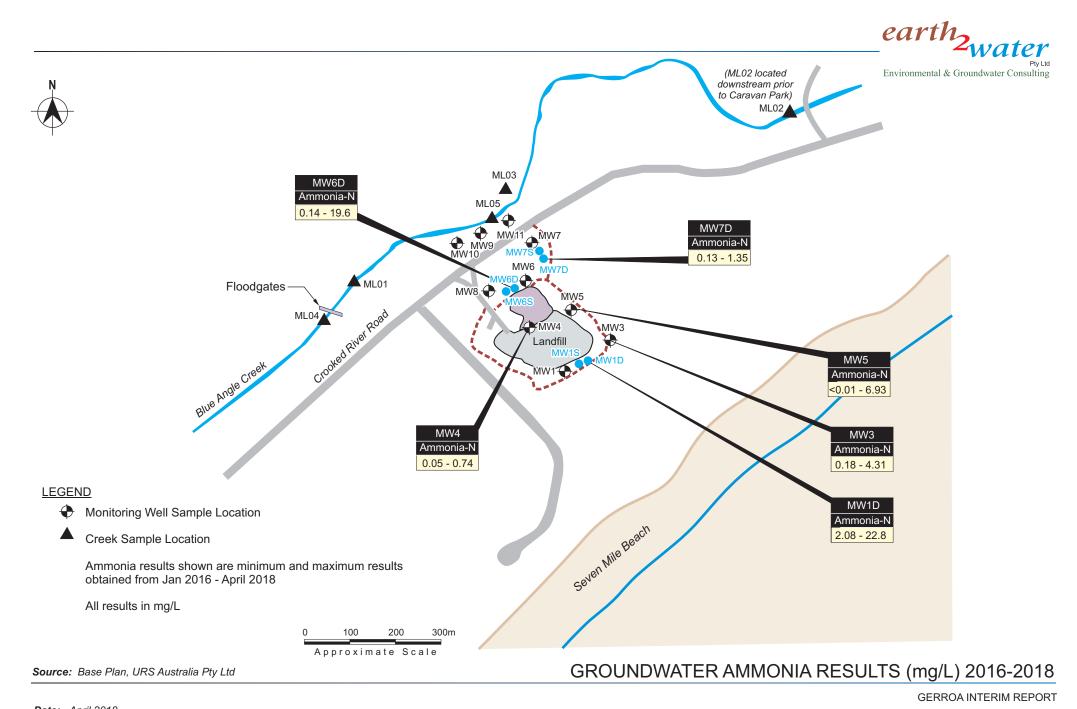


Dino Parisotto - Director BAppSc Geology (Hons); MAppSc (Groundwater) SCPA Certified Practitioner- Site Assessment and Management



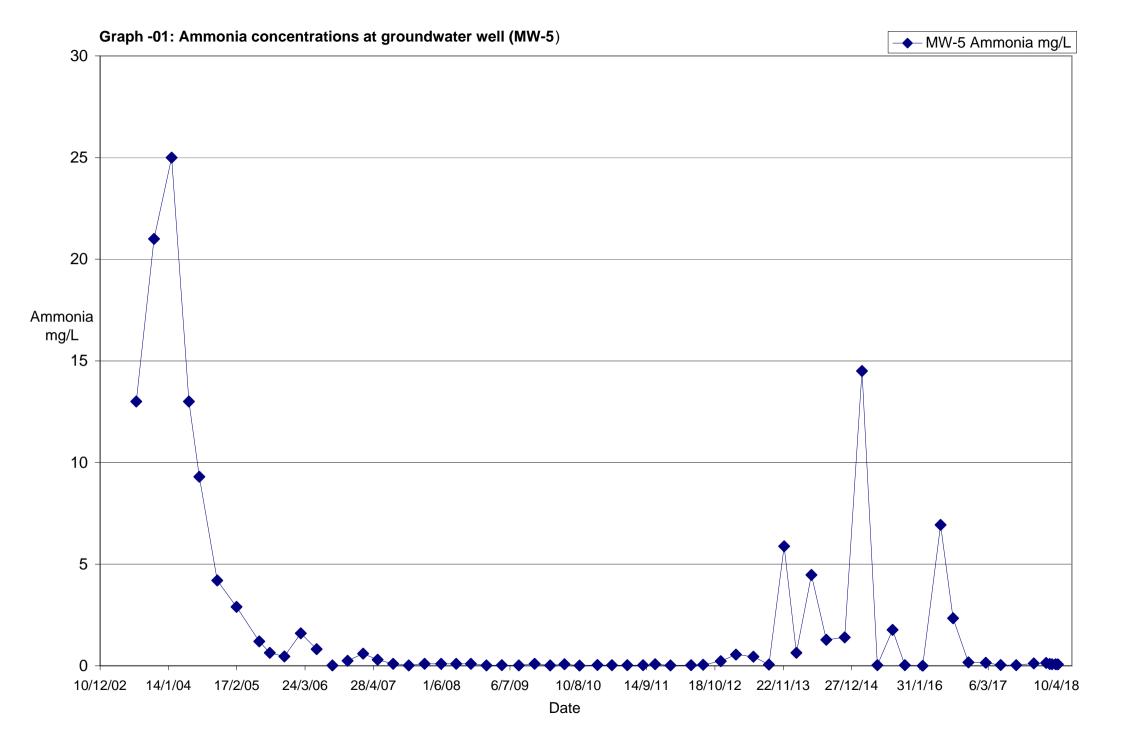
Ph: (02) 4234 0829 Mobile: 0422 334102 175 Fern Street, Gerringong, NSW, 2534

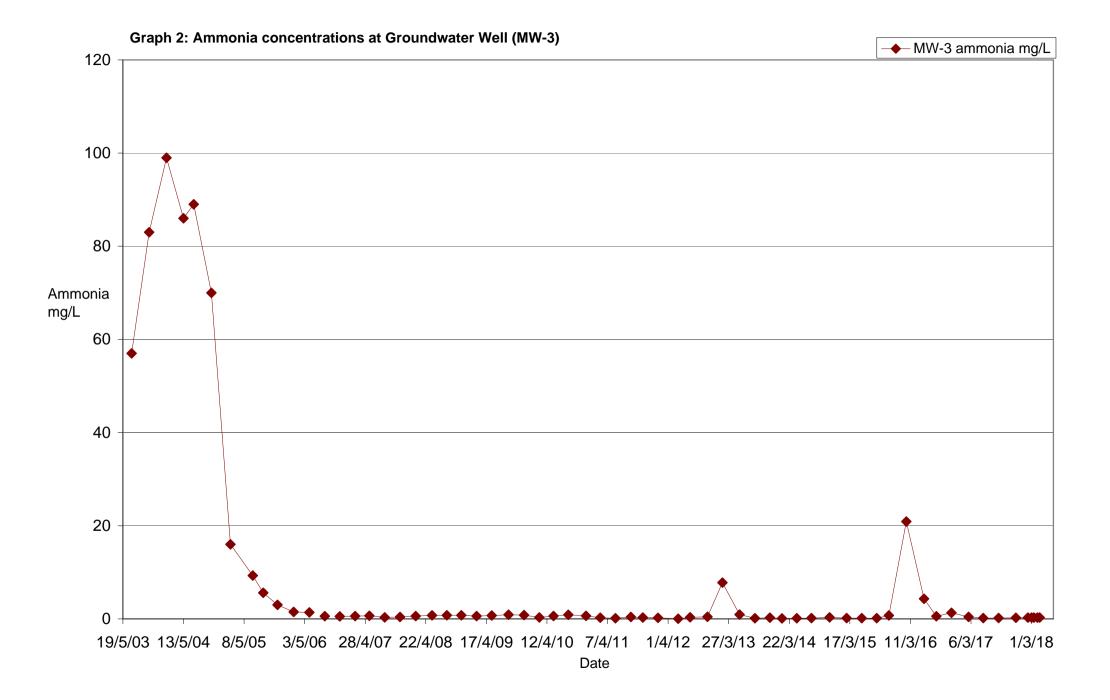
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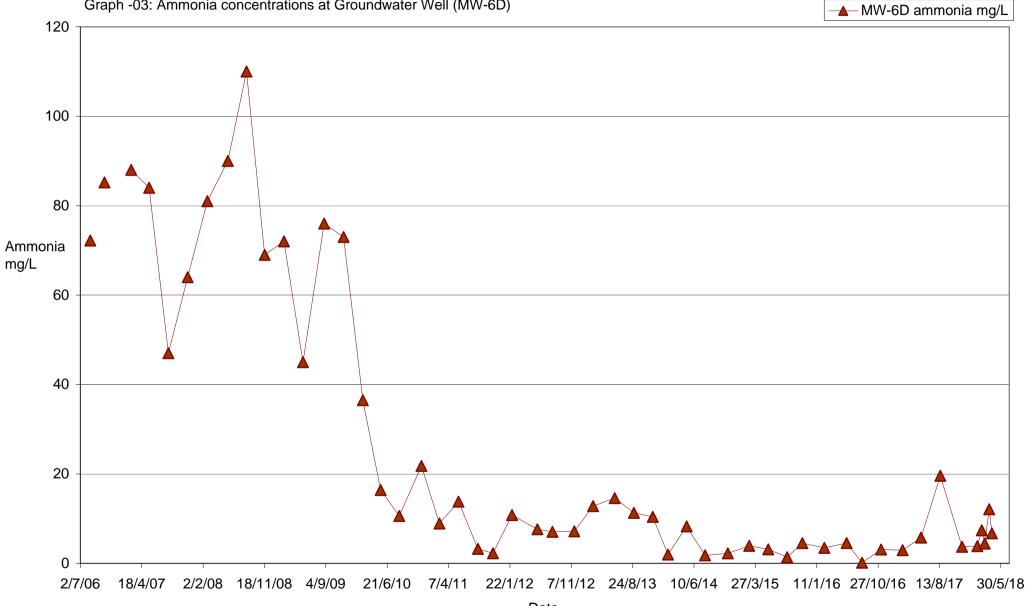


Date: April 2018 **Reference:** E2W_025_58.cdr

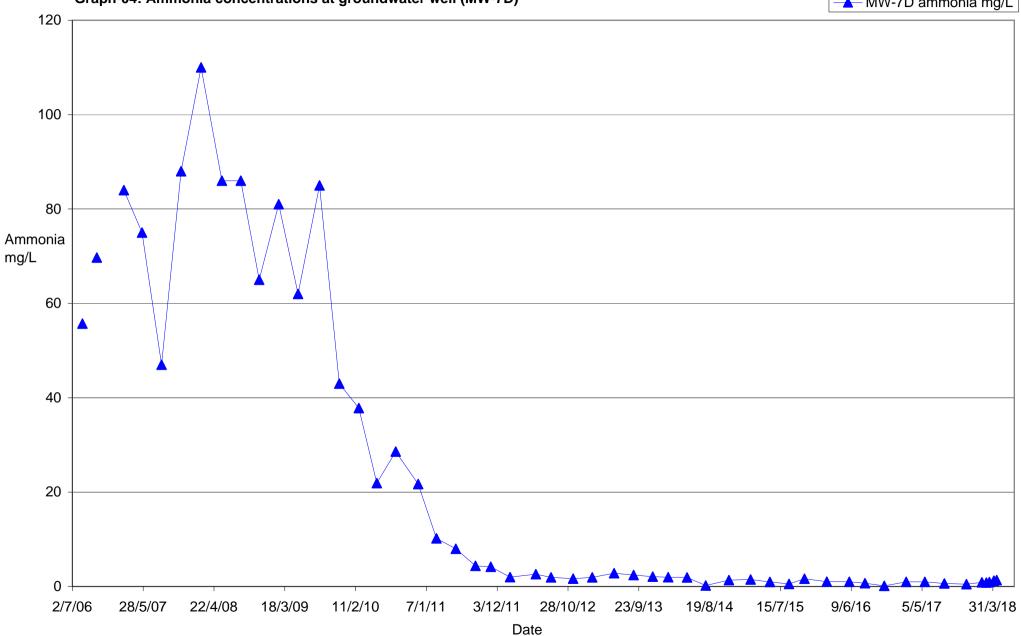
Figure 1





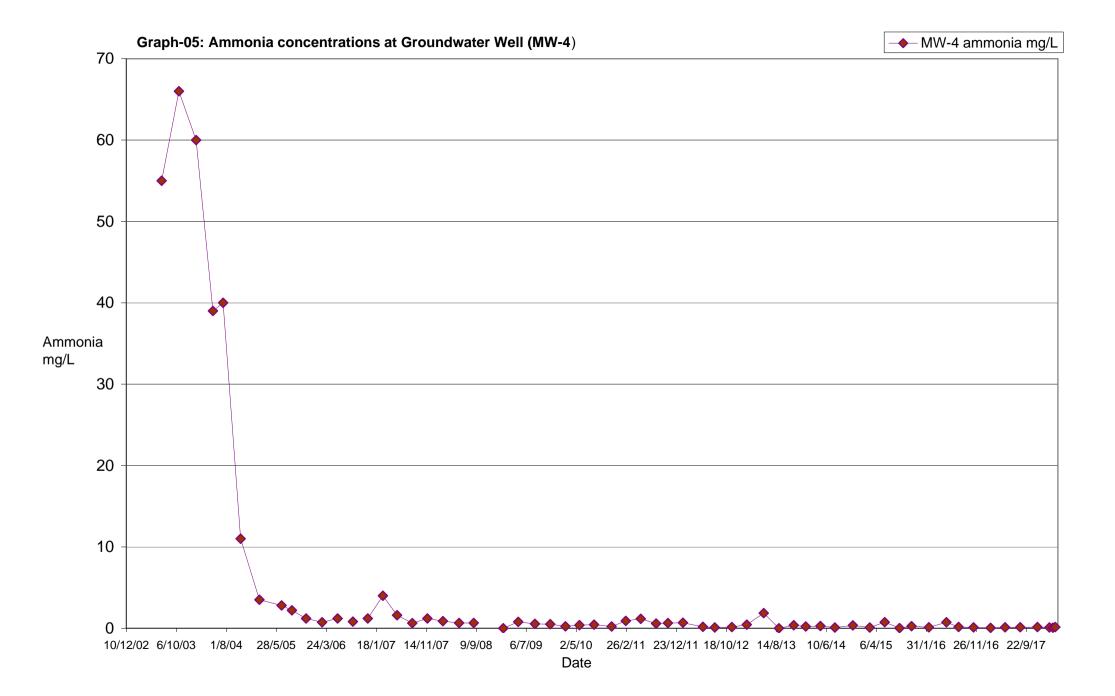


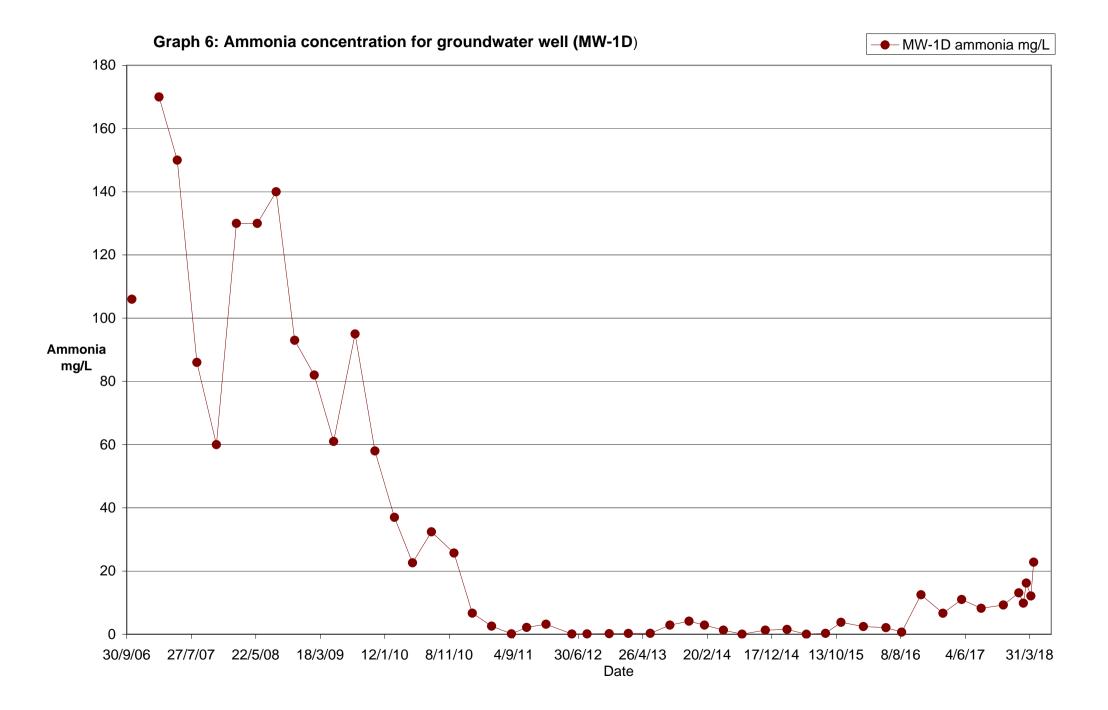
Graph -03: Ammonia concentrations at Groundwater Well (MW-6D)



Graph-04: Ammonia concentrations at groundwater well (MW-7D)

MW-7D ammonia mg/L







Appendix E

Limitations

Earth2Water Pty Ltd has prepared this report for the use of Kiama Council in accordance with the standard terms and conditions of the consulting profession. This report is prepared in accordance with the scope of work and for the purpose outlined in the proposal. The methodology adopted and sources of information used by E2W are outlined in this report.

This report was prepared in August 2018 and is based on the information reviewed at the time of preparation. This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report, and our previous experience.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, E2W should be notified of any such findings and be provided with an opportunity to review recommendations and or conclusions offered.

 e_2W

LAST PAGE OF REPORT

Thank you for the opportunity to work with Kiama Council.

Your feedback is appreciated at Earth2Water (dino@earth2water.com.au)





Appendix E

Limitations

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