



# **QUARTERLY ENVIRONMENTAL MONITORING REPORT (QEMR) DECEMBER 2021**

**DUNMORE RECYCLING & WASTE DEPOT  
44 BUCKLEYS ROAD,  
DUNMORE, NSW, 2529**

**ENVIRONMENT PROTECTION LICENCE (EPL) 5984**

Prepared For: **Shellharbour City Council**  
Project Number: **ENRS0033**  
Date: **December 2021**

**ENRS**

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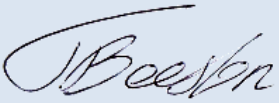

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### ACKNOWLEDGEMENTS

The project was conducted through close liaison with Shellharbour City Council (SCC) and ALS Environmental.

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## EXECUTIVE SUMMARY

Environment & Natural Resource Solutions (ENRS Pty Ltd) were commissioned as independent environmental consultants by *ALS Environmental* (Wollongong) on behalf of *Shellharbour City Council* (SCC) to prepare the Quarterly Monitoring Report for the Dunmore Recycling and Waste Depot (herein referred to as the Site).

This report summarises the results of field testing and laboratory analysis conducted by ALS for the December 2021 quarterly monitoring period. This Quarterly Report provides the necessary data assessment and analysis to meet requirements of the Site's Environment Protection Licence/s (EPL's); No.5984 and No.12903.

The Site was established in 1945 and has been managed by Shellharbour Council (SC) since 1983. The Site accepts putrescible and non-putrescible waste within its managed landfill cell. Recycling activities conducted at the site include Resource Recovery Centre, Revolve Centre and Food Organics and garden Organics (FOGO) processing.

Waste regulation in NSW is administered by the EPA under the Protection of the Environment Operations (POEO) Act (1997); the *Waste Avoidance and Resource Recovery Act* (2001).

The Site operates under the conditions of two (2) EPLs:

- **EPL No. 5984.** Landfill activities. Consisting of; extractive activities, waste disposal and composting.
- **EPL No. 12903.** Resource recovery activities. Consisting of; composting and waste storage within the FOGO Facilities and Resource Recovery Centre.

A copy of the relevant EPL sections outlining the sampling requirements is provided in **Appendix A** (EPL No. 5984). ENRS note that EPL No. 12903 does not specify sample points.

The objectives of this AEMR are to:

- Meet the environmental monitoring requirements of Sites EPLs; No. 5984 and 12903;
- Assess and analyse the environmental monitoring data for the Site against NSW EPA endorsed criteria;
- Identify trends of the environmental monitoring data over the reporting period;
- Identify any on-site or off-site impacts associated with operation of the Site;
- Advise SCC if the current environmental monitoring program is providing adequate information to identify potential environmental impacts from existing operations (if any) and provide recommendations on improvement to the monitoring program if required; and
- Document monitoring results in a Quarterly Environmental Monitoring Report.
- The scope of work for this QEMR comprised the collation, assessment and reporting of Site data made available to ENRS from the December 2021 monitoring period in regard to the following tasks:
  - Review previous reports and document the hydrogeological setting;

- Tabulate results of all monitoring data for both water and dust samples, collected and provided by ALS as required by the EPLs for the respective reporting period.
- Analysis and interpretation of all monitoring data (water, dust and landfill surface gas);
- Review all quarterly environmental monitoring reports from the 2020-2021 reporting period and available data from the last three (3) years;
- Identification of any deficiencies in environmental performance identified by the monitoring data, trends or environmental incidents, and identification of remedial actions taken or proposed to be taken to address these deficiencies; and
- Recommendations on improving the environmental performance of the facility including improvement to the monitoring program.

Based on the findings obtained during the December 2021 monitoring program the following conclusions and recommendations are provided:

- Shallow groundwater flow is expected to mimic topography with low hydraulic gradients flowing towards the south and southeast towards Rocklow creek. The nearest sensitive receptors are likely to include; recreational users of the Minnamurra River estuary environs; down gradient stakeholders; and downgradient alluvial aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems near discharge zones;
- Groundwater throughout the monitoring period reported exceedances of the assessment criteria for; ammonia, heavy metals, nitrate and salinity (EC) within multiple groundwater bores including; BH-1c, BH-3, BH-4, BH-9, BH-12r, BH-13, BH-14, BH-15, BH-19r, BH-21 and BH-22. This was considered to be consistent with historical values;
- Downgradient Rocklow Creek surface water samples (SWC-Up, SWC-2, SWC-down and SWC-down 2) were reported within the adopted Site Assessment Criteria;
- Downgradient Rocklow Creek surface water samples (SWC-Up, SWC-2, SWC-down and SWC-down 2) have maintained reductions in Potassium, Calcium and Sulphate concentrations from May 2021 to December 2021 monitoring period.
- Flare operating temperature were generally observed to be below the target operating threshold of 760 degrees Celsius. Operations taken by the operator to address the root causes of the low Flare Stack temperatures are outlined in the monthly LGI reports attached as Appendix G;
- Surface gas methane monitoring reported satisfactory results all within the adopted assessment criteria;
- Gas accumulation monitoring reported satisfactory results for all enclosures tested within 250m of emplaced waste or leachate storage facility;
- Dust deposition gauges recorded satisfactory results below the guidelines provided in AS3580.10.1. Monitoring should continue in accordance with EPL 5984 requirements;

- No non-compliances with the EPL were reported during the December 2021 monitoring period;
- Based on this review of the December 2021 monitoring period, contaminants associated with the landfill cell, leachate dam/s and general site uses are considered to be relatively consistent with the range of historical results;
- Should any change in Site conditions or incident occur which causes a potential environmental impact, a suitable environmental professional should be engaged to further assess the Site and consider requirements for any additional monitoring; and
- This report must be read in conjunction with the attached Statement of Limitations.

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## 1.0 INTRODUCTION

Environment & Natural Resource Solutions (ENRS Pty Ltd) were commissioned as independent environmental consultants by *ALS Environmental* (Wollongong) on behalf of *Shellharbour City Council* (SCC) to prepare the Quarterly Environmental Monitoring Report (QEMR) for the Dunmore Recycling and Waste Depot (*herein referred to as the Site*).

This (QEMR) summarises the results of field testing and laboratory analysis conducted by ALS for the December 2021 monitoring period, and provides the necessary data assessment and analysis to meet requirements of the Site's Environment Protection Licence/s (EPL's); No.5984 and No.12903.

### 1.1 PROJECT BACKGROUND

#### 1.1.1 Site History

The Site was established in 1945 and has been managed by Shellharbour Council (SC) since 1983. The Site accepts putrescible and non-putrescible waste within its managed landfill cell. Recycling activities conducted at the site include Resource Recovery Centre, Revolve Centre and Food Organics and garden Organics (FOGO) processing.

In late 2020 to July 2021 Shellharbour City Council moved away from sole reliance on traditional onsite leachate management techniques through initiating a secondary leachate treatment option in which leachate was transported from site for processing at a contractor facility.

In early 2021 Shellharbour City Council constructed a new Leachate Treatment Plant (LTP) on site, which was commissioned in July/August 2021. The LTP is comprised of three primary biological treatment units, including an anoxic reactor, nitrifying reactor, and sequencing batch reactor. The treated stream meets Sydney Water requirements for discharge into Sydney Water sewer, under a trade waste agreement. On average the LTP discharges 60kL/day of treated water, equating to approximately 22ML of leachate removal from site per annum.

#### 1.1.2 EPL Requirements

Waste regulation in NSW is administered by the EPA under the Protection of the Environment Operations (POEO) Act (1997); the *Waste Avoidance and Resource Recovery Act* (2001).

The Site operates under the conditions of two (2) EPLs:

- **EPL No. 5984.** Landfill activities. Consisting of; extractive activities, waste disposal and composting.
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A copy of the relevant EPL sections outlining the sampling requirements is provided in **Appendix A** (EPL No. 5984). ENRS note that EPL No. 12903 does not specify sample points.

## 1.2 OBJECTIVES

The objectives of this AEMR are to:

- Meet the environmental monitoring requirements of Sites EPLs; No. 5984 and 12903;
- Assess and analyse the environmental monitoring data for the Site against NSW EPA endorsed criteria;
- Identify trends of the environmental monitoring data over the reporting period;
- Identify any on-site or off-site impacts associated with operation of the Site;
- Advise SCC if the current environmental monitoring program is providing adequate information to identify potential environmental impacts from existing operations (if any) and provide recommendations on improvement to the monitoring program if required; and
- Document monitoring results in an Annual Environmental Monitoring Report.

## 1.3 SCOPE OF WORK

The scope of work for this QEMR comprised the collation, assessment and reporting of Site data made available to ENRS from the December 2021 monitoring period in regard to the following tasks:

- Review previous reports and document the hydrogeological setting;
- Tabulate results of all monitoring data for both water and dust samples, collected and provided by ALS as required by the EPLs for the respective reporting period.
- Analysis and interpretation of all monitoring data (water, dust and landfill surface gas);
- Review all quarterly environmental monitoring reports from the 2020-2021 reporting period and available data from the last three (3) years;
- Identification of any deficiencies in environmental performance identified by the monitoring data, trends or environmental incidents, and identification of remedial actions taken or proposed to be taken to address these deficiencies; and
- Recommendations on improving the environmental performance of the facility including improvement to the monitoring program.

## 2.0 SITE DESCRIPTION

### 2.1 LOCATION

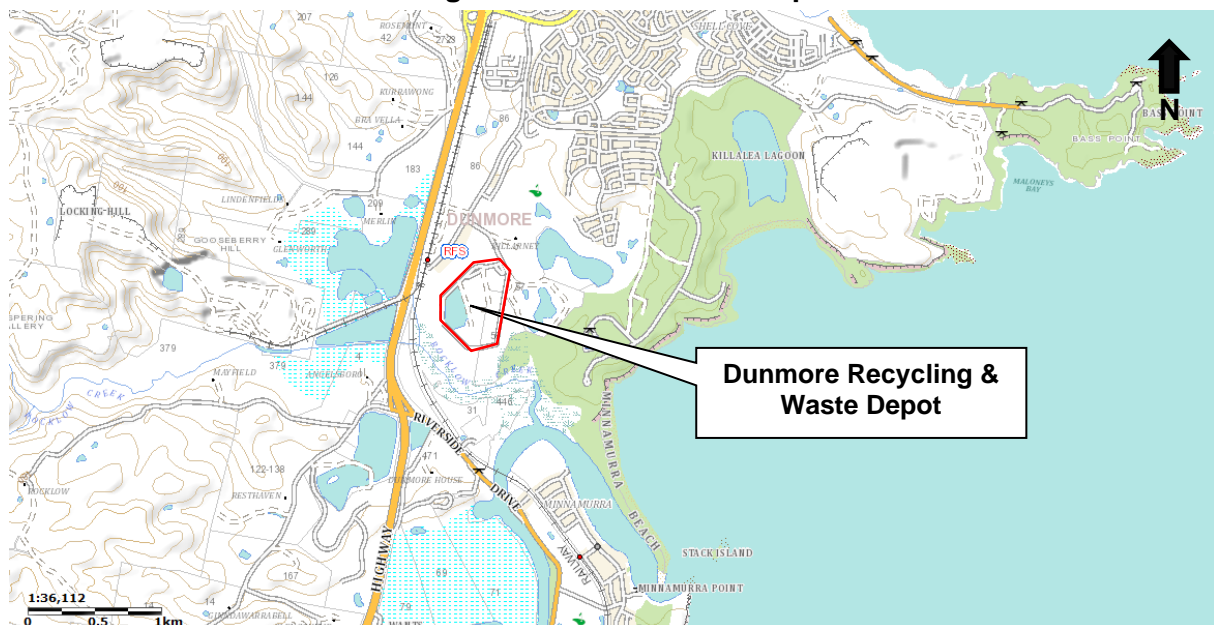
The Site is located at 44 Buckleys Road, Dunmore, NSW, 2529, legally defined as Lot 21 in Deposited Plan 653009 and Lot 1 Deposited Plan 419907. The Site is situated approximately three and a half (3.5) kilometres southwest of the Shellharbour town centre. The area's

regional location is defined in **Figure 1** below. Details of the Site boundary and sampling points are provided in the Site Plan (see **Figure 2**). The key features required to identify the Site are summarised in **Table 1**.

**Table 1: Site Identification**

Aspect	Description
<b>Site</b>	Dunmore Recycling and Waste Depot
<b>Street Address</b>	44 Buckleys Road, Dunmore, NSW 2529
<b>Site Area</b>	72.36 hectares
<b>Title Identifier</b>	Lot 21 DP 653009, Lot 1 DP 419907
<b>Zoning</b>	RU1 Primary Production
<b>Local Government Area</b>	Shellharbour City Council

**Figure 1: Site Location Map**



Source: SIX Maps (<https://maps.six.nsw.gov.au/>) (cited 16/01/2020)

## 2.2 SURROUNDING LANDUSE

The current activities and operations on adjacent properties and the surrounding area include:

**Table 2: Surrounding Land use**

Direction	Land Use
<b>North:</b>	Buckleys Road, commercial infrastructure and open grassland. Residential dwellings along the northwest border of the Site. Golf course further to the northeast.

Direction	Land Use
East:	Dunmore Resources and Recycling facility immediately to the east, bushland to the southeast.
South:	Bushland, Rocklow Creek (300m from landfill activities). Further to Kiama Community Recycling Centre and Riverside Drive.
West:	Bushland to the southwest, scattered trees immediately to the west and further to the Princes Highway. Boral Quarries complex beyond the Highway. Residential dwellings to the Northwest.

### 2.2.1 Sensitive Receptors

The nearest sensitive receptors are likely to include:

- Recreational users of the Minnamurra River estuary environs;
- Down gradient stakeholders; and
- Down gradient alluvial aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems (GDE) near discharge zones.

## 2.3 TOPOGRAPHY & DRAINAGE

A review of the current series Albion Park (90281N) 1:25,000 topographic map sheet was conducted to assess the regional topography and to identify potential runoff and groundwater controls in the region. Topography provides a useful indicator for groundwater controls including gradient and flow path.

The Site presents low topographic relief, remaining between approximately 3-5 mAHD across the entirety of the Site. The regional topographic gradient trends south-southeast towards Rocklow Creek and Minnamurra River.

## 2.4 SOIL LANDSCAPE

The previous annual monitoring report (Environmental Earth Sciences 2018) reported the soil profile at the Site as organic, black, massive sandy loam topsoil overlying loose bleached light grey sand with iron staining in the subsoil.

Review of the online *Shellharbour City Council Acid Sulphate Soil Risk Map* indicates that the Site lies within a **Class 3** area, suggesting that works beyond 1 metre below the ground level (mbGL) have the potential to encounter Acid Sulphate Soils (ASS).

## 2.5 GEOLOGY

A review of the Site geology was undertaken with reference to the Wollongong 1:250,000 geological series sheet (Si56.9) and the Shellharbour-Kiama area coastal quaternary 1:50,000 geology sheet (see **Figure 4**). The Site is predominately underlain by the Quaternary alluvial deposits (Qal) characterised as Holocene backbarrier flat; marine sand, silt, clay, gravel and shell (Qhbf). The northern most corner of the site is intersected by the Gerringong Volcanics (Pbb) characterised by Latite. Based on the mapped geology, previous investigations and

borehole logs, the Site infrastructure including the landfill cell is located within the alluvial deposits.

## 2.6 HYDROGEOLOGY

Groundwater resources in the area are expected to be associated with *Shallow unconfined* alluvial and unconsolidated systems, generally less than 20 m in depth with moderate to high transmissivity, variable water quality, and strongly controlled by rainfall recharge.

### 2.6.1 Existing Bores

A network of groundwater monitoring bores is installed at the Site to provide specific data on the quality and nature of groundwater. Given the spatial distribution of the bores and disturbed ground condition expected within the land fill cell, groundwater contours could not be accurately mapped.

A review of the *NSW Office of Water (NOW)* existing bore records was conducted to develop the conceptual understanding of regional groundwater conditions, including aquifer depths, yields, water quality, and distribution. A search of the Bureau of Meteorology Australian Groundwater Explorer groundwater database identified a total of eighty-eight (88) registered bores within one and a half (1.5) kilometres of the Site (see **Figure 5**). Registered bores in the area are predominantly associated with the Landfill Site and with the quarry complex (*Boral Site*) to the west of the EPL Site. The majority of bores are registered for monitoring purposes, excluding a single well (GW044447), which is registered for stock and domestic purposes. The stock bore is located approximately one (1) kilometre to the north of the Site, on the western side of the Princes Highway, which is considered to be up gradient of the Site and not in direct hydraulic connectivity. Registered bore depths are between 1.25 m and 22 m. Bore records indicate shallow unconsolidated aquifer systems.

### 2.6.2 Flow Regime

Previous reports (*Environmental Earth Sciences, 2018*) have identified that groundwater flows vary across the Site, but the general trend is south, towards Rocklow Creek.

Based on the unconfined nature of the aquifers, the shallow groundwater flow is inferred to mimic topography with low to moderate hydraulic gradients flowing towards the south.

The Site and adjoining land, was largely unsealed with potential for local recharge from rainfall infiltration. Likely discharge areas are predominantly to the south and east of the Site including swamps and Rocklow Creek. The waterbodies surrounding the Site are recognised as State Environmental Planning Policy No.14 (SEPP14) registered wetlands and Proximity Areas for Coastal Wetlands border the eastern, southern and western boundaries of the Site.

## 2.7 SURFACE WATER

The Site topography indicates that surface water flow will generally trend to the east towards off Site wetlands and southeast towards Rocklow Creek. These present the primary regional drainage structures for natural surface water and runoff. A series of stormwater infrastructure is present at the Site which is expected to capture run off. Infrastructure includes but not limited

to; stormwater drains; sedimentation ponds; levee banks; collection and diversion drains; and leachate dams.

## 3.0 ASSESSMENT CRITERIA

### 3.1 CONTAMINANTS OF POTENTIAL CONCERN

This section of the report provides a summary of the Contaminants of Potential Concern (CoPC) associated with the Site. CoPC's are identified in the Sites EPL/s which document the CoPC and water quality indicators required to be monitored. Analytical requirements for all water sampling are provided in Appendix A.

### 3.2 WATER QUALITY GUIDELINES

Nationally developed guidelines are provided in the National Water Quality Management Strategy (NWQMS): Guidelines for Groundwater Protection in Australia (ARMCANZ & ANZECC 1995). For the purpose of this assessment, the relevant criteria selected to protect environmental values are summarised in **Table 3** below:

**Table 3: Groundwater Assessment Criteria**

Environmental Value	Relevant Guideline
Ecosystems / Health Screening Levels	ANZG (2018) (Australian and New Zealand Guidelines for Fresh and Marine Water Quality).
	National Environment Protection Measure (NEPM) (2013).
Drinking Water	Australian Drinking Water Guidelines (ADWG) (2018)

#### 3.2.1 ANZG Guidelines

The relevant criteria for this water quality assessment are the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG;2018). The ANZG (2018) provide Default Guideline Values (DGVs) for four (4) levels of protection categorised by the percentage of species possibly affected, being 80%, 90%, 95% or 99% of species. Values for a level of protection for 95% of species in a marine environment have been adopted and are displayed in **Table 4**. Where DVGs are not available reference is made against the ANZECC (2000) Trigger Values (TVs). The *NSW Office of Water* (DECCW;2007) endorsed groundwater management guidelines recommend assessment for aquatic ecosystems based on the **95 per cent of species level of protection**.

**Table 4: Adopted Guideline Criteria**

Parameter	Groundwater Guideline	Surface water Guideline
Ammonia	0.9 mg/L	0.9 mg/L
Nitrate	10.6 mg/L	10.6 mg/L
pH	6.5-8.0 pH units	6.5-8.0 pH units

Parameter	Groundwater Guideline	Surface water Guideline
Soluble Iron	0.3 mg/L	0.3 mg/L
Manganese	1.9 mg/L	1.9 mg/L
Electrical Conductivity	125-2200 µS/cm	125-2200 µS/cm

### 3.2.2 National Environmental Protection Measure (NEPM)

The NSW EPA has endorsed the use of the Groundwater Investigation Levels (GILs) given in the 2013 ASC NEPM ‘Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater’. The latest NEPM provide a framework for risk-based assessment of groundwater contamination.

Groundwater Health Screening Levels (HSLs) are provided for four (4) land use categories for vapour intrusion (Table 1A[4]) associated with Total Recoverable Hydrocarbons TRH (F1 & F2) and BTEX compounds.

NEPM	Description of Land use Categories
HIL A	Residential A with garden/accessible soil also includes children’s day care centres, preschools and primary schools.
HIL B	Residential B with minimal opportunities for soil access; includes buildings with fully and permanently paved yard space such as high-rise buildings and apartments.
HIL C	Recreational C includes public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and unpaved footpaths.
HIL D	Commercial/industrial D includes premises such as shops, offices, factories and industrial sites.
<b>GILs</b>	Groundwater Investigation Levels (GILs) should be applied based on the receiving environment and groundwater resources. GILs are provided in NEPM Table 1C for; Fresh Waters; Marine Waters; and Drinking Water;
<b>EILs</b>	Ecological Investigation Levels (EILs) for common contaminants in the top two (2) metres of soil based on three (3) generic land use settings: <ul style="list-style-type: none"> <li>• Areas of ecological significance;</li> <li>• Urban residential areas and public open space; and</li> <li>• Commercial and industrial land uses.</li> </ul>

### 3.3 DUST DEPOSITION ASSESSMENT CRITERIA

Criteria for collection and assessment of dust deposition concentrations are provided within the Australian standard AS3580.10.1 - Methods for sampling and analysis of ambient air; method 10.1- Determination of particulate matter - Deposited matter - Gravimetric method. AS3580.10.1 provides an acceptable level of 4 g/m<sup>2</sup>/month.

### 3.4 SURFACE METHANE GAS ASSESSMENT CRITERIA

The NSW EPA Solid Waste Landfill Guidelines 2<sup>nd</sup> Edition (2016) provides sampling methodologies and threshold for surface methane gas concentrations at landfill sites. The acceptable threshold for capped landfills is 500 parts per million (ppm) at 5 cm above the capping surface.



### 3.5 GAS ACCUMULATION MONITORING IN ENCLOSED STRUCTURES

The NSW EPA Solid Waste Landfill Guidelines 2<sup>nd</sup> Edition (2016) provides sampling methodologies and threshold gas levels to ensure that gas is not accumulating within enclosed structures on or within 250m of deposited waste or leachate storage. The acceptable threshold for 1% (volume/volume).

## 4.0 SAMPLING METHODOLOGY

Field sampling was conducted by *ALS Environmental* (Wollongong) as commissioned by SCC on quarterly basis. ENRS understands that sampling was conducted in accordance with ALS sampling protocols with reference to current industry standards and Code of Practices. The following sub-sections provide a summary of the sampling methodologies.

Monitoring frequency is defined by the EPL's and is designed to capture necessary site data to support assessment of Site conditions (quarterly and annual), any long-term trends or overflow events. Monitoring is conducted quarterly and annually for selected analytes with additional overflow and event-based sampling triggered by Site conditions.

### 4.1 WATER SAMPLING

#### 4.1.1 Location of Water Monitoring Points

Groundwater and surface water monitoring requirements are defined by the EPL No. 5984, as provided in Appendix A. The water sampling regime includes; five (5) surface waters, one (1) located onsite and four (4) located off-site; twelve (12) groundwater monitoring wells surrounding the landfill operations; and two (1) leachate point. Sampling locations are illustrated in **Figure 2** attached.

#### 4.1.2 Depth to Water

Prior to sampling, the depth to the groundwater table was measured from the top of casing (TOC) using a water dipper and clear disposable bailer. The bores were inspected for the presence of hydrocarbon and the thickness of any LNAPL was measured visually in clear disposable bailers. ***No LNAPL was identified in monitoring Wells.***

#### 4.1.3 Sample Collection

Sampling is conducted independently by *ALS Environmental* under contract with SCC. Chain of Custody records and field sheets are provided in Appendix D. ENRS understand sampling was conducted in accordance with *ALS* sampling protocols.

#### 4.1.4 Groundwater Sampling

Groundwater wells were sampled in order of distance from any areas of known contamination to ensure that lower contaminated wells are sampled before likely higher contaminated wells. Groundwater bores were purged prior to sampling by removing at least three (3) well volumes or low flow parameter stabilisation methods applied with field sheets provided to document

pumping volumes and field parameters. Samples were collected using clear disposal bailers, and were sealed in laboratory-prepared sampling containers appropriate for the analysis. All samples were stored on ice immediately after their collection and transported to the laboratory under Chain of Custody (CoC) documentation.

Surface water and leachate samples were collected using as ‘grab samples’ from the midpoint of the structure and at mid-depth.

Any loss of volatile compounds was kept to a minimum by employing the following sampling techniques:

- Minimal practical disturbance during sampling;
- Samples placed in sample containers as soon as possible;
- Sample containers contain zero headspace;
- Samples placed directly on ice and transported to the laboratory as soon as possible; and
- Employing the most appropriate analytical method to minimise volatile losses at the laboratory.

#### **4.1.5 Field Testing**

Field testing was conducted during bore purging and sampling to record physical water parameters. A multi-probe water quality meter was used to measure the following parameters:

- Oxygen Reduction Potential (ORP, representing redox).
- Electrical Conductivity (Salinity - EC);
- Temperature; and
- pH (Acidity).

## **4.2 DUST DEPOSITION SAMPLING**

Measurement of dust deposition was carried out in accordance with the Australian Standard AS3580.10.1 (2016). This Australian Standard provides a mean of determining the mean surface concentration of deposited matter from the atmosphere.

Dust collection gauges were set up for a one (1) month period between the dates; **18<sup>th</sup> November** and **7<sup>th</sup> December 2021**. A total of four (4) dust monitoring locations were considered adequate to assess site conditions.

## **4.3 SURFACE METHANE GAS MONITORING**

The concentration of methane gas (in units of ppm) at the Site was carried out in accordance with EPA Guidelines Solid Waste Landfill 2<sup>nd</sup> Edition 2016. On the day of sampling the wind speed was below 10 km/hr. Testing was conducted using a calibrated *LaserOne* portable gas monitor specifically designed for landfill gas monitoring. A calibration Certificate is provided in **Appendix F**.

One field technician commenced data collection along transect lines in a grid pattern across the landfill surface at 25-metre spacings. A site plan depicting the sampled transect line is provide in **Figure 3**. Transects were recorded using a Magellan *SporTrak* GPS. The concentration of methane gas was measured at a height of 5 cm above the ground in areas with intermediate or final cover over the emplaced waste.

#### **4.4 GAS ACUMMULATION MOITORING IN ENCLOSED STRUCTURES**

The concentration of methane gas (in units of percent volume/volume) inside all enclosed structures within 250m of emplaced waste or leachate storage facility at the Site was carried out in accordance with EPA Guidelines Solid Waste Landfill 2<sup>nd</sup> Edition 2016. On the day of sampling testing was conducted using a calibrated *LaserOne* portable gas monitor specifically designed for landfill gas monitoring. A calibration Certificate is provided in **Appendix F**.

The internal methane concentrations for each enclosed structure were recorded by a field technician. A site plan depicting the location onsite of each structure provided in **Figure 3**. Any depressions or surface fissures away from the sampling grid were also investigated.

#### **4.5 LABORATORY ANALYSIS**

*ALS*, a NATA accredited laboratory, was contracted by *SCC* to undertake the sample analysis in accordance with current standards. Laboratory QA/QC results are detailed in the Laboratory reports contained in the appendices section of this report.

#### **4.6 FLARE MONITORING**

Landfill gases (LFG) are formed through bacterial action on emplaced waste and are a normal by-product of Landfilling operations. Landfill gas is a mixture of many different gases, typically its major components include methane and carbon dioxide. Smaller concentrations of nitrogen, oxygen, ammonia, sulphides, hydrogen, carbon monoxide, and nonmethane organic compounds (NMOCs) and Volatile Organic Compounds (VOC's) may also be present.

When operated efficiently the use of a gas flare to burn landfill gas can significantly reduce emissions of methane, NMOCs and VOC's.

The flare was monitored, maintained and operated by *LGI LTD*. Copies of LFG reports for the relevant reporting period are included as **Appendix G**.

### **5.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)**

#### **5.1 DATA QUALITY OBJECTIVES**

Data Quality Objectives (DQO) are required to define the quality and quantity of data needed to support management decisions. The process for establishing DQO's is documented by Australian Standard: AS 4482.1-2005 and referenced by the National Environment Protection

(Assessment of Site Contamination) Measure (NEPC;2013). The DQO’s for the investigation were to obtain representative data to allow assessment of:

- groundwater quality;
- The risks posed to human health and the environment, including potential future users of the Site; and
- The requirements for any further investigative works.

The assessment was conducted to a standard consistent with generally accepted and current professional consulting practice for such an investigation. The evaluation criteria adopted for the investigation are summarised in **Table 5**.

**Table 5: Data Quality Objectives**

DQO	Evaluation Criteria
Documentation completeness	Completion of field records, chain of custody documentation, laboratory test certificates from NATA-accredited laboratories.
Data comparability	Use of appropriate techniques for the sampling, storage and transportation of samples. Use of NATA accredited laboratory using NEPM endorsed procedures.
Data representativeness	Adequate sampling coverage of all areas of environmental concern at the Site, and selection of representative samples.
Precision and accuracy for sampling and analysis	Use properly trained and qualified field personnel and achieve field and laboratory QA/ QC criteria.

## 5.2 QA/QC PROCEDURES

It should be noted that whilst the EPL does not require field duplicates, ENRS recommend sampling include rinsate samples and field duplicates at the standard rate of 1 in 10, or field QA/QC is conducted in accordance with *ALS* procedures.

The majority of the QA/QC data provided for this report by SC was prepared by *ALS* and is included in the attached *ALS* QC and QCI reports. *ALS* is NATA accredited for field sampling and laboratory testing.

Relative Percent Difference (RPD) analysis of all duplicate and triplicate samples(s) results was performed by ENRS and is included in the report as **Table 9** and **Table 10**.

Since all QA/QC results complied with the required standards, or showed variations that would have no significant effect on the quality of the data or the conclusions of this environmental assessment. Therefore, the data was considered acceptable for use in this assessment.

## 5.3 EPL NON-COMPLIANCE

Monitoring requirements are defined by the EPL.

## 6.0 WATER QUALITY RESULTS

Laboratory results for groundwater and surface water were provided to ENRS for tabulation and comparison with relevant EPL assessment criteria. A summary of results is provided in **Table 8** with comparison against the relevant Site Assessment Criteria (SAC). The laboratory certificates of analysis are provided in Appendix B.

### 6.1 OVERFLOW RESULTS

No overflow event was recorded over the December 2021 reporting period.

### 6.2 FIELD TESTING

Field testing was conducted by ALS during sampling to record physical water parameters. A water quality meter is used to measure the following parameters in the field:

- Electrical Conductivity (Salinity);
- pH (Acidity); and
- Dissolved Oxygen (surface waters only).

### 6.3 PHYSICAL INDICATORS

#### 6.3.1 Depth

##### **Groundwater**

Depth of ground water to TOC ranged between **0.69 mbgl** (BH-15, 06/12/2021) to **4.72 mbgl** (BH-14, 06/12/2021). Ground water levels remained consistent with historical data sets.

#### 6.3.2 Temperature

##### **Groundwater**

Temperature of groundwater in the December 2021 monitoring period ranged between **17.6 degrees Celsius** (BH-15, 06/12/2021) and **23.9 degrees Celsius** (BH-1C, 06/12/2021).

##### **Surface Waters**

Surface water temperature at SWP-1 was **20.4 degrees Celsius** (07/12/2021)

##### **Leachate**

Leachate Temperatures at the leachate Tank (LP-1) was **20.4 degrees Celsius** (07/12/2021). Results are consistent with historical data.

#### 6.3.3 Salinity (EC & TDS)

Salinity is reported by the laboratory as either Electrical Conductivity (EC) or Total Dissolved Solids (TDS). The ANZECC guidelines document a conversion ratio for of  $0.68 \text{ mg/L} = 0.68 \text{ EC } (\mu\text{S/cm})$ . Table 3.3.3 of the ANZECC (2000) guidelines document default TV for EC in lowland freshwater rivers between **125  $\mu\text{S/cm}$  - 2,200  $\mu\text{S/cm}$**  (~1,500 mg/L).

### **Groundwater**

During the 2020 - 2021 monitoring period, salinity ranged between; **414  $\mu\text{S/cm}$**  (BH-18, 06/12/2021) and **7,370  $\mu\text{S/cm}$**  (BH-1C, 06/12/2021). Four (4) monitoring points reported salinity values in excess of freshwater SAC of **2,200  $\mu\text{S/cm}$**  of, **7,370  $\mu\text{S/cm}$**  (BH-1c), **4,700  $\mu\text{S/cm}$**  (BH-9), **2,740  $\mu\text{S/cm}$**  (BH-15), **2,610  $\mu\text{S/cm}$**  (BH-21).

### **Surface Waters**

Electrical Conductivity results for onsite surface water (SWP-1, 07/12/2021) was **806  $\mu\text{S/cm}$**  which corresponds to a calculated Total Dissolved Solids result of **564 mg/L**. These results were below the TV.

Electrical conductivity for offsite surface waters ranged between **7,180  $\mu\text{S/cm}$**  (SWC-UP, 07/12/2021) to **17,100  $\mu\text{S/cm}$**  (SWC-DOWN, 07/12/2021).

Total Dissolved Solids results for offsite surface waters located along Rocklow Creek ranged between **4,130 mg/L** (SWC-UP, 07/12/2021) to **10,400 mg/L** (SWC-DOWN, 07/12/2021).

The Electrical Conductivity and Total Dissolved Solids results were consistent with a tidal creek.

### **Leachate**

Salinity in leachate is expected to vary significantly with leachate concentration and stormwater dilution. Leachate salinity for December 2021 monitoring was **12,400  $\mu\text{S/cm}$**  (LP1, 07/12/2021) which was above the TV.

## **6.3.4 Dissolved Oxygen**

Levels of Dissolved Oxygen (DO) were measured in the field during sampling. DO reflects the equilibrium between oxygen-consuming processes and oxygen-releasing processes. DO can initiate redox reactions resulting in the uptake or release of nutrients. Low DO concentrations can result in adverse effects on many aquatic organisms which depend on oxygen for their efficient metabolism. At reduced DO concentrations many compounds become increasingly toxic, for example Zinc, Lead, Copper, phenols, cyanide, hydrogen sulphide and Ammonia.

The ANZECC (2000) guidelines Table 3.3.2 outlines a range between 85% to 110% saturation for low land rivers. Assuming a water temperature of 18°C this is equivalent to approximately 7-11 mg/L or ppm.

### **Surface Waters**

Dissolved Oxygen at SWP-1 was **4.09 mg/L** (07/12/2021). SWP-1 was not discharging at the time of sampling and are consistent with previous data.

Dissolved Oxygen for the offsite surface waters at Rocklow Creek ranged from **4.90 mg/L** (SWC-2, 07/12/2021) to **6.20 mg/L** (SWC-UP, 07/12/2021). These results are consistent with a tidal creek passing through a mangrove swamp and are consistent with previous data.

### **Leachate**

Dissolved oxygen at LP1 (Leachate Tank) was **3.38 mg/L** (07/12/2021). Results were consistent with previous data.

### 6.3.5 pH

pH is a measure of hydrogen activity. pH determines the balance between positive hydrogen ions (H<sup>+</sup>) and negative hydroxyl ions (OH<sup>-</sup>) and provides a test of water acidity (low pH) or alkalinity (high pH). Most natural freshwaters have a pH in the range 6.5 to 8.0. Changes in pH may affect the physiological functioning of biota and affect the toxicity of contaminants. Both increases and decreases in pH can result in adverse effects, although decreases are likely to cause more significant problems. Low pH indicates acidic conditions which may increase the mobility of heavy metals, whilst high pH indicates alkaline conditions which may also generate Ammonia. Previous investigations of other regional Landfill Sites in the Illawarra-Shoalhaven (Forbes Rigby;1996) report regionally acidic groundwater with low readings in the range of 4.3 pH associated with silica saturation and oxidation of accessory marcasites grains (iron sulphide).

#### **Groundwater**

Groundwater pH was reported between **pH 6.7** (BH-14 and BH-18, 06/12/2021) and **pH 7.5** (BH-3, 07/12/2021). All groundwater results were reported within the ANZECC recommended range of pH 6.5-8.0 and are consistent with historical data.

#### **Surface Water**

Surface water for the December 2021 monitoring period reported pH values of between **pH 7.1** (SWC-DOWN, 07/12/2021) and **pH 7.5** (SWP-1, 07/12/2021). All surface water were reported within the ANZECC recommended range of pH 6.5-8.0 and are consistent with historical data.

#### **Leachate**

Leachate pH at LP-1 was as 8.4 (07/12/2021). Leachate results were reported within the ANZECC recommended range of pH 6.5-8.0 and are consistent with historical data.

### 6.3.6 Total Suspended Solids (TSS)

TSS provides a measure of turbidity reported as the mass of fine inorganic particles suspended in the water. Measurement of TSS provides a valuable indication of the sediment and potential nutrient load. Elevated TSS decreases light penetration whilst phosphorus is absorbed onto sediment surfaces.

TSS was reported for surface water only. Concentrations for the December 2021 monitoring period were reported between **<5 mg/L** (SWC-DOWN, 07/12/2021, SWC-DOWN-2, 07/12/2021) and **10 mg/L** (SWC-up, 07/12/2021). All results were below the **50mg/L** TV.

TSS results are generally consistent with historical results.

## 6.4 INORGANIC ANALYTES

### **Nutrients**

Water samples were analysed for select nutrients including Ammonia, Ammonium, Nitrate and Nitrite. The most bio-available forms of Nitrogen are Ammonium (NH<sub>4</sub><sup>+</sup>) and Nitrate (NO<sub>3</sub><sup>-</sup>). Ammonia is an oxygen-consuming compound and is toxic to aquatic biota at elevated concentrations. Ammonia toxicity increases under low oxygen levels and higher pH.

## 6.4.1 Ammonia

### **Groundwater**

For the December 2021 monitoring period, ammonia was measured within groundwater monitoring bores between **0.72 mg/L** (BH18, 06/12/2021) and **371 mg/L** (BH-1c, 06/12/2021). With the exception of BH-18 all groundwater wells exceeded the adopted trigger value of **0.91 mg/L** for the December 2021 monitoring period. This is consistent with historical values.

### **Surface Water**

Ammonia in surface water samples ranged from **0.01 mg/L** (SWP-1, 07/12/2021) to **1.28 mg/L** (SWC-down, 07/12/2021). The result **1.28 mg/L** (SWC-down, 07/12/2021) was the only surface water result that exceeded the adopted trigger value of **0.91 mg/L** during the monitoring period. However, since the corresponding pH was below 8.00 pH units it was not considered significant.

### **Leachate**

Ammonia in leachate was reported between **1150 mg/L** (LP1, 07/12/2021). High ammonia concentrations are expected in untreated leachate.

## 6.4.2 Nitrate

### **Groundwater**

Results for Nitrate in groundwater were reported between **<0.1 mg/L** in multiple bores and **2.46 mg/L** (BH-22, 06/12/2021). Although results generally continue to trend downward a total of four (4) groundwater wells reported exceedances above the TV of 0.7mg/L in the December 2021 monitoring period, including BH-3, BH-12r, BH-13 and BH-14.

### **Surface Water**

Nitrate concentration for Rocklow Creek surface water samples in the December 2021 monitoring period ranged between **0.06 mg/L** (SWC-DOWN; 07/12/2021) and **0.08 mg/L**. (SWC-UP; 07/12/2021).

The nitrate concentration of the onsite surface water SWP-1 in the December 2021 monitoring period was **<0.01 mg/L** (SWP-1; 07/12/2021)

The Nitrate concentration of all surface water samples was below the TV of **0.7mg/L**.

### **Leachate**

Nitrate concentration of leachate (LP-1) was **<0.1mg/L in the December 2021** monitoring period.

## 6.4.3 Nitrite

### **Groundwater**

Results for Nitrate in groundwater during the December 2021 monitoring period were reported between **<0.01 mg/L** in multiple bores and **0.06 mg/L** (BH-3, 06/12/2021). No exceedances were reported for nitrite during the December 2021 monitoring period. All results are below the accepted TV and consistent with previous data.

### **Surface Water**

During the December 2021 monitoring period surface water SWP-1 was reported as **<0.01 mg/L**. Results are below the accepted TV and consistent with previous data.



### **Leachate**

Leachate LP1 result was reported as to **0.1 mg/L** (07/12/2021). Results are below the accepted TV and consistent with previous data.

## **Anions**

### **6.4.4 Chloride**

#### **Groundwater**

Results for Chloride in groundwater were reported between **16 mg/L** in (BH-18, 06/12/2021) and **939 mg/L** (BH-1c, 06/12/2021). Results for BH-15 continue to trend down since 11/03/2020, all other groundwater results are generally consistent with historical data.

#### **Surface Water**

During the December 2021 monitoring period chloride results for surface water SWP-1 was **115 mg/L** (07/12/2021). The results are below the accepted TV and are consistent with historical data.

### **Leachate**

Chloride at the Leachate Tank (LP-1) ranged between **1760 mg/L** (07/12/2021). Results are consistent with historical data.

### **6.4.5 Fluoride**

#### **Groundwater**

Results for Fluoride in groundwater were reported between **<0.1 mg/L** in multiple bores and **0.4 mg/L** (BH-14 and BH-9, 06/12/2021). Results are consistent with historical data.

#### **Surface Water**

Surface water results ranged from of **0.2 mg/L** (SWP-1, 07/12/2021) and **0.5 mg/L** (SWC-down, 07/12/2021). Results are consistent with historical data.

### **Leachate**

The chloride result at the Leachate tank (LP-1) was **0.2 mg/L** (07/12/2021). Results are consistent with historical data.

### **6.4.6 Sulphate**

#### **Groundwater**

Results for Sulphate in groundwater were reported between **3 mg/L** (BH-18, 06/12/2021) and **478 mg/L** (BH-15, 06/12/2021).

#### **Surface Water**

Sulphate in surface water ranged from **33 mg/L** (SWP-1, 07/12/2021) and **733 mg/L** (SWC-down, 06/12/2021). Historical data indicates a stepwise reduction in sulphate concentration levels for Rocklow Creek surface waters from 16/06/2021.

### **Leachate**

Sulphate level at the leachate tank (LP-1) in the December 2021 monitoring period was **<10 mg/L** (07/12/2021). The sulphate concentration in leachate has been trending down since 2017 and has been consistent at **<10 mg/L** for the last four (4) sampling events.

## 6.4.7 Total Alkalinity

### *Surface Water*

Total Alkalinity at SWP-1 ranged was **238 mg/L** (07/12/2021). Results are consistent with historical data.

### *Leachate*

Total Alkalinity in Leachate (LP-1) was **4,350 mg/L** (07/12/21). Results are consistent with historical data.

## 6.4.8 Bicarbonate Alkalinity

### *Groundwater*

Bicarbonate in groundwaters ranged from **175 mg/L** (BH-18, 06/06/2021) to **2,190 mg/L** (BH-1C, 06/12/2021). Results are generally consistent with historical data.

## Metals & Metalloids

### 6.4.9 Manganese

#### *Groundwater*

Manganese was analysed as dissolved manganese in groundwater, total manganese in surface water and total manganese in leachate sampling points. Concentrations of dissolved manganese in groundwater for the December 2021 monitoring period were reported between **0.064 mg/L** (BH-22, 06/12/2021) and **0.575 mg/L** (BH-9, 06/12/2021). Results are generally consistent with historical data.

#### *Surface Water*

The total manganese concentration at SWP-1 was from **0.314mg/L** (07/12/2021). Results are consistent with historical data.

#### *Leachate*

Total Manganese concentrations in leachate was reported as **0.241 mg/L** (Leachate Tank LP-1, 07/12/2021). These values are below the adopted TV (1.9 mg/L 95% of Species - freshwater) and are considered acceptable. Concentrations of Manganese should continue to be reviewed during subsequent monitoring events.

### 6.4.10 Iron (Total Fe)

Iron was measured as total Iron in selected surface water samples including SWP-1 and Leachate Tank.

#### *Surface Water*

Concentrations of total iron for onsite surface water was reported as **0.012 mg/L** (SWP-1, 07/12/2021). Results are generally consistent with historical data.

#### *Leachate*

Concentration of iron at the leachate Tank (LP-1) was reported between **1.24 mg/L** (07/062021). Results are generally consistent with historical data.

#### **6.4.11 Iron (Dissolved Fe)**

##### ***Groundwater***

Dissolved iron was measured within selected groundwater and surface water sampling points. Groundwater results were reported between **0.15 mg/L** (BH21, 06/12/2021) and **12.1 mg/L** (BH1c, 06/12/2021). Results are generally consistent with historical data.

#### **6.4.12 Calcium**

Calcium was measured within selected groundwater and surface water sampling points.

##### ***Groundwater***

Groundwater results were reported between **48 mg/L** (BH-18, 06/12/2021) and **249 mg/L** (BH13, 06/12/2021). Results are generally consistent with historical data.

##### ***Surface Water***

Calcium in surface water ranged from **43 mg/L** (SWP-1, 07/12/2021) to **172 mg/L** (SWC-DOWN 07/12/2021).

Historical data indicates from 17/03/2021 a step change reduction in the order of 70% saw calcium concentrations for all Roclow Creek samples return to 2017 levels.

##### ***Leachate***

Calcium concentration in Leachate (LP-1) for the December 2021 monitoring period was **84 mg/L** (07/12/2021).

Historical observations indicate that low calcium levels have been observed for three (3) of the last five (5) sampling events since 15/12/2020 at LP-1. This has produced a corresponding reduction in the average calcium concentration of leachate, down from 180mg/L to 104mg/L for the period 15/12/2021 – 07/12/2021.

#### **6.4.13 Potassium**

Potassium was measured within selected groundwater and surface water sampling points.

##### ***Groundwater***

Groundwater results were reported between the **4 mg/L** (BH-18, 06/12/2021) and **197 mg/L** (BH1C, 06/12/2021). With the exception of BH-15 which continues to decrease the potassium levels for groundwaters are generally consistent with historical data.

##### ***Surface Water***

During the December 2021 monitoring period potassium levels for the offsite groundwaters ex Rocklow Creek ranged from **45 mg/L** (SWC-up, 17/06/2021) to **375 mg/L** (SWC-down 2, 15/12/2020).

Potassium concentrations in surface waters have generally been trending down since 2018 and historical data indicates that an additional step change reduction which took place in June 2021 has been sustained and has resulted in 70% lower average potassium concentrations for all Rocklow Creek samples as of 07/12/2021.

## Organic Analytes

### 6.4.14 Total Organic Carbon

Total Organic Carbon (TOC) provides a measure of the total concentration of organic material in a water sample. TOC is typically higher in surface water than groundwater, however high TOC is also characteristic of leachate from landfill. TOC provides a marker for biological activity associated with contaminant degradation and can be used to delineate contaminant plumes. TOC influences geochemical processes by:

- acting as proton donors/acceptors;
- providing pH buffering;
- participating in mineral dissolution/precipitation reactions; and
- providing carbon substrate for microbe-based biodegradation.

TOC was reported during the December 2021 monitoring period at the following concentrations:

#### **Groundwater**

TOC levels ranged between **10 mg/L** (BH-18; 06/12/2021) and **160 mg/L** (BH-1c; 06/12/2021). Results are consistent with historical data.

#### **Surface Water**

In the December 2021 monitoring period the TOC levels ranged between **9 mg/L** (SWC-DOWN 2; SWC- DOWN; SWC- 2; SWC- UP; 07/12/2021) and **23 mg/L** (SWP-1; 07/12/2021). Results are consistent with historical data.

#### **Leachate**

For the December 2021 monitoring period TOC concentration in leachate was **500 mg/L** (Tank; 07/12/2021). The results are generally consistent with previous data

## 7.0 DUST GAUGE RESULTS

The below table provides the results of the dust depositions results. A total of four (4) dust collectors were onsite for one (1) month between **18<sup>th</sup> November** and **7<sup>th</sup> December 2021**, in general accordance with AS3580.10.1. A summary of results is provided in **Table 6** below.

**Table 6: Summary of Dust Gauge Results**

Sample ID	Guideline Criteria (g/m <sup>2</sup> /month)	Total Insoluble Matter (g/m <sup>2</sup> /month)	Comments
DDG1	4	1.1	Satisfactory
DDG2		0.9	Satisfactory
DDG3		2.1	Satisfactory
DDG4		2.9	Satisfactory

Results for depositional dust during the December 2021 quarterly monitoring period reported levels of dust below the adopted assessment criteria of **4 g/m<sup>2</sup>/month**.

The results were considered satisfactory. Dust gauge locations are provided in **Figure 2** attached. It is recommended that monitoring is continued in accordance with EPL 5984.

## 8.0 FLARE MONITORING

**Table 7: Summary of Flare Operating Temperatures**

Monitoring Period	Month	Date	Average Flare Temp	
Qtr 1	Oct	7-Oct	599.0	
		14-Oct	611.0	
		20-Oct	617.0	
		25-Oct	599.0	
	Mean Oct Temp			606.5
	Nov	9-Nov	531.0	
		18-Nov	566.0	
		26-Nov	495.0	
		30-Nov	561.0	
	Mean Nov Temp			538.3
	Dec	7-Dec	568.0	
		16-Dec	960.0	
		21-Dec	681.0	
		31-Dec	663.0	
Mean Dec Temp			718.0	
Mean Quarterly Flare Temp			620.9	

Weekly average operating temperatures supplied by LGI displayed typical variation associated with a continuous process but generally trended downward over the quarter.

Weekly operating temperatures at the Flare were generally below the Lower Limit of 760 degrees throughout the December 2021 monitoring period.

LGI advise that reduced Flare temperatures are a consequence of high moisture levels within the landfill negatively impacting gas extraction operations. The actions taken to address the root causes are outlined in the LGI Gas Flare report included as Appendix G.

## 9.0 METHANE MONITORING

### 9.1 SURFACE GAS METHANE

The surface gas monitoring for the December 2021 monitoring period *DID NOT* detect any levels of methane above the EPA license limits of 500 ppm. The results were considered satisfactory. A table of results is provided in Appendix D.

## 9.2 GAS ACCUMULATION MONITORING IN ENCLOSED STRUCTURES

The internal methane testing for enclosed structures within 250m of the landfill during the December 2021 monitoring period *DID NOT* detect any levels of methane above the EPA license limits of 1% V/V. The results were considered satisfactory. A table of results is provided in Appendix D.

# 10.0 ENVIRONMENTAL ASSESSMENT

## 10.1 MONITORING POINT SUMMARY

Field measurements and NATA laboratory results for dust and methane results for the December 2021 monitoring period reported satisfactory results. Water results including leachate, groundwater, onsite and offsite surface water reported concentrations of analytes within the range historical values. Water results from the last four (4) years have been tabulated and presented **Charts 1-59** attached.

Groundwater and surface water within the Site boundary generally reported multiple high levels of analytes considered to be characteristic of landfill and leachate. Offsite sample locations within Rocklow Creek generally reported satisfactory results.

Generally, all dust gauges reported satisfactory results over the December 2021 monitoring period.

Results of surface methane gas monitoring recorded satisfactory results. The landfill surface cap was therefore considered intact and effective during the monitoring period.

Gas accumulation monitoring reported satisfactory results for all enclosed structures within 250m of emplaced waste or leachate storage facility.

Results for flare monitoring reported consistent temperature exceedances throughout the December 2021 monitoring period.

## 10.2 ENVIRONMENTAL MANAGEMENT

### 10.2.1 Landfill Operations

ENRS understand 'solid' waste (general solid waste putrescible and non-putrescible) landfill operations are ongoing at the Site. Landfill practices should be conducted in accordance with the Site's Landfill Environmental Management Plan (LEMP) and the EPA Solid Waste Landfill Guidelines (EPA; 2016).

## 10.3 ENVIRONMENTAL SAFEGUARDS

Appropriate management actions are required to continue to prevent and detect potential groundwater and surface water pollution. The nearest sensitive receptors for any uncontrolled Site water and leachate include; areas of adjoining bushland; recreational users of the Minnamurra River estuary environs, down gradient stakeholders; and down gradient alluvial

aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems (GDE).

It is recommended that any drainage and detention structures are inspected annually by a suitably qualified environmental professional to assess their structural integrity and identify the need for any maintenance (such as removal of deep rooted vegetation, sediment, and re-lining).

Access tracks to sampling points should be inspected prior to each quarterly sampling events. Continue to review annual surface and groundwater monitoring results from up and down gradient of the land fill cells and offsite sampling locations within Rocklow Creek. Continue to monitor surface methane gas in order to assess the capping integrity of the landfill cells.

## 10.4 MONITORING PROGRAM

The water, dust and surface methane monitoring program are required to demonstrate that Site activities are not generating any off-site pollution. The Site's EPL's and monitoring regime should be reviewed annually.

Review of the December 2021 monitoring results indicate no significant change in environmental conditions at the Site during the past 3 months. Future sampling events should continue to monitor the key indicators of leachate within surface and ground waters, especially concentration of ammonia and nitrate.

Should monitoring continue to report any significant changes in analyte concentrations the need for additional monitoring locations should be reviewed, including additional groundwater monitoring bores both up and down gradient locations of areas with analytical exceedances.

It is recommended that water quality results from future monitoring rounds continue be forwarded to a suitably qualified environmental professional for review within the laboratory holding time to compare against relevant guidelines and identify any irregularities so that additional testing may be conducted within the holding time.

## 11.0 CONCLUSIONS

Based on the findings obtained during the December 2021 monitoring program the following conclusions and recommendations are provided:

- Shallow groundwater flow is expected to mimic topography with low hydraulic gradients flowing towards the south and southeast towards Rocklow creek. The nearest sensitive receptors are likely to include; recreational users of the Minnamurra River estuary environs; down gradient stakeholders; and downgradient alluvial aquifers, swamps, Rocklow Creek, Minnamurra River and Groundwater Dependent Ecosystems near discharge zones;
- Groundwater throughout the monitoring period reported exceedances of the assessment criteria for; ammonia, heavy metals, nitrate and salinity (EC) within multiple groundwater bores including; BH-1c, BH-3, BH-4, BH-9, BH-12r, BH-13, BH-14, BH-15, BH-19r, BH-21 and BH-22. This was considered to be consistent with historical values;

- Downgradient Rocklow Creek surface water samples (SWC-Up, SWC-2, SWC-down and SWC-down 2) were reported within the adopted Site Assessment Criteria;
- Downgradient Rocklow Creek surface water samples (SWC-Up, SWC-2, SWC-down and SWC-down 2) have maintained reductions in Potassium, Calcium and Sulphate concentrations from May 2021 to December 2021 monitoring period.
- Flare operating temperature were generally observed to be below the target operating threshold of 760 degrees Celsius. Operations taken by the operator to address the root causes of the low Flare Stack temperatures are outlined in the monthly LGI reports attached as Appendix G;
- Surface gas methane monitoring reported satisfactory results all within the adopted assessment criteria;
- Gas accumulation monitoring reported satisfactory results for all enclosures tested within 250m of emplaced waste or leachate storage facility;
- Dust deposition gauges recorded satisfactory results below the guidelines provided in AS3580.10.1. Monitoring should continue in accordance with EPL 5984 requirements;
- No non-compliances with the EPL were reported during the December 2021 monitoring period;
- Based on this review of the December 2021 monitoring period, contaminants associated with the landfill cell, leachate dam/s and general site uses are considered to be relatively consistent with the range of historical results;
- Should any change in Site conditions or incident occur which causes a potential environmental impact, a suitable environmental professional should be engaged to further assess the Site and consider requirements for any additional monitoring; and
- This report must be read in conjunction with the attached Statement of Limitations.



## 12.0 LIMITATIONS

This report and the associated services performed by ENRS are in accordance with the scope of services set out in the contract between ENRS and the Client. The scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

ENRS derived the data in this report primarily from visual inspections, examination of available records, interviews with individuals with information about the site, and if requested, limited sample collection and analysis made on the dates indicated. In preparing this report, ENRS has relied upon, and presumed accurate, certain information provided by government authorities, the Client and others identified herein. The report has been prepared on the basis that while ENRS believes all the information in it is deemed reliable and accurate at the time of preparing the report, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by the Client arising from or in connection with the supply or use of the whole or any part of the information in the report through any cause whatsoever.

Limitations also apply to analytical methods used in the identification of substances (or parameters). These limitations may be due to non-homogenous material being sampled (i.e., the sample to be analysed may not be representative), low concentrations, the presence of 'masking' agents and the restrictions of the approved analytical technique. As such, non-statistically significant sampling results can only be interpreted as 'indicative' and not used for quantitative assessments.

The data, findings, observations, conclusions and recommendations in the report are based solely upon the state of the site at the time of the investigation. The passage of time, manifestation of latent conditions or impacts of future events (e.g., changes in legislation, scientific knowledge, land uses, etc) may render the report inaccurate. In those circumstances, ENRS shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of the report.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between ENRS and the Client. ENRS accepts no liability or responsibility whatsoever and expressly disclaims any responsibility for or in respect of any use of or reliance upon this report by any third party or parties.

It is the responsibility of the Client to accept if the Client so chooses any recommendations contained within and implement them in an appropriate, suitable and timely manner.

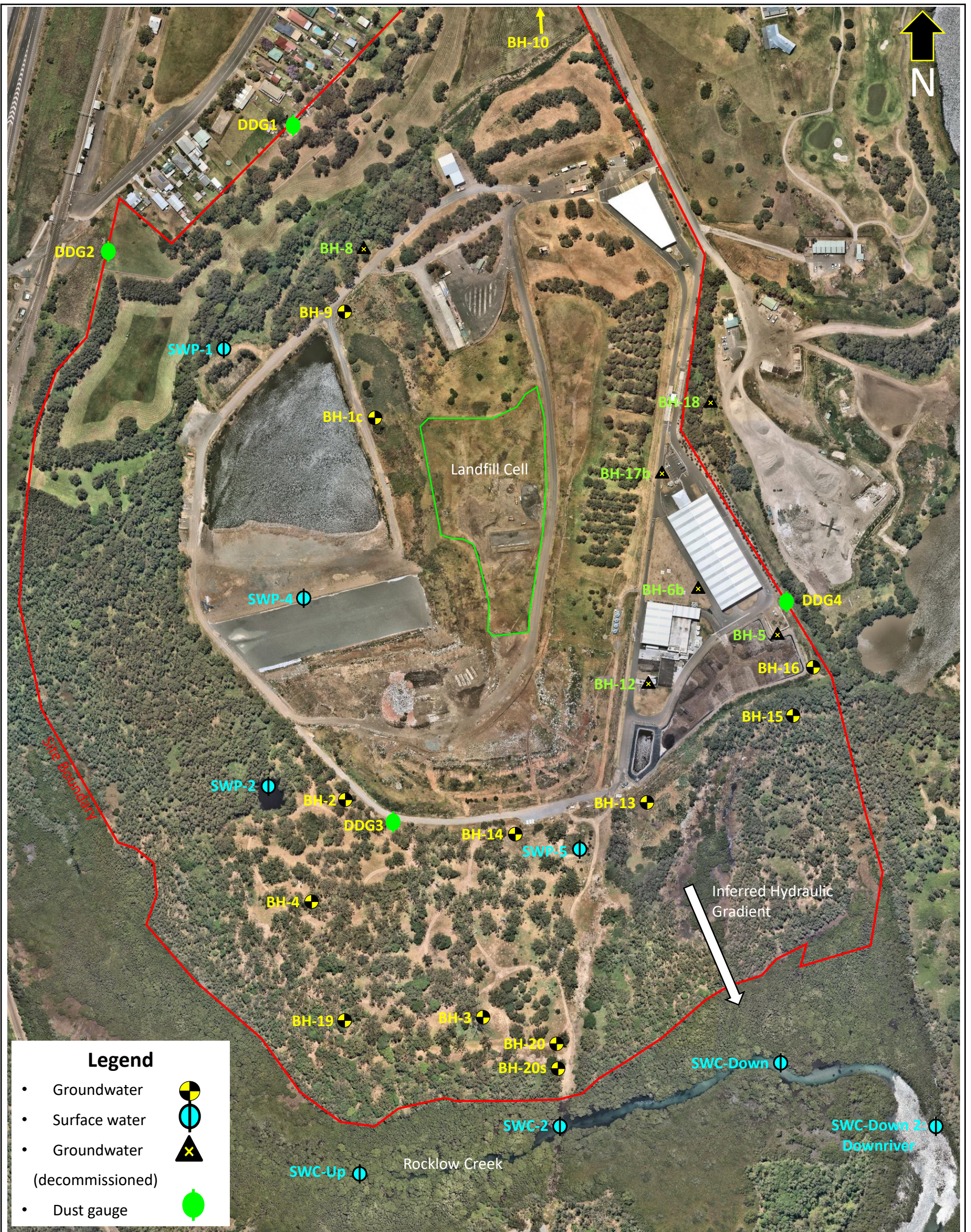
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# FIGURES


**Figure 2: Sampling Points & Site Plan**

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**Legend**

- Groundwater 
- Surface water 
- Groundwater (decommissioned) 
- Dust gauge 

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	Project:	<b>ENRS0033</b>	Source:	<b>NearMaps</b>	Date:	<b>4/02/2020</b>
	Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW, 2529	Scale:	<b>NA</b>	Title:	<b>Site Plan</b>
			Status:	<b>Rev 1</b>		

**Figure 3: Surface Methane Gas Sample Transects**

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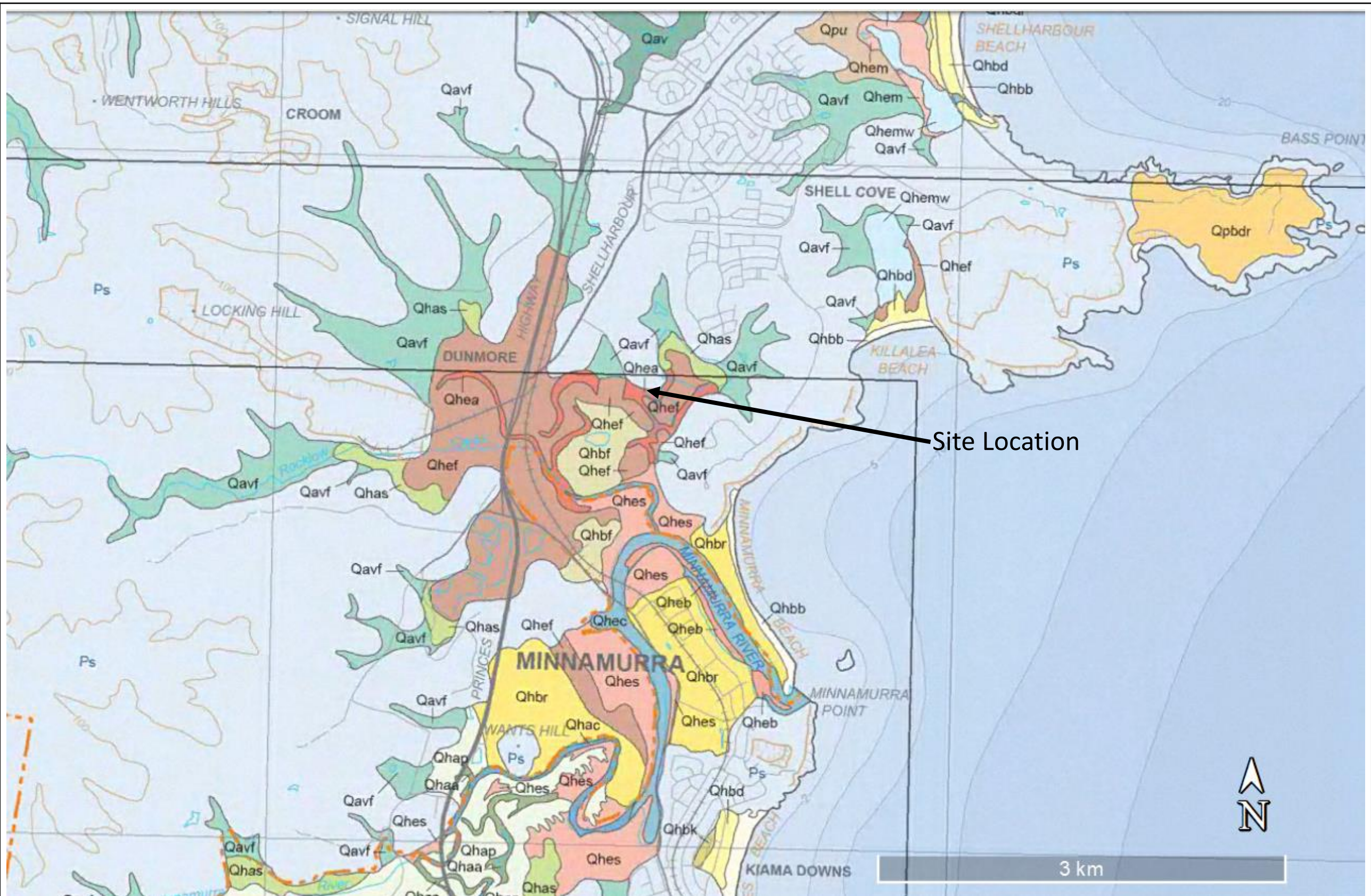
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Client:	Shellharbour City Council	Drawn:	PL	Figure:	3
Project:	ENRS0033	Source:	SixMaps	Date:	16/01/2020
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW, 2529	Scale:	NA	Title:	Surface Gas Sample transects
		Status:	Rev 1		

**Figure 4: Regional Geology**

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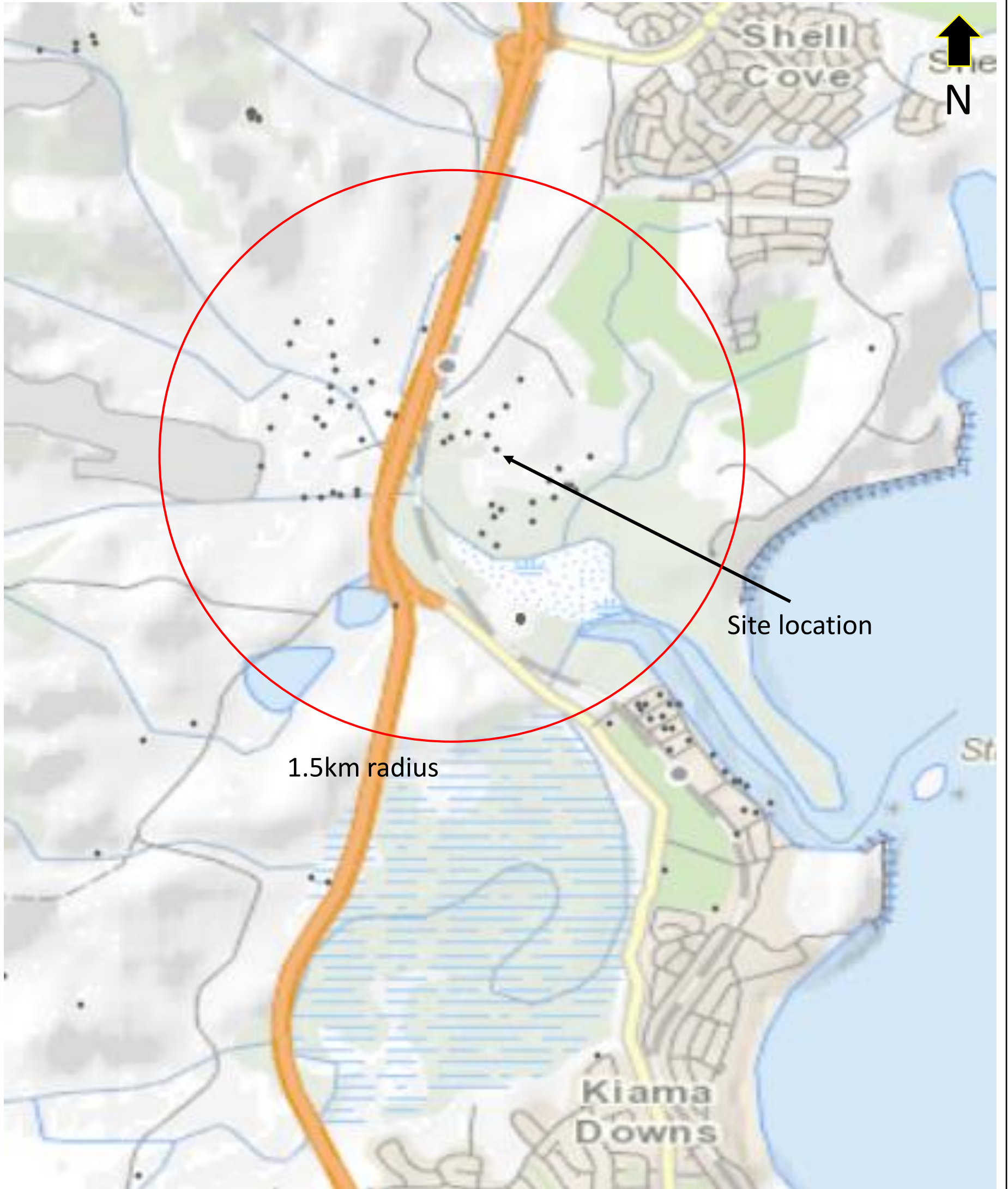
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Client:	Shellharbour City Council	Drawn:	PL	Figure:	4
Project:	ENRS0033	Source:	Geological Survey of NSW	Date:	16/01/2020
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW, 2529	Scale:	See figure	Title:	Site Geology
		Status:	Rev 1		

**Figure 5: Registered Bores**

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Client:	Shellharbour City Council	Drawn:	PL	Figure:	5
Project:	ENRS0033	Source:	NSW Office of Water	Date:	16/01/2020
Location:	Dunmore Recycling & Waste Depot 44 Buckleys Rd, Dunmore, NSW, 2529	Scale:	NA	Title:	Registered Bores
		Status:	Rev 1		

# TABLES

**Table 8: Water Quality Results Comparison of Quarterly Monitoring Results Against Site Assessment Criteria – Q1**

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**TABLE 8: Total Concentration Results**  
 Quarterly Water Monitoring Results - December 2021: Dunmore Recycling and Waste Depot

GILs - Trigger Values for Freshwater (Protection of 95% of Species) <sup>A</sup> GILs - Trigger Values for Marine Water (Protection of 95% of Species) <sup>A</sup> Australian Drinking Water Guidelines (2018) <sup>C</sup>																														
Health Aesthetic																														
Lab Report	Sample No.	Sample type	EPA No.	Date Sampled	Chloride	Calcium	Magnesium	Sodium	Potassium	Manganese	Total Iron	Dissolved Iron	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	Total Organic Carbon	Bicarbonate Alkalinity as CaCO <sub>3</sub>	Total Alkalinity as CaCO <sub>3</sub>	Sulfate as SO <sub>4</sub> - Turbidimetric	Dissolved Oxygen	Dissolved Oxygen - % Saturation	Suspended Solids (SS)	Turbidity	pH	Electrical Conductivity (Non Compensated)	Temperature	Standing Water Level	Comments	
					Units																									
					Laboratory PQL	1	1	1	1	1	0.001	0.05	0.05	0.1	0.01	0.01	0.01	1	1	1	1	0.01	0.1	5	NTU	0.01	1	0.1	0.1	-
	BH1c	Groundwater	3	Dec 2021	939	134			197	0.12		12.10	0.2	371.00	< 0.01	< 0.01	160	2,390	2,390	<	10					7.10	7,370	23.9	3.15	
	BH3	Groundwater	5	Dec 2021	284	147			34	0.15		3.56	0.1	29.50	0.06	2.46	16	377	377							7.50	1,810	18.2	3.09	
	BH4	Groundwater	6	Dec 2021	254	238			21	0.21		5.01	< 0.1	14.70	< 0.01	0.01	16	491	491	133						7.10	2,140	18.8	4.29	
	BH9	Groundwater	18	Dec 2021	626	242			73	0.58		4.82	0.4	90.40	< 0.01	< 0.01	64	1,290	1,290	114						7.00	4,700	18.4	3.10	
	BH12r	Groundwater	17	Dec 2021	296	223			56	0.50		3.67	0.2	6.51	0.04	1.65	21	448	448	247						6.80	2,170	21.7	4.29	
	BH13	Groundwater	10	Dec 2021	228	249			26	0.29		1.14	0.2	4.05	0.02	1.31	20	589	589	225						6.90	2,100	20.6	4.29	
	BH14	Groundwater	11	Dec 2021	124	121			14	0.10		0.19	0.4	1.17	0.04	0.97	19	418	418	121						6.70	1,380	21.4	4.72	
	BH15	Groundwater	7	Dec 2021	402	96			182	0.25		7.05	0.2	14.70	0.02	0.04	29	290	290	478						7.00	2,740	17.6	0.69	
	BH18	Groundwater	25	Dec 2021	16	48			4	0.18		2.13	0.2	0.72	< 0.01	< 0.01	10	175	175	3						6.70	414	19.1	2.18	
	BH19r	Groundwater	16	Dec 2021	268	166			24	0.14		1.05	0.1	4.90	< 0.01	< 0.01	16	430	430	178						7.20	1,880	18.6	4.45	
	BH21	Groundwater	23	Dec 2021	380	156			20	0.33		0.15	0.3	2.95	< 0.01	0.12	26	494	494	351						7.10	2,610	21.1	2.96	
	BH22	Groundwater	24	Dec 2021	274	160			23	0.06		0.27	0.3	1.54	< 0.01	< 0.01	23	433	433	255						7.10	2,030	17.9	2.57	
	SWP1	Surfacewater	1	Dec 2021	115	43	19	94	7	0.31	0.12	0.06	0.2	< 0.01	< 0.01	< 0.01	23	238	238	33	4.09		6	1.60	7.50	806	20.4			
	SWC_up	Surfacewater	20	Dec 2021	2,250	89	135	1,090	41	0.10	0.72	0.10	0.3	0.19	< 0.01	0.08	9	169	169	340	6.20		10	5.30	7.30	7,180	19.2			
	SWC_2	Surfacewater	19	Dec 2021	3,870	127	225	1,860	71	0.10	0.66	0.11	0.4	0.62	< 0.01	0.07	9	174	174	518	4.90		7	---	7.30	11,900	18.8			
	SWC_down	Surfacewater	21	Dec 2021	5,760	172	331	2,740	102	0.12	0.60	0.25	0.5	1.28	< 0.01	0.06	9	188	188	733	4.81		< 5	4.20	7.10	17,100	19.5			
	SWC_down_2	Surfacewater	22	Dec 2021	3,540	118	205	1,710	65	0.10	0.61	0.09	0.4	0.31	< 0.01	0.07	9	169	169	488	5.66		< 5	4.80	7.30	10,900	19.0			
	Leachate Storage Tank LP1	Leachate	2	Dec 2021	1,760	84			332	0.24	1.24		0.2	1150.00	< 0.10	< 0.10	500	4,180	4,350	<	10	3.38				8.40	12,400	24.9		

Investigation Investigation levels apply to typical slightly-moderately disturbed systems. Trigger Levels for 95% of species. See ANZECC & ARMCANZ (2000) for guidance on applying these levels to different ecosystem conditions. Also the same as the NEPM (2013) ELs.  
 ANZECC 2000 ANZG 2018 - pH Upper and Lower Limit for NSW Lowland Rivers (Table 3.3.2).  
 Investigation Investigation levels are taken from the health values of the Australian Drinking Water Guidelines (NHMRC 2018).  
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 Former NSW Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the Technical Note for Investigation of Service Station Sites (EPA,2014).  
 E Former NSW EPA (1994) Guidelines for Assessing Service Station Sites. Replaced by the

**Table 9: Duplicate Groundwater Sample Results and QC Data – Q1**

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**TABLE 9: Duplicate Groudwater Sample Results and QC Data**

TABLE 9: Duplicate Groudwater Sample Results and QC Data						
Lab Report.						RPD
Sample No.				BH18	GWDuplicate	
Sample type				Groundwater	GWQC	
EPA No,				25	QC1	
Date Sampled				6/12/2021	6/12/2021	
Analyte	Units	PQL	5 x PQL	Result	Result	
Chloride	mg/L	1	5	16	16	✓ 0.00
Calcium	mg/L	1	5	48	48	✓ 0.00
Potassium	mg/L	1	5	4	4	✓ 0.00
Manganese	mg/L	0.001	0.005	0.178	0.174	✓ 2.27
Dissolved Iron	mg/L	0.05	0.25	2.13	2.12	✓ 0.47
Fluoride	mg/L	0.1	0.5	0.2	0.2	✓ 0.00
Ammonia as N	mg/L	0.01	0.05	0.72	0.71	✓ 1.40
Nitrite as N	mg/L	0.01	0.05	< 0.01	< 0.01	✓ 0.00
Nitrate as N	mg/L	0.01	0.05	< 0.01	< 0.01	✓ 0.00
Nitrite + Nitrate as N	mg/L	0.01	0.05	< 0.01	< 0.01	✓ 0.00
Total Organic Carbon	mg/L	1	5	10	10	✓ 0.00
Bicarbonate Alkalinity as CaCO3	mg/L	1	5	175	175	✓ 0.00
Total Alkalinity as CaCO3	mg/L	1	5	175	175	✓ 0.00
Sulfate as SO4 - Turbidimetric	mg/L	1	5	3	3	✓ 0.00
pH	pH	0.01	0.05	6.70	6.70	✓ 0.00
Electrical Conductivity (Non Compensated)	µS/cm	1	5	414	414	✓ 0.00
Temperature	°C	0.1	0.5	19.1	19.1	✓ 0.00
Standing Water Level	mbgl	-		2.2	2.2	✓ 0.00



**Table 10: Duplicate Surface Water Results and QC Data – Q1**

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**TABLE 10: Duplicate Surface Water Results and QC Data**

TABLE 10: Duplicate Surface Water Results and QC Data						
Lab Report.						RPD
Sample No.				SWC_2	SWDuplicate	
Sample type				Surfacewater	OffSiteSWQC	
EPA No,				19	QC2	
Date Sampled				6/12/2021	6/12/2021	
Analyte	Units	PQL	5 x PQL	Result	Result	
Chloride	mg/L	1	5	3,870	3,820	✓ 1.95
Calcium	mg/L	1	5	127	127	✓ 0.00
Potassium	mg/L	1	5	71	70	✓ 2.13
Manganese	mg/L	0.001	0.005	0.104	0.101	✓ 4.39
Total Iron	mg/L	0.05	0.25	0.66	0.66	✓ 0.00
Dissolved Iron	mg/L	0.05	0.25	0.11	0.11	✓ 0.00
Fluoride	mg/L	0.1	0.5	0.4	0.4	✓ 0.00
Ammonia as N	mg/L	0.01	0.05	0.62	0.62	✓ 0.00
Nitrite as N	mg/L	0.01	0.05	< 0.01	< 0.01	✓ 0.00
Nitrate as N	mg/L	0.01	0.05	0.07	0.07	✓ 0.00
Nitrite + Nitrate as N	mg/L	0.01	0.05	0.07	0.07	✓ 0.00
Total Organic Carbon	mg/L	1	5	9	9	✓ 0.00
Bicarbonate Alkalinity as CaCO3	mg/L	1	5	174	173	✓ 0.86
Total Alkalinity as CaCO3	mg/L	1	5	174	173	✓ 0.86
Sulfate as SO4 - Turbidimetric	mg/L	1	5	518	523	✓ 1.44
Dissolved Oxygen	mg/L	0.01	0.05	4.90	4.88	✓ 0.61
pH	pH	0.01	0.05	7.30	7.30	✓ 0.00
Electrical Conductivity (Non Compensated)	µS/cm	1	5	11,900	11,900	✓ 0.00
Temperature	°C	0.1	0.5	18.8	18.8	✓ 0.00

# CHARTS

**Chart 1 to Chart 16 – Groundwater Water Quality Results 2017-2020**

**Chart 17 to Chart 32 – Onsite Surface Water Quality Results 2017-2020**

**Chart 33 to Chart 44 – Rocklow Creek Surface Water Quality Results 2017-2020**

**Chart 45 to Chart 59 – Leachate Water Quality Results 2017-2020**

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### Charts 1-16: Groundwater Charts

Chart 1: Ammonia as N (mg/L)

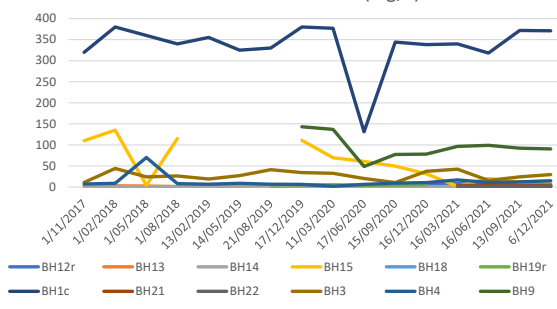


Chart 2: Bicarbonate Alkalinity as CaCO3 (mg/L)

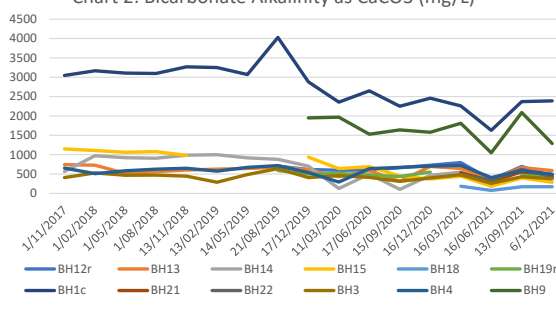


Chart 3: Calcium (mg/L)

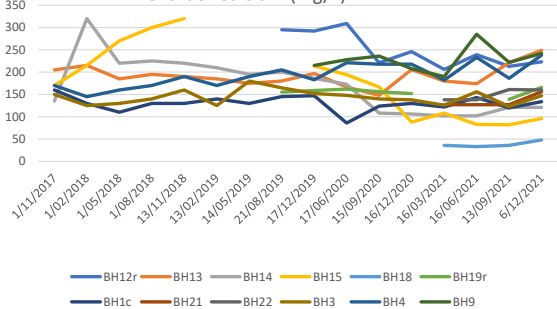


Chart 4: Chloride (mg/L)

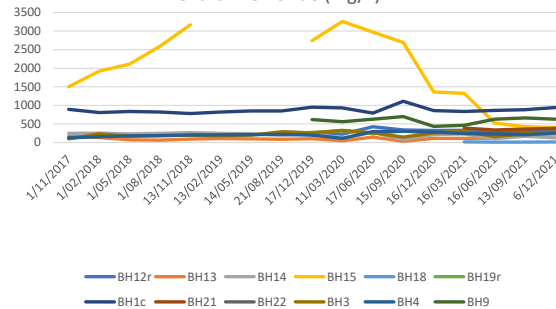


Chart 5: Depth to Water (mbgl TOC)

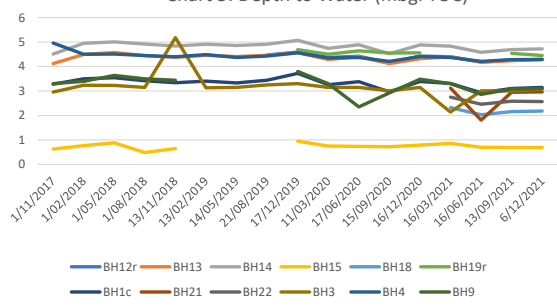


Chart 6: Dissolved Iron (mg/L)

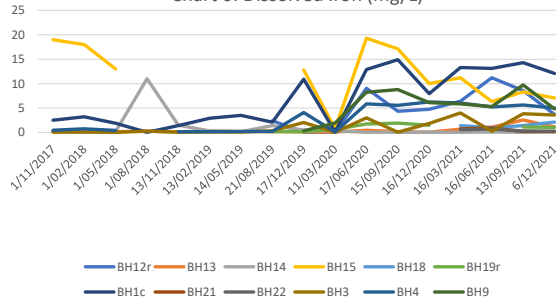


Chart 7: Electrical Conductivity (Us/cm)

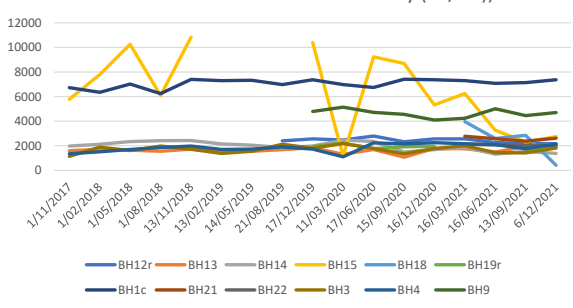
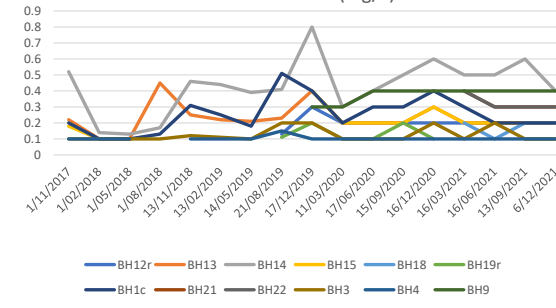
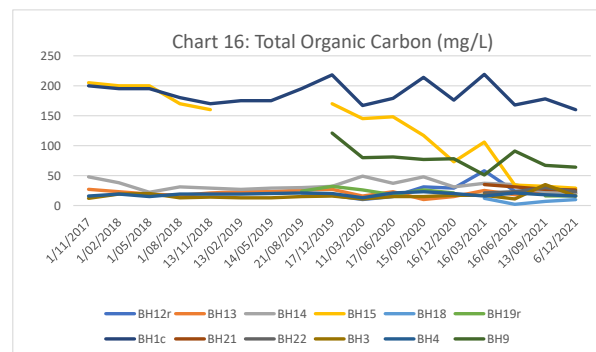
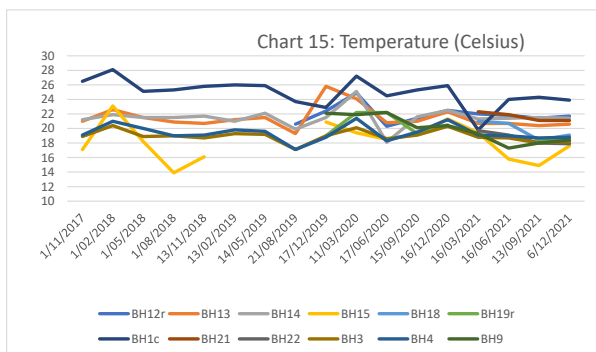
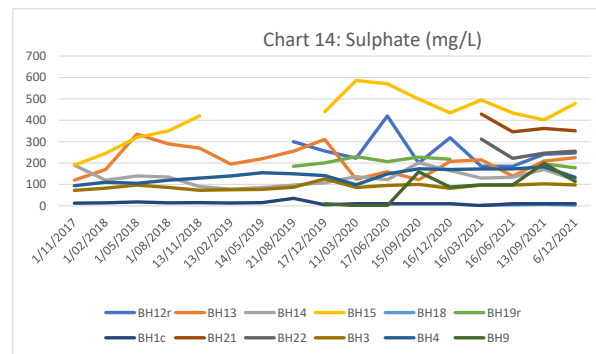
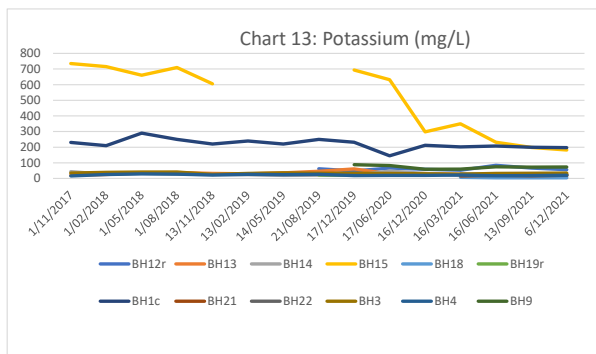
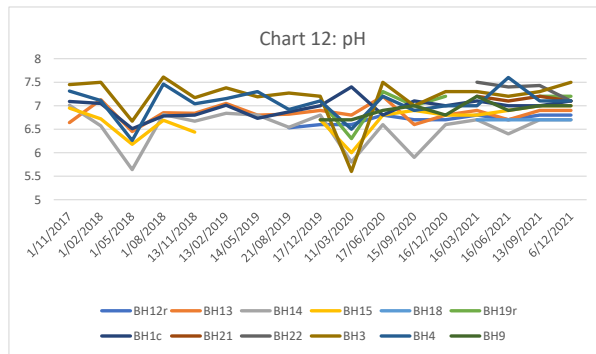
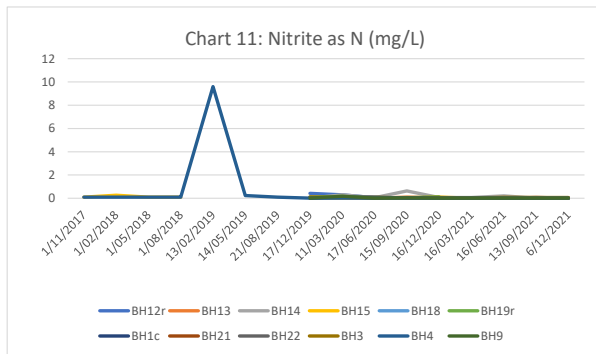
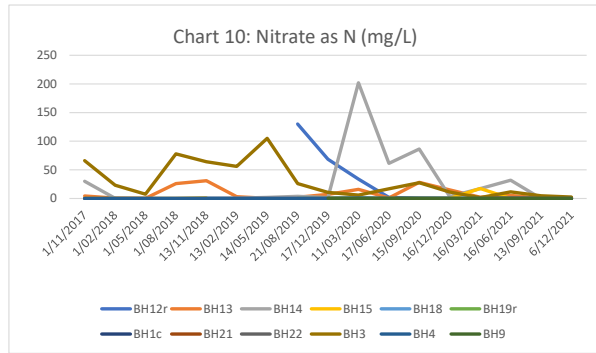
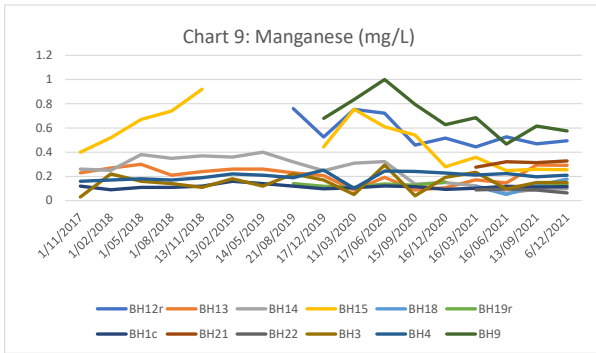
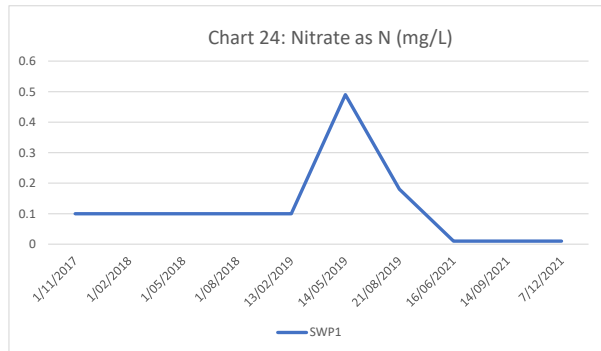
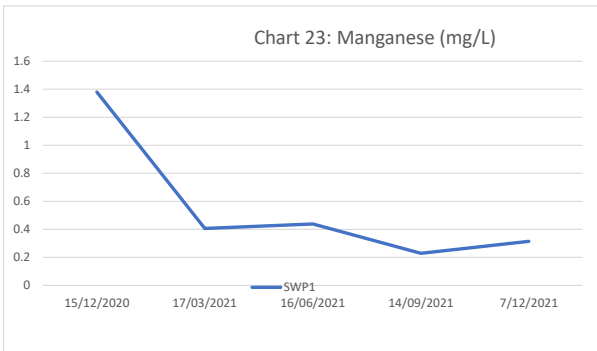
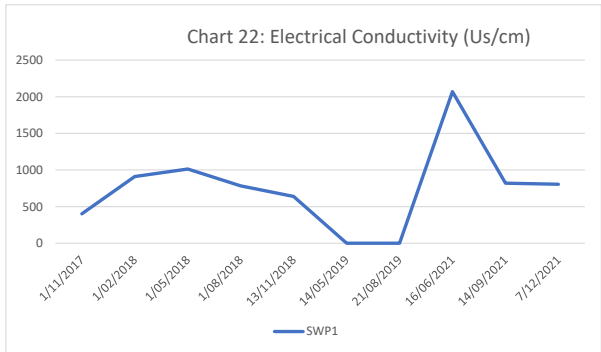
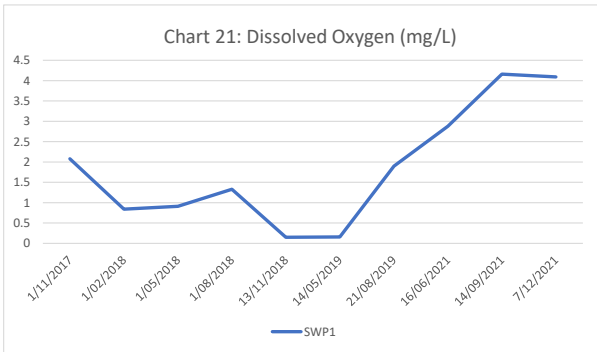
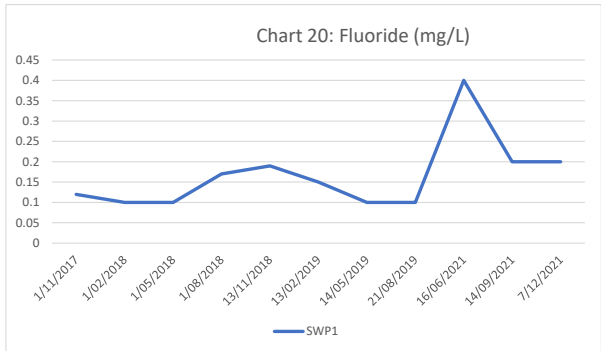
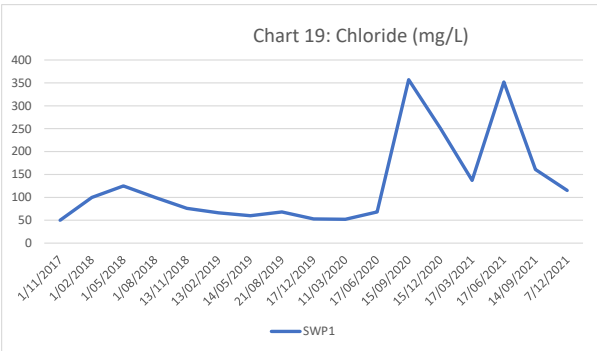
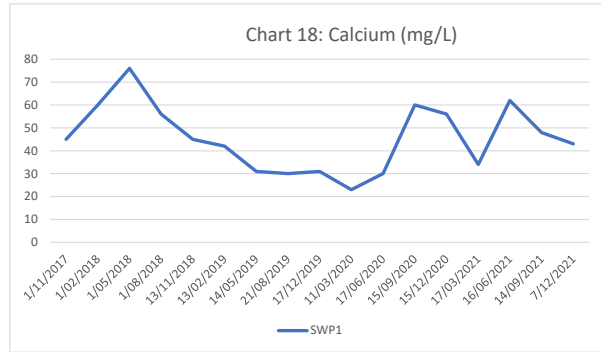
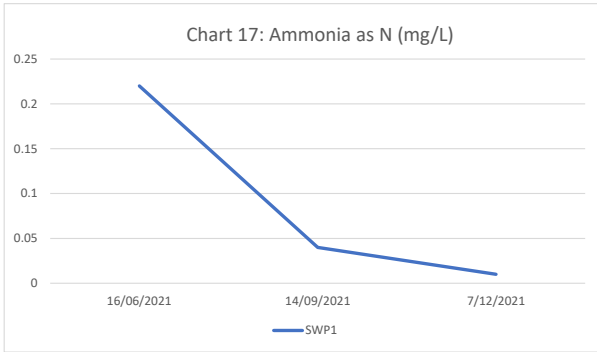


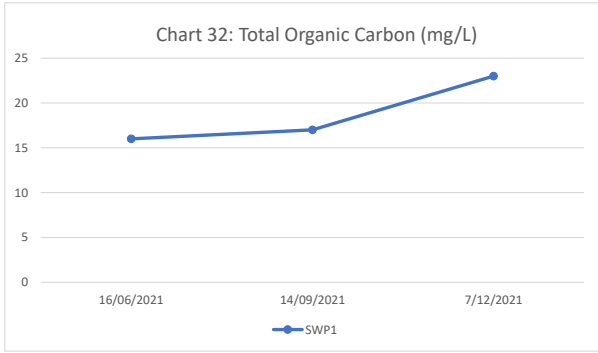
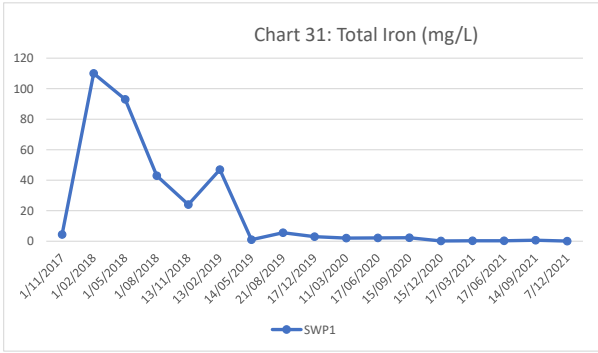
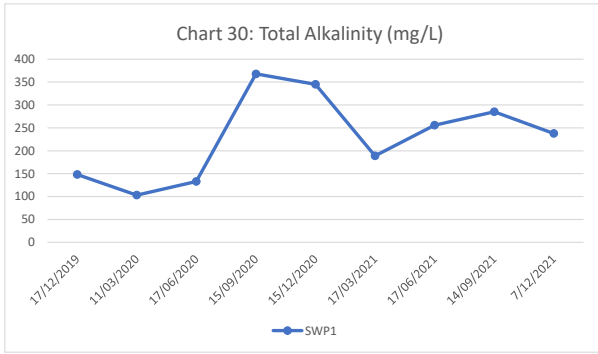
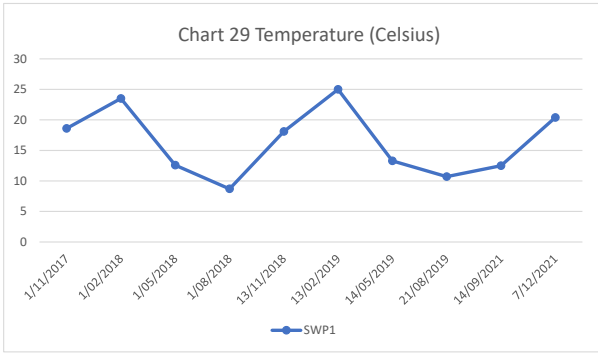
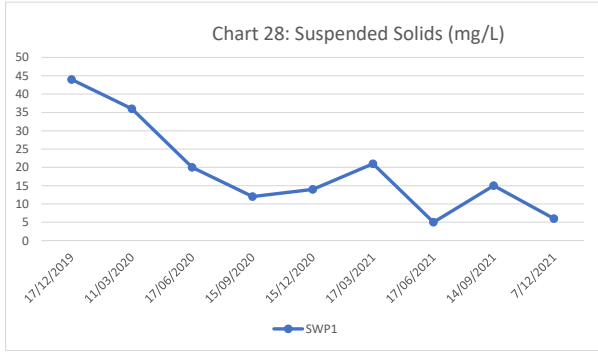
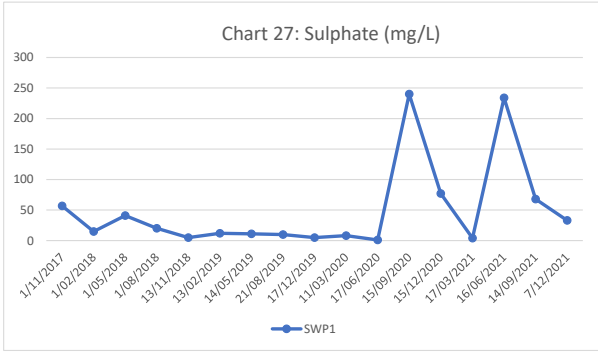
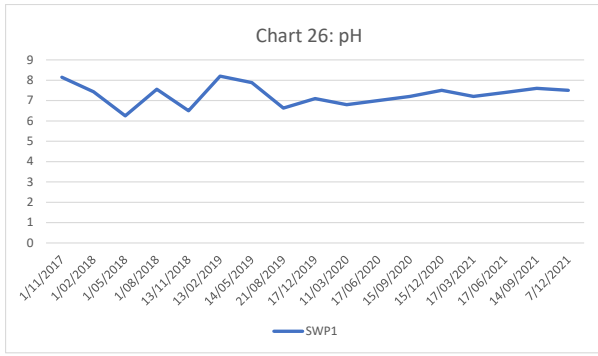
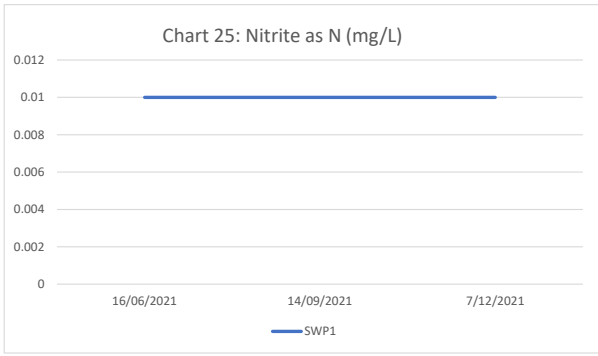
Chart 8: Fluoride (mg/L)





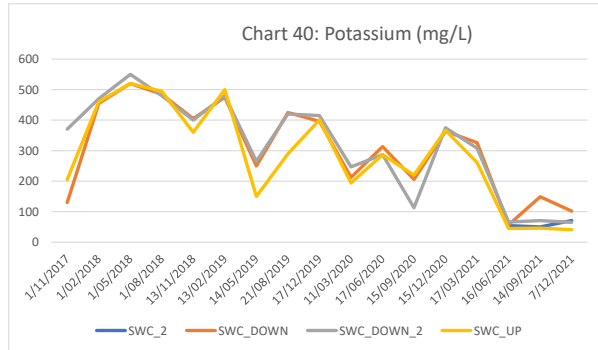
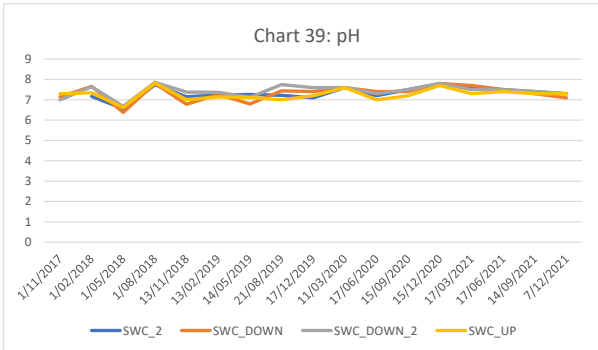
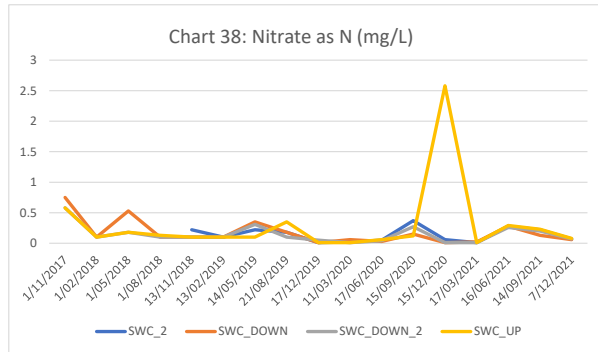
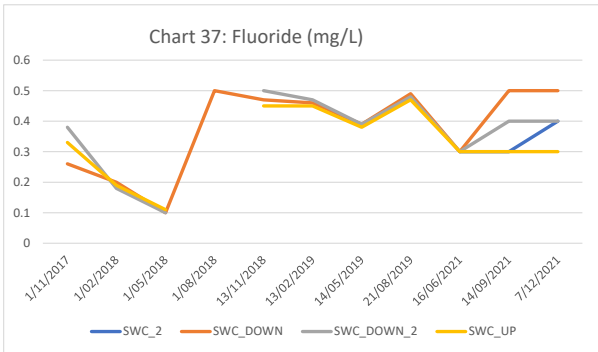
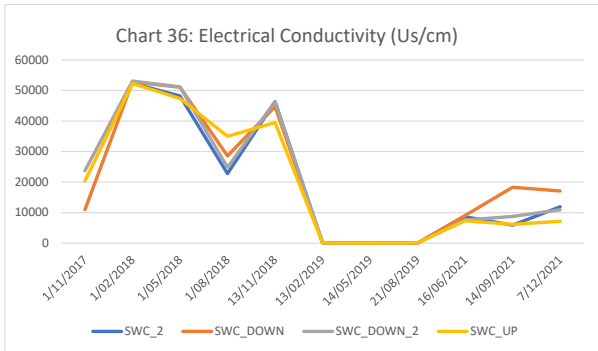
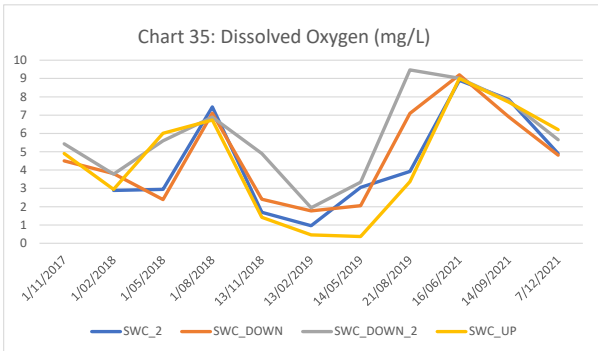
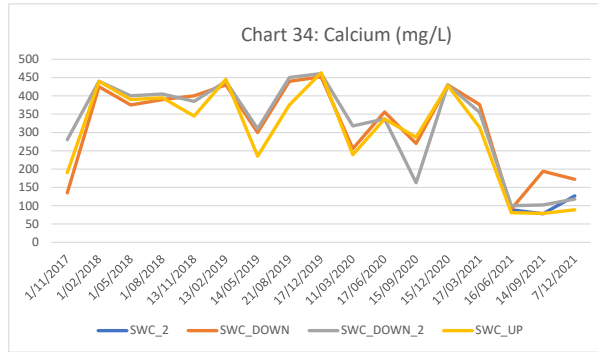
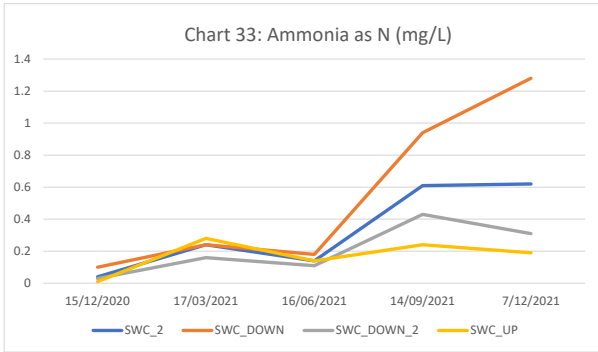
Charts 17-32: Onsite Surface Water Charts

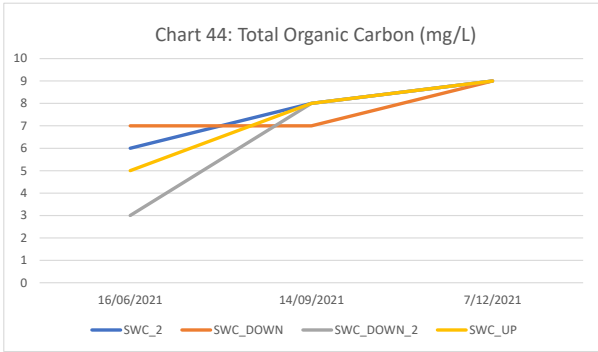
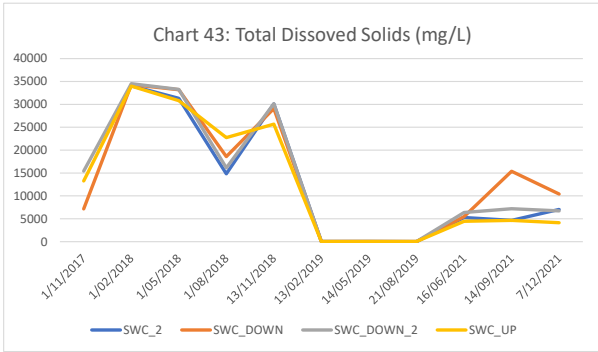
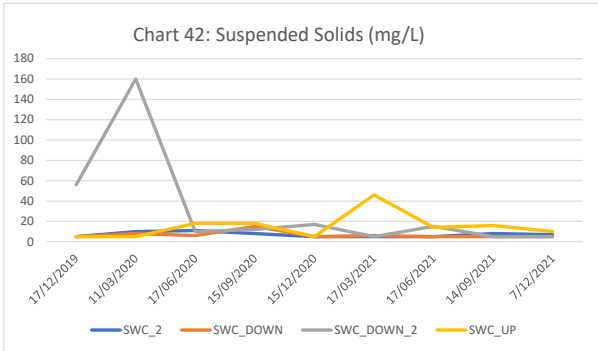
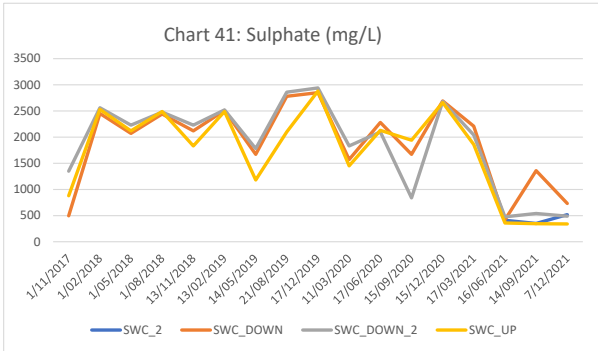




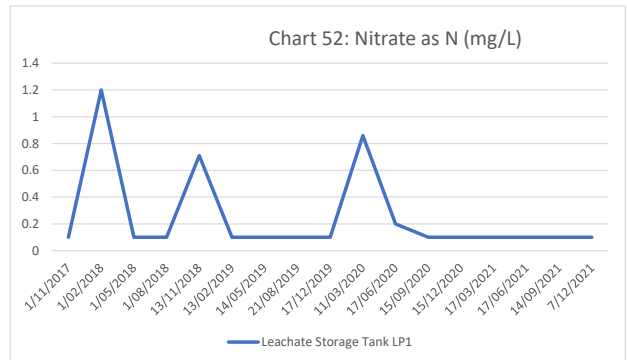
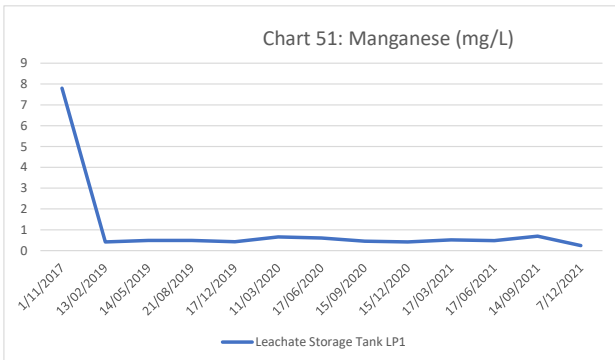
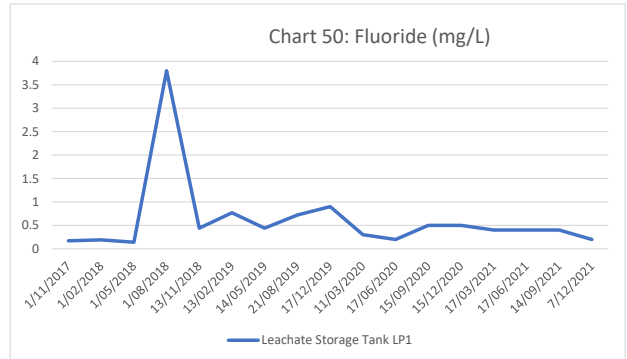
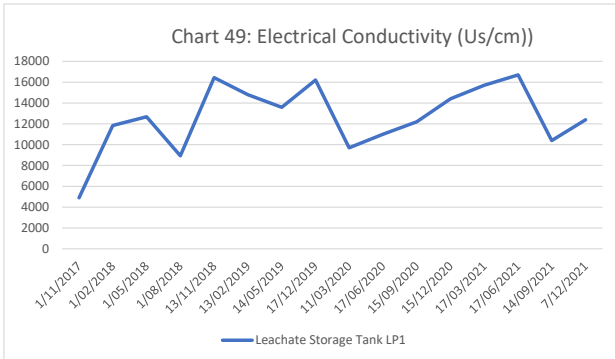
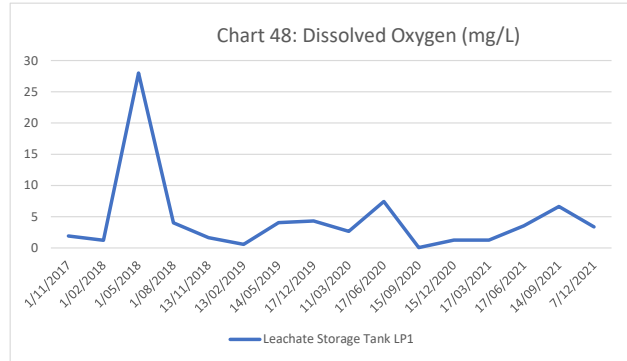
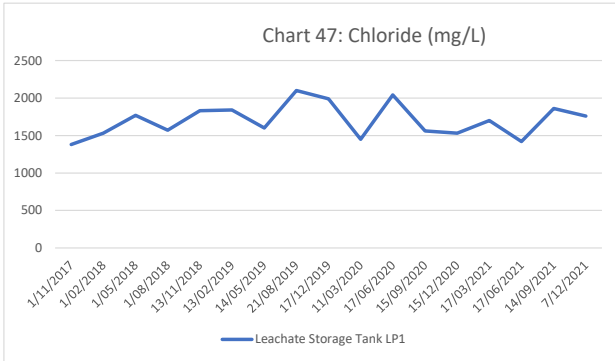
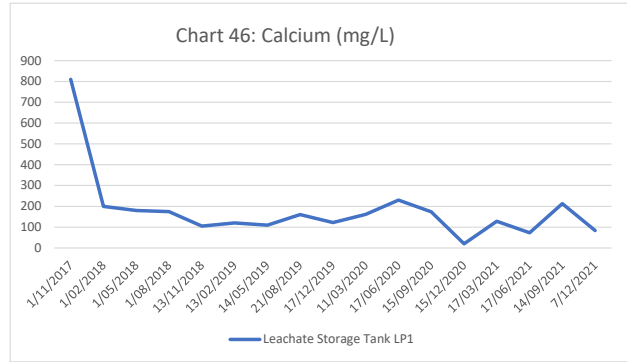
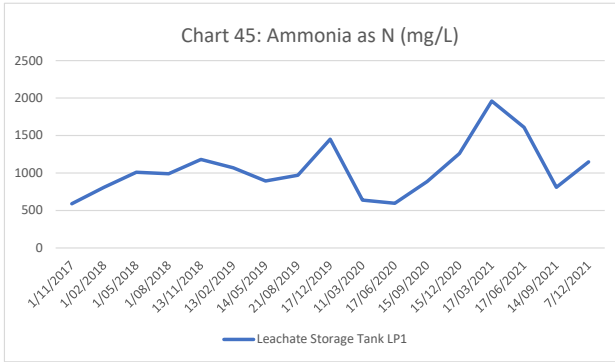


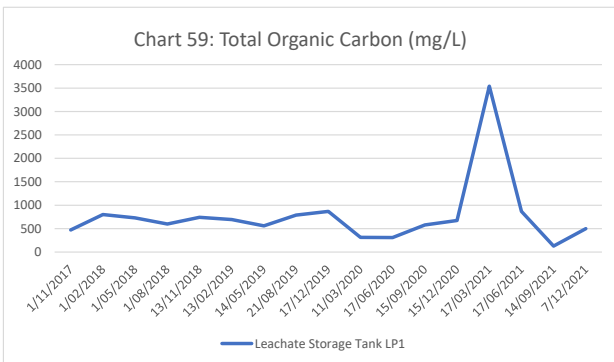
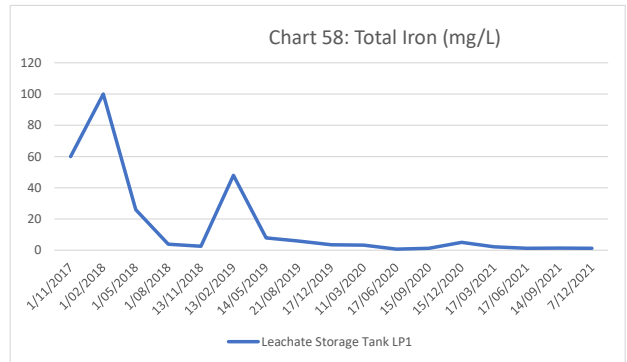
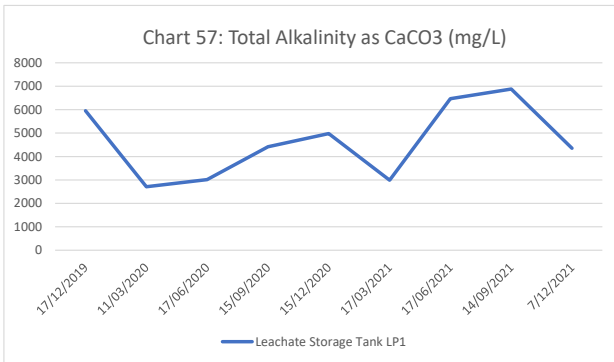
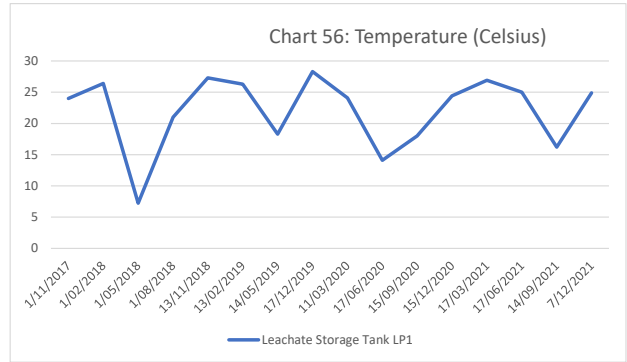
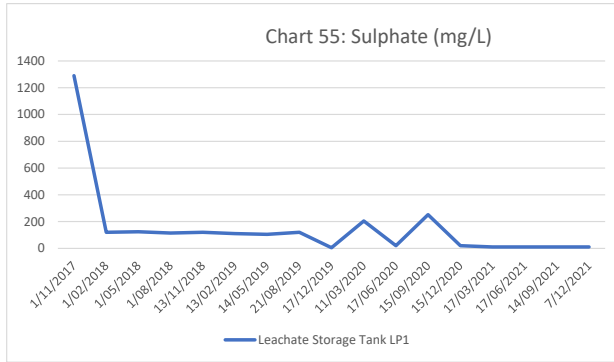
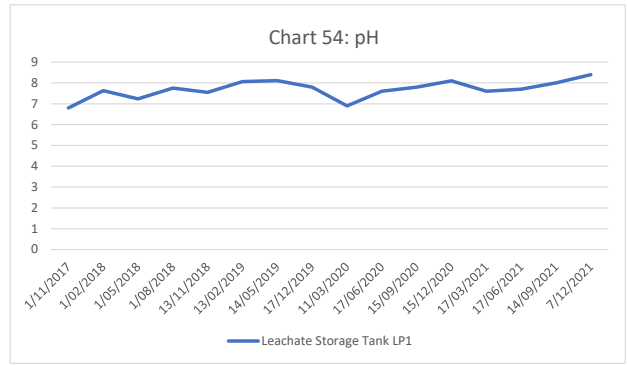
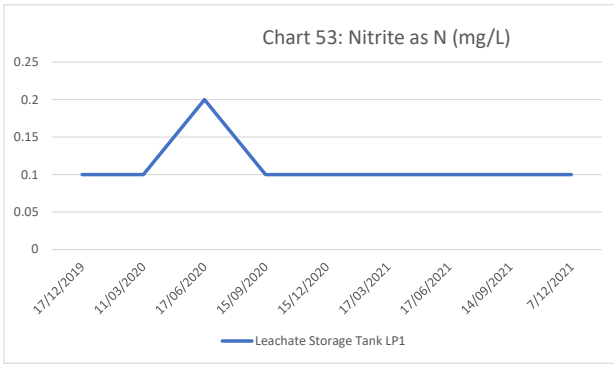
Charts 33-44: Rocklow Creek Surface Water Charts





## Charts 45-59 Leachate Water Quality Charts





# APPENDICES

# Appendix A

## EPL 5984 Sampling Point Summary (NSW EPA, 10/05/2021)

2	Leachate monitoring	Leachate tank labelled LP1 on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
3	Groundwater monitoring	BH1c - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
5	Groundwater monitoring	BH3 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
6	Groundwater monitoring	BH4 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
7	Groundwater monitoring	BH15 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
10	Groundwater monitoring	BH13 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
11	Groundwater monitoring	BH14 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
16	Groundwater monitoring	BH19 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
17	Groundwater monitoring	BH12R - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).

18	Groundwater monitoring	BH9 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
19	Surface Water Monitoring	SWC_2 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
20	Surface Water Monitoring	SWC_UP - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
21	Surface Water Monitoring	SWC_DOWN - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
22	Surface Water Monitoring	SWC_DOWN2 - as shown on the drawing titled "Shellharbour City Council - Dunmore, NSW - Site Layout - Figure no. 1" dated July 2019 (EPA Ref. no. DOC19/1027702).
23	Groundwater Monitoring	BH21 - as shown on drawing titled "Monitoring Point Location Plan - Dunmore Recycling and Waste Depot - EPL No. 5984" prepared by Cardno and attached to correspondence dated 7 April 2020 (EPA ref. no. DOC20/317779).
24	Groundwater monitoring	BH22 - as shown on drawing titled "Monitoring Point Location Plan - Dunmore Recycling and Waste Depot - EPL No. 5984" prepared by Cardno and attached to correspondence dated 7 April 2020 (EPA ref. no. DOC20/317779).
25	Groundwater monitoring	BH18 - as shown on drawing titled "Monitoring Point Location Plan - Dunmore Recycling and Waste Depot - EPL No. 5984" prepared by Cardno and attached to correspondence dated 7 April 2020 (EPA ref. no. DOC20/317779).

# **Appendix B**

## **Laboratory Chain of Custody (COC) & Certificates of Analysis (COA) – Water Samples**





# CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney: 277 Woodpark Rd, Berrigalong NSW 2173  
Ph: 02 8794 8055 E: samples.syd@alsenviro.com

Newcastle: 5 Rosegum Rd, Warabrook NSW 2304  
Ph: 02 4968 3433 E: samples.newcastle@alsenviro.com

Brisbane: 38 Strand St, Stafford QLD 4053  
Ph: 07 5243 7222 E: samples.brisbane@alsenviro.com

Townsville: 14-15 Coorna Ct, Brialmont QLD 4816  
Ph: 07 4708 0600 E: townsville.environmental@alsenviro.com

Melbourne: 2-4 Waverail Rd, Springvale VIC 3171  
Ph: 03 8540 0600 E: samples.melbourne@alsenviro.com

Adelaide: 2-1 Burma Rd, Pooraka SA 5095  
Ph: 08 8359 0800 E: adelaide@alsenviro.com

Perth: 10 Had Way, Maida WA 6000  
Ph: 09 9206 7855 E: samples.perth@alsenviro.com

Launceston: 27 Wellington St, Launceston TAS 7250  
Ph: 03 6331 2156 E: launceston@alsenviro.com

<b>CLIENT:</b> Shellharbour City Council	<b>TURNAROUND REQUIREMENTS:</b> (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	<input type="checkbox"/> Standard TAT (List due date):	<b>FOR LABORATORY USE ONLY (Circle)</b> Custody Seal Intact? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Fragile / Frozen ice packs present upon receipt? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Random Sample Temperature on Receipt: 7.2 °C Other comment:							
<b>OFFICE:</b> 41 Burelli St WOLLONGONG NSW 2500	<input type="checkbox"/> Non Standard or urgent TAT (List due date):	<b>ALS QUOTE NO.:</b> WO/030/19 TENDER								
<b>PROJECT:</b> Dunmore Quarterly Ground Waters EPL	<b>COC SEQUENCE NUMBER (Circle)</b>									
<b>ORDER NUMBER:</b>	COC: <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table>	1	2	3	4	5	6	7		
1	2	3	4	5	6	7				
<b>PROJECT MANAGER:</b> Joel Culton	OF: <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table>	1	2	3	4	5	6	7		
1	2	3	4	5	6	7				
<b>SAMPLER:</b>	<b>SAMPLER MOBILE:</b>	<b>RELINQUISHED BY:</b> R. [Signature]	<b>RECEIVED BY:</b> Aneta [Signature]							
<b>COC emailed to ALS? (YES / NO)</b>	<b>EDD FORMAT (or default):</b>	<b>DATE/TIME:</b> 6.12.21 15:45	<b>DATE/TIME:</b> 6.12.21							
<b>Email Reports to:</b>										
<b>Email Invoice to:</b>										
<b>COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:</b>	<b>CC reports to:</b>									

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	CONTAINER INFORMATION TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
						Ammonia	NT-2A (Alka, So4, Cl, F)	Filtered Ca, K	TOC	Dissolved Fe & Mn	NT-4 (NO2, NO3)	Send to Eurofins	
	BH1C	6.12.21 10:15	W			✓	✓	✓	✓	✓	✓		
	BH3	13:40	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH4	14:25	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH9	9:25	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH12R	12:10	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH13	12:30	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH14	13:15	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH15	11:30	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH19R	14:00	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH18	8:45	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH21	11:00	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	BH22	10:40	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	Duplicate	8:45	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL
	Triplicate	8:45	W			✓	✓	✓	✓	✓	✓		Field Tests - pH, EC, Temp & SWL

Environmental Division  
Wollongong  
Work Order Reference  
**EW2105172**



Telephone : 02 42253125

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC;  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Aspartate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

## CERTIFICATE OF ANALYSIS

**Work Order** : **EW2105172**  
**Client** : **SHELLHARBOUR CITY COUNCIL**  
**Contact** : Joel Coulton  
**Address** : LAMERTON HOUSE, LAMERTON CRESCENT  
 SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529  
  
**Telephone** : ----  
**Project** : Dunmore Quarterly Groundwaters EPL  
**Order number** : 138956  
**C-O-C number** : ----  
**Sampler** : Robert DaLio  
**Site** : DUNMORE LANDFILL TENDER  
**Quote number** : WO/030/19 TENDER GROUNDWATERS  
**No. of samples received** : 14  
**No. of samples analysed** : 13

**Page** : 1 of 8  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Aneta Prosaroski  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia  
  
**Telephone** : +61 2 4225 3125  
**Date Samples Received** : 06-Dec-2021 15:52  
**Date Analysis Commenced** : 06-Dec-2021  
**Issue Date** : 20-Dec-2021 15:32



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aneta Prosaroski	Client Liaison Officer	Laboratory - Wollongong, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	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.  
~ = Indicates an estimated value.

- **Analytical work for this work order will be conducted at ALS Sydney.**
- ED041G:LOR raised due to sample matrix.
- 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 High Flow Method.
- Temperature performed by ALS Wollongong via in-house method EA116 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.



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH1C	BH3	BH4	BH9	BH12R
Sampling date / time				06-Dec-2021 10:15	06-Dec-2021 13:40	06-Dec-2021 14:25	06-Dec-2021 09:25	06-Dec-2021 12:10	
Compound	CAS Number	LOR	Unit	EW2105172-001	EW2105172-002	EW2105172-003	EW2105172-004	EW2105172-005	
				Result	Result	Result	Result	Result	
<b>EA005FD: Field pH</b>									
pH	----	0.1	pH Unit	7.1	7.5	7.1	7.0	6.8	
<b>EA010FD: Field Conductivity</b>									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	7370	1810	2140	4700	2170	
<b>EA116: Temperature</b>									
Temperature	----	0.1	°C	23.9	18.2	18.8	18.4	21.7	
<b>ED037P: Alkalinity by PC Titrator</b>									
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	2390	377	491	1290	448	
Total Alkalinity as CaCO3	----	1	mg/L	2390	377	491	1290	448	
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	98	133	114	247	
<b>ED045G: Chloride by Discrete Analyser</b>									
Chloride	16887-00-6	1	mg/L	939	284	254	626	296	
<b>ED093F: Dissolved Major Cations</b>									
Calcium	7440-70-2	1	mg/L	134	147	238	242	223	
Potassium	7440-09-7	1	mg/L	197	34	21	73	56	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Manganese	7439-96-5	0.001	mg/L	0.116	0.150	0.210	0.575	0.495	
Iron	7439-89-6	0.05	mg/L	12.1	3.56	5.01	4.82	3.67	
<b>EK040P: Fluoride by PC Titrator</b>									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.1	<0.1	0.4	0.2	
<b>EK055G: Ammonia as N by Discrete Analyser</b>									
Ammonia as N	7664-41-7	0.01	mg/L	371	29.5	14.7	90.4	6.51	
<b>EK057G: Nitrite as N by Discrete Analyser</b>									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.06	<0.01	<0.01	0.04	
<b>EK058G: Nitrate as N by Discrete Analyser</b>									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	2.46	0.01	<0.01	1.65	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	2.52	0.01	<0.01	1.69	
<b>EP005: Total Organic Carbon (TOC)</b>									
Total Organic Carbon	----	1	mg/L	160	16	16	64	21	



**Analytical Results**

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH1C	BH3	BH4	BH9	BH12R
Sampling date / time				06-Dec-2021 10:15	06-Dec-2021 13:40	06-Dec-2021 14:25	06-Dec-2021 09:25	06-Dec-2021 12:10	
Compound	CAS Number	LOR	Unit	EW2105172-001	EW2105172-002	EW2105172-003	EW2105172-004	EW2105172-005	
				Result	Result	Result	Result	Result	
<b>QWI-EN 67.11 Sampling of Groundwaters</b>									
Standing Water Level	----	0.01	m AHD	3.15	3.09	4.29	3.10	4.29	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH13	BH14	BH15	BH19R	BH18
Sampling date / time				06-Dec-2021 12:30	06-Dec-2021 13:15	06-Dec-2021 11:30	06-Dec-2021 14:00	06-Dec-2021 08:45	
Compound	CAS Number	LOR	Unit	EW2105172-006	EW2105172-007	EW2105172-008	EW2105172-009	EW2105172-010	
				Result	Result	Result	Result	Result	
<b>EA005FD: Field pH</b>									
pH	----	0.1	pH Unit	6.9	6.7	7.0	7.2	6.7	
<b>EA010FD: Field Conductivity</b>									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	2100	1380	2740	1880	414	
<b>EA116: Temperature</b>									
Temperature	----	0.1	°C	20.6	21.4	17.6	18.6	19.1	
<b>ED037P: Alkalinity by PC Titrator</b>									
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	589	418	290	430	175	
Total Alkalinity as CaCO3	----	1	mg/L	589	418	290	430	175	
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	225	121	478	178	3	
<b>ED045G: Chloride by Discrete Analyser</b>									
Chloride	16887-00-6	1	mg/L	228	124	402	268	16	
<b>ED093F: Dissolved Major Cations</b>									
Calcium	7440-70-2	1	mg/L	249	121	96	166	48	
Potassium	7440-09-7	1	mg/L	26	14	182	24	4	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Manganese	7439-96-5	0.001	mg/L	0.291	0.100	0.254	0.135	0.178	
Iron	7439-89-6	0.05	mg/L	1.14	0.19	7.05	1.05	2.13	
<b>EK040P: Fluoride by PC Titrator</b>									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.4	0.2	0.1	0.2	
<b>EK055G: Ammonia as N by Discrete Analyser</b>									
Ammonia as N	7664-41-7	0.01	mg/L	4.05	1.17	14.7	4.90	0.72	
<b>EK057G: Nitrite as N by Discrete Analyser</b>									
Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.04	0.02	<0.01	<0.01	
<b>EK058G: Nitrate as N by Discrete Analyser</b>									
Nitrate as N	14797-55-8	0.01	mg/L	1.31	0.97	0.04	<0.01	<0.01	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	1.33	1.01	0.06	<0.01	<0.01	
<b>EP005: Total Organic Carbon (TOC)</b>									
Total Organic Carbon	----	1	mg/L	20	19	29	16	10	



**Analytical Results**

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH13	BH14	BH15	BH19R	BH18
Sampling date / time					06-Dec-2021 12:30	06-Dec-2021 13:15	06-Dec-2021 11:30	06-Dec-2021 14:00	06-Dec-2021 08:45
Compound	CAS Number	LOR	Unit		EW2105172-006	EW2105172-007	EW2105172-008	EW2105172-009	EW2105172-010
					Result	Result	Result	Result	Result
<b>QWI-EN 67.11 Sampling of Groundwaters</b>									
Standing Water Level	----	0.01	m AHD		4.29	4.72	0.69	4.45	2.18



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Sample ID		BH22	Duplicate	BH21	----	----
		Sampling date / time		06-Dec-2021 10:40	06-Dec-2021 08:45	06-Dec-2021 11:00	----	----
Compound	CAS Number	LOR	Unit	EW2105172-011	EW2105172-012	EW2105172-014	-----	-----
				Result	Result	Result	----	----
<b>EA005FD: Field pH</b>								
pH	----	0.1	pH Unit	7.1	6.7	7.1	----	----
<b>EA010FD: Field Conductivity</b>								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	2030	414	2610	----	----
<b>EA116: Temperature</b>								
Temperature	----	0.1	°C	17.9	19.1	21.1	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	433	175	494	----	----
Total Alkalinity as CaCO3	----	1	mg/L	433	175	494	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	255	3	351	----	----
<b>ED045G: Chloride by Discrete Analyser</b>								
Chloride	16887-00-6	1	mg/L	274	16	380	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	160	48	156	----	----
Potassium	7440-09-7	1	mg/L	23	4	20	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Manganese	7439-96-5	0.001	mg/L	0.064	0.174	0.328	----	----
Iron	7439-89-6	0.05	mg/L	0.27	2.12	0.15	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.3	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	1.54	0.71	2.95	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	0.12	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.12	----	----
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	23	10	26	----	----





### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BH22	Duplicate	BH21	----	----
Sampling date / time				06-Dec-2021 10:40	06-Dec-2021 08:45	06-Dec-2021 11:00	----	----	
Compound	CAS Number	LOR	Unit	EW2105172-011	EW2105172-012	EW2105172-014	-----	-----	
				Result	Result	Result	----	----	
<b>QWI-EN 67.11 Sampling of Groundwaters</b>									
<b>Standing Water Level</b>		----	0.01	m AHD	<b>2.57</b>	<b>2.18</b>	<b>2.96</b>	----	----

### Inter-Laboratory Testing

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

- (WATER) ED093F: Dissolved Major Cations
- (WATER) EP005: Total Organic Carbon (TOC)
- (WATER) EK055G: Ammonia as N by Discrete Analyser
- (WATER) EG020F: Dissolved Metals by ICP-MS
- (WATER) EK057G: Nitrite as N by Discrete Analyser
- (WATER) EK058G: Nitrate as N by Discrete Analyser
- (WATER) EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser
- (WATER) ED045G: Chloride by Discrete Analyser
- (WATER) ED037P: Alkalinity by PC Titrator
- (WATER) EK040P: Fluoride by PC Titrator
- (WATER) ED041G: Sulfate (Turbidimetric) as SO4 2- by DA

## QUALITY CONTROL REPORT

<b>Work Order</b>	<b>: EW2105172</b>	<b>Page</b>	: 1 of 5
<b>Client</b>	<b>: SHELLHARBOUR CITY COUNCIL</b>	<b>Laboratory</b>	: Environmental Division NSW South Coast
<b>Contact</b>	: Joel Coulton	<b>Contact</b>	: Aneta Prosaroski
<b>Address</b>	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	<b>Address</b>	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
<b>Telephone</b>	: ----	<b>Telephone</b>	: +61 2 4225 3125
<b>Project</b>	: Dunmore Quarterly Groundwaters EPL	<b>Date Samples Received</b>	: 06-Dec-2021
<b>Order number</b>	: 138956	<b>Date Analysis Commenced</b>	: 06-Dec-2021
<b>C-O-C number</b>	: ----	<b>Issue Date</b>	: 20-Dec-2021
<b>Sampler</b>	: Robert DaLio		
<b>Site</b>	: DUNMORE LANDFILL TENDER		
<b>Quote number</b>	: WO/030/19 TENDER GROUNDWATERS		
<b>No. of samples received</b>	: 14		
<b>No. of samples analysed</b>	: 13		



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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

### 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aneta Prosaroski	Client Liaison Officer	Laboratory - Wollongong, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	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.

Key :  
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot  
 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  
 RPD = Relative Percentage Difference  
 # = Indicates failed QC

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>ED037P: Alkalinity by PC Titrator (QC Lot: 4058356)</b>									
EW2105172-009	BH19R	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	430	395	8.7	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	430	395	8.7	0% - 20%
ES2144376-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	22	23	0.0	0% - 20%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	714	708	0.9	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	736	747	1.4	0% - 20%
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4059718)</b>									
ES2144405-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	19	19	0.0	0% - 50%
ES2144165-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	64	61	5.7	0% - 20%
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4059722)</b>									
EW2105207-004	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	6	0.0	No Limit
EW2105207-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5	5	0.0	No Limit
<b>ED045G: Chloride by Discrete Analyser (QC Lot: 4059717)</b>									
EW2105172-007	BH14	ED045G: Chloride	16887-00-6	1	mg/L	124	125	0.0	0% - 20%
ES2144165-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	348	348	0.0	0% - 20%
<b>ED093F: Dissolved Major Cations (QC Lot: 4071318)</b>									
EW2105172-001	BH1C	ED093F: Calcium	7440-70-2	1	mg/L	134	131	2.1	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	197	197	0.0	0% - 20%
EW2105243-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	8	7	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	1	<1	0.0	No Limit
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 4071319)</b>									

Page : 3 of 5  
 Work Order : EW2105172  
 Client : SHELLHARBOUR CITY COUNCIL  
 Project : Dunmore Quarterly Groundwaters EPL



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 4071319) - continued</b>									
EW2105172-001	BH1C	EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.116	0.112	3.1	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	12.1	12.0	1.3	0% - 20%
EW2105243-001	Anonymous	EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.049	0.050	0.0	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.24	0.24	0.0	No Limit
<b>EK040P: Fluoride by PC Titrator (QC Lot: 4058357)</b>									
EW2105172-009	BH19R	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.1	0.1	0.0	No Limit
ES2144376-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.0	No Limit
<b>EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4072441)</b>									
EW2105172-001	BH1C	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	371	347	6.5	0% - 20%
EW2105172-010	BH18	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.72	0.74	2.9	0% - 20%
<b>EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4059721)</b>									
EW2105172-007	BH14	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.04	0.04	0.0	No Limit
EW2105207-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4072439)</b>									
ES2144794-004	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.02	0.0	No Limit
EW2105172-006	BH13	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.33	1.31	1.5	0% - 20%
<b>EP005: Total Organic Carbon (TOC) (QC Lot: 4067357)</b>									
ES2145068-002	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	3	3	0.0	No Limit
EW2105172-008	BH15	EP005: Total Organic Carbon	----	1	mg/L	29	28	0.0	0% - 20%



## Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
				Result	Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
<b>ED037P: Alkalinity by PC Titrator (QCLot: 4058356)</b>								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	88.2	81.0	111
				----	50 mg/L	97.7	80.0	120
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4059718)</b>								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	82.0	122
				<1	500 mg/L	103	82.0	122
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4059722)</b>								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	82.0	122
				<1	500 mg/L	97.9	82.0	122
<b>ED045G: Chloride by Discrete Analyser (QCLot: 4059717)</b>								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	97.4	80.9	127
				<1	1000 mg/L	105	80.9	127
<b>ED093F: Dissolved Major Cations (QCLot: 4071318)</b>								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	111	80.0	114
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	95.6	85.0	113
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 4071319)</b>								
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	82.2	82.0	110
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	88.3	82.0	112
<b>EK040P: Fluoride by PC Titrator (QCLot: 4058357)</b>								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	92.8	82.0	116
<b>EK055G: Ammonia as N by Discrete Analyser (QCLot: 4072441)</b>								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	101	90.0	114
<b>EK057G: Nitrite as N by Discrete Analyser (QCLot: 4059721)</b>								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	105	82.0	114
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4072439)</b>								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	91.0	113
<b>EP005: Total Organic Carbon (TOC) (QCLot: 4067357)</b>								
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	99.2	72.0	120

## Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Matrix Spike (MS) Report



Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4059718)</b>							
ES2144165-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70.0	130
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4059722)</b>							
EW2105207-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	116	70.0	130
<b>ED045G: Chloride by Discrete Analyser (QCLot: 4059717)</b>							
ES2144165-001	Anonymous	ED045G: Chloride	16887-00-6	50 mg/L	# Not Determined	70.0	130
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 4071319)</b>							
EW2105172-002	BH3	EG020A-F: Manganese	7439-96-5	1 mg/L	102	70.0	130
<b>EK040P: Fluoride by PC Titrator (QCLot: 4058357)</b>							
ES2144376-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	92.4	70.0	130
<b>EK055G: Ammonia as N by Discrete Analyser (QCLot: 4072441)</b>							
EW2105172-001	BH1C	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
<b>EK057G: Nitrite as N by Discrete Analyser (QCLot: 4059721)</b>							
EW2105207-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	124	70.0	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4072439)</b>							
ES2144794-004	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	101	70.0	130
<b>EP005: Total Organic Carbon (TOC) (QCLot: 4067357)</b>							
ES2145068-003	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	108	70.0	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EW2105172	Page	: 1 of 9
Client	: SHELLHARBOUR CITY COUNCIL	Laboratory	: Environmental Division NSW South Coast
Contact	: Joel Coulton	Telephone	: +61 2 4225 3125
Project	: Dunmore Quarterly Groundwaters EPL	Date Samples Received	: 06-Dec-2021
Site	: DUNMORE LANDFILL TENDER	Issue Date	: 20-Dec-2021
Sampler	: Robert DaLio	No. of samples received	: 14
Order number	: 138956	No. of samples analysed	: 13

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

### Summary of Outliers

#### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

#### Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

#### Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



### Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: WATER

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
<b>Matrix Spike (MS) Recoveries</b>							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES2144165--001	Anonymous	Sulfate as SO4 - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	ES2144165--001	Anonymous	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK055G: Ammonia as N by Discrete Analyser	EW2105172--001	BH1C	Ammonia as N	7664-41-7	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

### Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: WATER

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA005FD: Field pH</b>							
<b>Field Test Dummy Bottle (EN67 PK)</b>							
BH4, BH12R, BH14, BH19R, BH22, BH21	BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	06-Dec-2021	----
<b>Field Test Dummy Bottle (EN67 PK)</b>							
BH1C,	BH3	06-Dec-2021	----	----	----	10-Dec-2021	----





Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EA010FD: Field Conductivity</b>								
<b>Field Test Dummy Bottle (EN67 PK)</b> BH4, BH12R, BH14, BH19R, BH22, BH21	BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	06-Dec-2021	----	----
<b>Field Test Dummy Bottle (EN67 PK)</b> BH1C,	BH3	06-Dec-2021	----	----	----	10-Dec-2021	----	----
<b>EA116: Temperature</b>								
<b>Field Test Dummy Bottle (EN67 PK)</b> BH4, BH12R, BH14, BH19R, BH22, BH21	BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	06-Dec-2021	----	----
<b>Field Test Dummy Bottle (EN67 PK)</b> BH1C,	BH3	06-Dec-2021	----	----	----	10-Dec-2021	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
<b>Clear Plastic Bottle - Natural (ED037-P)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	06-Dec-2021	20-Dec-2021	✓
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
<b>Clear Plastic Bottle - Natural (ED041G)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	07-Dec-2021	03-Jan-2022	✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>ED045G: Chloride by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Natural (ED045G)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	07-Dec-2021	03-Jan-2022	✓
<b>ED093F: Dissolved Major Cations</b>								
<b>Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	13-Dec-2021	03-Jan-2022	✓
<b>EG020F: Dissolved Metals by ICP-MS</b>								
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	13-Dec-2021	04-Jun-2022	✓
<b>EK040P: Fluoride by PC Titrator</b>								
<b>Clear Plastic Bottle - Natural (EK040P)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	06-Dec-2021	03-Jan-2022	✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Sulfuric Acid (EK055G)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	13-Dec-2021	03-Jan-2022	✓
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Natural (EK057G)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	07-Dec-2021	08-Dec-2021	✓
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Sulfuric Acid (EK059G)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	13-Dec-2021	03-Jan-2022	✓
<b>EP005: Total Organic Carbon (TOC)</b>								
<b>Amber TOC Vial - Sulfuric Acid (EP005)</b> BH1C, BH4, BH12R, BH14, BH19R, BH22, BH21	BH3, BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	10-Dec-2021	03-Jan-2022	✓



Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>QWI-EN 67.11 Sampling of Groundwaters</b>								
<b>Field Test Dummy Bottle (EN67 PK)</b>								
BH4, BH12R, BH14, BH19R, BH22, BH21	BH9, BH13, BH15, BH18, Duplicate,	06-Dec-2021	----	----	----	06-Dec-2021	----	----
<b>Field Test Dummy Bottle (EN67 PK)</b>								
BH1C,	BH3	06-Dec-2021	----	----	----	10-Dec-2021	----	----



## Quality Control Parameter Frequency Compliance

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

Matrix: **WATER** Evaluation: \* = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	39	10.26	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	39	10.26	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	39	5.13	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Matrix Spikes (MS) - Continued</b>							
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	1	13	7.69	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by Discrete Analyser	ED041G	2	39	5.13	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



## Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO <sub>4</sub> <sup>2-</sup> by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO <sub>4</sub> . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO <sub>4</sub> suspension is measured by a photometer and the SO <sub>4</sub> <sup>2-</sup> concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH <sub>3</sub> G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO <sub>2</sub> - B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO <sub>3</sub> - F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO <sub>3</sub> - F. Combined oxidised Nitrogen (NO <sub>2</sub> +NO <sub>3</sub> ) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Field Tests - Port Kembla	EN67 PK	WATER	Field determinations as per methods described in APHA. The analysis is performed in the field by ALS samplers. ALS NATA accreditation apply for this service.
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM Schedule B(3)



# CHAIN OF CUSTODY

ALS Laboratory: please tick →

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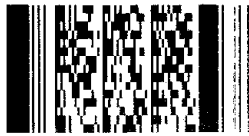
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 Launceston: 27 Wellington St. Launceston TAS 7250  
Ph: 03 8331 2158 E: launceston@alsenviro.com

<b>CLIENT:</b> Shellharbour City Council	<b>TURNAROUND REQUIREMENTS:</b> (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	<input type="checkbox"/> Standard TAT (List due date): <input type="checkbox"/> Non Standard or urgent TAT (List due date):	<b>FOR LABORATORY USE ONLY (Circle)</b> Custody Seal Intact? <input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A Free ice / frozen ice bricks present upon receipt? <input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A Random Sample Temperature on Receipt: <input type="checkbox"/> C Other comment: 6.8													
<b>OFFICE:</b> 41 Burrell St WOLLONGONG NSW 2500	<b>ALS QUOTE NO.:</b> WO/030/19 TENDER	<b>COC SEQUENCE NUMBER (Circle)</b> COC: <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table> OF: <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table>		1	2	3	4	5	6	7	1	2	3	4	5	6
1	2	3	4	5	6	7										
1	2	3	4	5	6	7										
<b>PROJECT:</b> Dunmore Quarterly Surface Waters EPL	<b>PROJECT MANAGER:</b> Joel Culton	<b>SAMPLER:</b> Robert Dalio	<b>SAMPLER MOBILE:</b>													
<b>ORDER NUMBER:</b>	<b>EDD FORMAT (or default):</b>	<b>RELINQUISHED BY:</b> Robert Dalio	<b>RECEIVED BY:</b> Aneta													
<b>COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:</b>	<b>CC reports to:</b>	<b>DATE/TIME:</b> 7.12.21 15:40	<b>DATE/TIME:</b> 7.12.21													

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)							Additional Information
					TSS	NT-1, NT-2A (Ionic Balance)	TOC, NT-4, NH3, Total Mn	Dissolved and Total Fe	Turbidity	NH3, NH4 & NO3	TSS, TDS, TOC, Total Mn	
	SWP1	7.12.21 10:25	W		✓	✓	✓	✓				
	SWC_2	8:40	W			✓		✓				Field Tests - pH, EC, DO & Temp
	SWC_UP	7:55	W			✓		✓		✓		Field Tests - pH, EC, DO & Temp
	SWC_DOWN	7:40	W			✓		✓	✓	✓		Field Tests - pH, EC, DO & Temp
	SWC_DOWN_2	7:45	W			✓		✓	✓	✓		Field Tests - pH, EC, DO & Temp
	Duplicate	8:40	W			✓		✓	✓	✓		Field Tests - pH, EC, DO & Temp

Environmental Division  
Wollongong  
Work Order Reference  
**EW2105184**



Telephone : 02 42253125

erved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic  
is: H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;



## CERTIFICATE OF ANALYSIS

**Work Order** : **EW2105184**  
**Client** : **SHELLHARBOUR CITY COUNCIL**  
**Contact** : Joel Coulton  
**Address** : LAMERTON HOUSE, LAMERTON CRESCENT  
 SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529  
  
**Telephone** : ----  
**Project** : Dunmore Quarterly Surface Water EPL  
**Order number** : 138956  
**C-O-C number** : ----  
**Sampler** : Robert DaLio  
**Site** : DUNMORE LANDFILL TENDER  
**Quote number** : WO/030/19 TENDER SURFACE WATER  
**No. of samples received** : 6  
**No. of samples analysed** : 6

**Page** : 1 of 7  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Aneta Prosaroski  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia  
  
**Telephone** : +61 2 4225 3125  
**Date Samples Received** : 07-Dec-2021 15:57  
**Date Analysis Commenced** : 07-Dec-2021  
**Issue Date** : 14-Dec-2021 15:56



Accreditation No. 825  
 Accredited for compliance with  
 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Robert DaLio	Sampler	Laboratory - Wollongong, 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.  
~ = Indicates an estimated value.

- **Analytical work for this work order will be conducted at ALS Sydney.**
- 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 completed by ALS Wollongong in accordance with in-house sampling method EN/67.6 Rivers and Streams.
- Temperature performed by ALS Wollongong via in-house method EA116 and EN67 PK.
- 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.



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SWP1 Point 1	SWC_2 Point 19	SWC_UP Point 20	SWC_Down Point 21	SWC_DOWN_2 Point 22
Sampling date / time				07-Dec-2021 10:25	07-Dec-2021 08:40	07-Dec-2021 07:55	07-Dec-2021 07:40	07-Dec-2021 07:45	
Compound	CAS Number	LOR	Unit	EW2105184-001	EW2105184-002	EW2105184-003	EW2105184-004	EW2105184-005	
				Result	Result	Result	Result	Result	
<b>EA005FD: Field pH</b>									
pH	----	0.1	pH Unit	7.5	7.3	7.3	7.1	7.3	
<b>EA010FD: Field Conductivity</b>									
Electrical Conductivity (Non Compensated)	----	1	µS/cm	806	11900	7180	17100	10900	
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>									
Total Dissolved Solids @180°C	----	10	mg/L	479	7040	4130	10400	6720	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	6	7	10	<5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	1.6	----	5.3	4.2	4.8	
<b>EA116: Temperature</b>									
Temperature	----	0.1	°C	20.4	18.8	19.2	19.5	19.0	
<b>ED037P: Alkalinity by PC Titrator</b>									
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	238	174	169	188	169	
Total Alkalinity as CaCO3	----	1	mg/L	238	174	169	188	169	
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	33	518	340	733	488	
<b>ED045G: Chloride by Discrete Analyser</b>									
Chloride	16887-00-6	1	mg/L	115	3870	2250	5760	3540	
<b>ED093F: Dissolved Major Cations</b>									
Calcium	7440-70-2	1	mg/L	43	127	89	172	118	
Magnesium	7439-95-4	1	mg/L	19	225	135	331	205	
Sodium	7440-23-5	1	mg/L	94	1860	1090	2740	1710	
Potassium	7440-09-7	1	mg/L	7	71	41	102	65	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Iron	7439-89-6	0.05	mg/L	0.06	0.11	0.10	0.25	0.09	
<b>EG020T: Total Metals by ICP-MS</b>									
Manganese	7439-96-5	0.001	mg/L	0.314	0.104	0.101	0.117	0.098	
Iron	7439-89-6	0.05	mg/L	0.12	0.66	0.72	0.60	0.61	
<b>EK040P: Fluoride by PC Titrator</b>									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.4	0.3	0.5	0.4	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SWP1 Point 1	SWC_2 Point 19	SWC_UP Point 20	SWC_Down Point 21	SWC_DOWN_2 Point 22
Sampling date / time				07-Dec-2021 10:25	07-Dec-2021 08:40	07-Dec-2021 07:55	07-Dec-2021 07:40	07-Dec-2021 07:45	
Compound	CAS Number	LOR	Unit	EW2105184-001	EW2105184-002	EW2105184-003	EW2105184-004	EW2105184-005	
				Result	Result	Result	Result	Result	
<b>EK055G: Ammonia as N by Discrete Analyser</b>									
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.62	0.19	1.28	0.31	
<b>EK055G-NH4: Ammonium as N by DA</b>									
Ammonium as N	14798-03-9_N	0.01	mg/L	<0.01	0.62	0.19	1.27	0.31	
<b>EK057G: Nitrite as N by Discrete Analyser</b>									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
<b>EK058G: Nitrate as N by Discrete Analyser</b>									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	0.07	0.08	0.06	0.07	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.07	0.08	0.06	0.07	
<b>EN055: Ionic Balance</b>									
∅ Total Anions	----	0.01	meq/L	8.69	123	73.9	181	113	
∅ Total Cations	----	0.01	meq/L	7.98	108	64.0	158	98.8	
∅ Ionic Balance	----	0.01	%	4.26	6.86	7.19	7.04	6.88	
<b>EP005: Total Organic Carbon (TOC)</b>									
Total Organic Carbon	----	1	mg/L	23	9	9	9	9	
<b>EP025FD: Field Dissolved Oxygen</b>									
Dissolved Oxygen	----	0.01	mg/L	4.09	4.90	6.20	4.81	5.66	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	Duplicate	----	----	----	----
Sampling date / time			07-Dec-2021 08:40	----	----	----	----	----
Compound	CAS Number	LOR	Unit	EW2105184-006	-----	-----	-----	-----
				Result	----	----	----	----
<b>EA005FD: Field pH</b>								
pH	----	0.1	pH Unit	7.3	----	----	----	----
<b>EA010FD: Field Conductivity</b>								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	11900	----	----	----	----
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>								
Total Dissolved Solids @180°C	----	10	mg/L	7250	----	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	<5	----	----	----	----
<b>EA045: Turbidity</b>								
Turbidity	----	0.1	NTU	5.3	----	----	----	----
<b>EA116: Temperature</b>								
Temperature	----	0.1	°C	18.8	----	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	173	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	173	----	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	523	----	----	----	----
<b>ED045G: Chloride by Discrete Analyser</b>								
Chloride	16887-00-6	1	mg/L	3820	----	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	127	----	----	----	----
Magnesium	7439-95-4	1	mg/L	224	----	----	----	----
Sodium	7440-23-5	1	mg/L	1860	----	----	----	----
Potassium	7440-09-7	1	mg/L	70	----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Iron	7439-89-6	0.05	mg/L	0.11	----	----	----	----
<b>EG020T: Total Metals by ICP-MS</b>								
Manganese	7439-96-5	0.001	mg/L	0.101	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.66	----	----	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	0.4	----	----	----	----



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Duplicate	----	----	----	----
Sampling date / time				07-Dec-2021 08:40	----	----	----	----	----
Compound	CAS Number	LOR	Unit	EW2105184-006	-----	-----	-----	-----	-----
Result				----	----	----	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>									
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.62</b>	----	----	----	----	----
<b>EK055G-NH4: Ammonium as N by DA</b>									
Ammonium as N	14798-03-9_N	0.01	mg/L	<b>0.62</b>	----	----	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>									
Nitrate as N	14797-55-8	0.01	mg/L	<b>0.07</b>	----	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	<b>0.07</b>	----	----	----	----	----
<b>EN055: Ionic Balance</b>									
∅ Total Anions	----	0.01	meq/L	<b>122</b>	----	----	----	----	----
∅ Total Cations	----	0.01	meq/L	<b>107</b>	----	----	----	----	----
∅ Ionic Balance	----	0.01	%	<b>6.37</b>	----	----	----	----	----
<b>EP005: Total Organic Carbon (TOC)</b>									
Total Organic Carbon	----	1	mg/L	<b>9</b>	----	----	----	----	----
<b>EP025FD: Field Dissolved Oxygen</b>									
Dissolved Oxygen	----	0.01	mg/L	<b>4.88</b>	----	----	----	----	----



### ***Inter-Laboratory Testing***

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

(WATER) EA045: Turbidity

(WATER) EP005: Total Organic Carbon (TOC)

(WATER) EG020F: Dissolved Metals by ICP-MS

(WATER) EG020T: Total Metals by ICP-MS

(WATER) EK057G: Nitrite as N by Discrete Analyser

(WATER) EK058G: Nitrate as N by Discrete Analyser

(WATER) EK059G: Nitrite plus Nitrate as N (NO<sub>x</sub>) by Discrete Analyser

(WATER) EA025: Total Suspended Solids dried at 104 ± 2°C

(WATER) EK055G-NH<sub>4</sub>: Ammonium as N by DA

(WATER) EK055G: Ammonia as N by Discrete Analyser

(WATER) EN055: Ionic Balance

(WATER) ED045G: Chloride by Discrete Analyser

(WATER) ED041G: Sulfate (Turbidimetric) as SO<sub>4</sub><sup>2-</sup> by DA

(WATER) EK040P: Fluoride by PC Titrator

(WATER) ED037P: Alkalinity by PC Titrator

(WATER) ED093F: Dissolved Major Cations

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

## QUALITY CONTROL REPORT

<b>Work Order</b>	<b>: EW2105184</b>	<b>Page</b>	: 1 of 6
<b>Client</b>	<b>: SHELLHARBOUR CITY COUNCIL</b>	<b>Laboratory</b>	: Environmental Division NSW South Coast
<b>Contact</b>	: Joel Coulton	<b>Contact</b>	: Aneta Prosaroski
<b>Address</b>	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	<b>Address</b>	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
<b>Telephone</b>	: ----	<b>Telephone</b>	: +61 2 4225 3125
<b>Project</b>	: Dunmore Quarterly Surface Water EPL	<b>Date Samples Received</b>	: 07-Dec-2021
<b>Order number</b>	: 138956	<b>Date Analysis Commenced</b>	: 07-Dec-2021
<b>C-O-C number</b>	: ----	<b>Issue Date</b>	: 14-Dec-2021
<b>Sampler</b>	: Robert DaLio		
<b>Site</b>	: DUNMORE LANDFILL TENDER		
<b>Quote number</b>	: WO/030/19 TENDER SURFACE WATER		
<b>No. of samples received</b>	: 6		
<b>No. of samples analysed</b>	: 6		



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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

### *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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Robert DaLio	Sampler	Laboratory - Wollongong, 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.

Key :  
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot  
 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  
 RPD = Relative Percentage Difference  
 # = Indicates failed QC

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 4071165)</b>									
ES2144719-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	11600	11800	1.1	0% - 20%
ES2144784-010	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	185	200	8.0	0% - 20%
<b>EA025: Total Suspended Solids dried at 104 ± 2 °C (QC Lot: 4071166)</b>									
ES2144719-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	163	182	11.3	0% - 20%
ES2144784-010	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	14	12	9.7	No Limit
<b>EA045: Turbidity (QC Lot: 4061252)</b>									
ES2144343-001	Anonymous	EA045: Turbidity	----	0.1	NTU	2.1	2.1	0.0	0% - 20%
ES2144447-001	Anonymous	EA045: Turbidity	----	0.1	NTU	1.6	1.6	0.0	0% - 50%
<b>ED037P: Alkalinity by PC Titrator (QC Lot: 4062757)</b>									
ES2144574-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	108	111	3.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	108	111	3.0	0% - 20%
EW2105184-002	SWC_2 Point 19	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	174	173	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	174	173	0.0	0% - 20%
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4061073)</b>									
EW2105184-002	SWC_2 Point 19	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	518	522	0.6	0% - 20%
ES2144426-006	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3870	3880	0.3	0% - 20%
<b>ED045G: Chloride by Discrete Analyser (QC Lot: 4061072)</b>									
EW2105184-002	SWC_2 Point 19	ED045G: Chloride	16887-00-6	1	mg/L	3870	3910	1.1	0% - 20%
ES2144426-006	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	44100	44500	0.8	0% - 20%



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>ED093F: Dissolved Major Cations (QC Lot: 4070580)</b>									
ES2144754-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	213	213	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	149	149	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	816	812	0.5	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	3	3	0.0	No Limit
ES2144754-009	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	415	422	1.8	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	180	181	0.6	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	2310	2320	0.1	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	64	65	0.0	0% - 20%
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 4070581)</b>									
ES2145278-001	Anonymous	EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EW2105250-002	Anonymous	EG020A-F: Iron	7439-89-6	0.05	mg/L	0.18	0.19	0.0	No Limit
<b>EG020T: Total Metals by ICP-MS (QC Lot: 4070564)</b>									
ES2145239-001	Anonymous	EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.43	0.45	3.4	No Limit
ES2145311-004	Anonymous	EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.077	0.086	11.9	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.11	<0.11	0.0	No Limit
<b>EG020T: Total Metals by ICP-MS (QC Lot: 4070565)</b>									
EW2105184-006	Duplicate	EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.101	0.103	1.7	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.66	0.66	0.0	0% - 50%
WN2113226-003	Anonymous	EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.996	0.973	2.3	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	46.5	43.0	7.9	0% - 20%
<b>EK040P: Fluoride by PC Titrator (QC Lot: 4062756)</b>									
ES2144444-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	3.2	3.1	4.5	0% - 20%
EW2105184-002	SWC_2 Point 19	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.4	0.4	0.0	No Limit
<b>EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4070852)</b>									
EW2105180-005	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	8.87	9.05	2.0	0% - 20%
EW2105184-004	SWC_Down Point 21	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	1.28	1.30	1.3	0% - 20%
<b>EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4061074)</b>									
EW2105184-002	SWC_2 Point 19	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2144426-006	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.12	0.12	0.0	0% - 50%
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4070851)</b>									
ES2144538-003	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.10	<0.10	0.0	No Limit
EW2105181-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.10	<0.10	0.0	No Limit
<b>EP005: Total Organic Carbon (TOC) (QC Lot: 4067358)</b>									
EW2105180-005	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	26	25	0.0	0% - 20%
EW2105184-005	SWC_DOWN_2 Point 22	EP005: Total Organic Carbon	----	1	mg/L	9	9	0.0	No Limit



## Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
				Result	Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 4071165)</b>								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	96.8	87.0	109
				<10	293 mg/L	107	75.2	126
				<10	2835 mg/L	103	83.0	124
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4071166)</b>								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	94.7	83.0	129
				<5	1000 mg/L	104	82.0	110
				<5	463 mg/L	106	83.0	118
<b>EA045: Turbidity (QCLot: 4061252)</b>								
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	96.2	91.0	105
<b>ED037P: Alkalinity by PC Titrator (QCLot: 4062757)</b>								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	106	81.0	111
				----	50 mg/L	118	80.0	120
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4061073)</b>								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	103	82.0	122
				<1	500 mg/L	102	82.0	122
<b>ED045G: Chloride by Discrete Analyser (QCLot: 4061072)</b>								
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	98.2	80.9	127
				<1	1000 mg/L	107	80.9	127
<b>ED093F: Dissolved Major Cations (QCLot: 4070580)</b>								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	113	80.0	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	99.3	90.0	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	96.7	82.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	97.9	85.0	113
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 4070581)</b>								
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	90.1	82.0	112
<b>EG020T: Total Metals by ICP-MS (QCLot: 4070564)</b>								
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	95.0	85.0	113
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.1	85.0	117
<b>EG020T: Total Metals by ICP-MS (QCLot: 4070565)</b>								
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	93.6	85.0	113
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	96.6	85.0	117
<b>EK040P: Fluoride by PC Titrator (QCLot: 4062756)</b>								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	97.6	82.0	116



Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
						LCS	Low	High
<b>EK055G: Ammonia as N by Discrete Analyser (QCLot: 4070852)</b>								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	96.2	90.0	114
<b>EK057G: Nitrite as N by Discrete Analyser (QCLot: 4061074)</b>								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	104	82.0	114
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4070851)</b>								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.3	91.0	113
<b>EP005: Total Organic Carbon (TOC) (QCLot: 4067358)</b>								
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	100	72.0	120

### Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%)	Acceptable Limits (%)	
					MS	Low	High
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4061073)</b>							
ES2144426-006	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70.0	130
<b>ED045G: Chloride by Discrete Analyser (QCLot: 4061072)</b>							
ES2144426-006	Anonymous	ED045G: Chloride	16887-00-6	50 mg/L	# Not Determined	70.0	130
<b>EG020T: Total Metals by ICP-MS (QCLot: 4070564)</b>							
ES2145239-002	Anonymous	EG020A-T: Manganese	7439-96-5	1 mg/L	98.1	70.0	130
<b>EG020T: Total Metals by ICP-MS (QCLot: 4070565)</b>							
EW2105250-001	Anonymous	EG020A-T: Manganese	7439-96-5	1 mg/L	98.0	70.0	130
<b>EK040P: Fluoride by PC Titrator (QCLot: 4062756)</b>							
ES2144444-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	83.2	70.0	130
<b>EK055G: Ammonia as N by Discrete Analyser (QCLot: 4070852)</b>							
EW2105180-005	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
<b>EK057G: Nitrite as N by Discrete Analyser (QCLot: 4061074)</b>							
ES2144426-006	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	120	70.0	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4070851)</b>							
ES2144538-003	Anonymous	EK059G: Nitrite + Nitrate as N	----	5 mg/L	92.6	70.0	130
<b>EP005: Total Organic Carbon (TOC) (QCLot: 4067358)</b>							

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 Work Order : EW2105184  
 Client : SHELLHARBOUR CITY COUNCIL  
 Project : Dunmore Quarterly Surface Water EPL



Sub-Matrix: **WATER**

				<i>Matrix Spike (MS) Report</i>			
				<i>Spike</i>	<i>SpikeRecovery(%)</i>	<i>Acceptable Limits (%)</i>	
<i>Laboratory sample ID</i>	<i>Sample ID</i>	<i>Method: Compound</i>	<i>CAS Number</i>	<i>Concentration</i>	<i>MS</i>	<i>Low</i>	<i>High</i>
<b>EP005: Total Organic Carbon (TOC) (QCLot: 4067358) - continued</b>							
EW2105180-006	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	103	70.0	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: <b>EW2105184</b>	Page	: 1 of 8
Client	: <b>SHELLHARBOUR CITY COUNCIL</b>	Laboratory	: Environmental Division NSW South Coast
Contact	: Joel Coulton	Telephone	: +61 2 4225 3125
Project	: Dunmore Quarterly Surface Water EPL	Date Samples Received	: 07-Dec-2021
Site	: DUNMORE LANDFILL TENDER	Issue Date	: 14-Dec-2021
Sampler	: Robert DaLio	No. of samples received	: 6
Order number	: 138956	No. of samples analysed	: 6

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

### Summary of Outliers

#### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

#### Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

#### Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**



### Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
<b>Matrix Spike (MS) Recoveries</b>							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES2144426--006	Anonymous	<b>Sulfate as SO4 - Turbidimetric</b>	14808-79-8	Not Determined	----	<b>MS recovery not determined, background level greater than or equal to 4x spike level.</b>
ED045G: Chloride by Discrete Analyser	ES2144426--006	Anonymous	<b>Chloride</b>	16887-00-6	Not Determined	----	<b>MS recovery not determined, background level greater than or equal to 4x spike level.</b>
EK055G: Ammonia as N by Discrete Analyser	EW2105180--005	Anonymous	<b>Ammonia as N</b>	7664-41-7	Not Determined	----	<b>MS recovery not determined, background level greater than or equal to 4x spike level.</b>

### Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Method					
<b>Matrix Spikes (MS)</b>					
Dissolved Metals by ICP-MS - Suite A	0	16	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

### Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for **VOC in soils** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA005FD: Field pH</b>							
<b>Field Test Dummy Bottle (EN67 PK)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	07-Dec-2021	----
<b>EA010FD: Field Conductivity</b>							
<b>Field Test Dummy Bottle (EN67 PK)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	07-Dec-2021	----



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>								
<b>Clear Plastic Bottle - Natural (EA015H)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	13-Dec-2021	14-Dec-2021	✔
<b>EA025: Total Suspended Solids dried at 104 ± 2 °C</b>								
<b>Clear Plastic Bottle - Natural (EA025H)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	13-Dec-2021	14-Dec-2021	✔
<b>EA045: Turbidity</b>								
<b>Clear Plastic Bottle - Natural (EA045)</b> SWP1 - Point 1, SWC_Down - Point 21, Duplicate	SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	07-Dec-2021	----	----	----	07-Dec-2021	09-Dec-2021	✔
<b>EA116: Temperature</b>								
<b>Field Test Dummy Bottle (EN67 PK)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	07-Dec-2021	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
<b>Clear Plastic Bottle - Natural (ED037-P)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	08-Dec-2021	21-Dec-2021	✔
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
<b>Clear Plastic Bottle - Natural (ED041G)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	07-Dec-2021	04-Jan-2022	✔
<b>ED045G: Chloride by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Natural (ED045G)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	07-Dec-2021	04-Jan-2022	✔
<b>ED093F: Dissolved Major Cations</b>								
<b>Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	11-Dec-2021	04-Jan-2022	✔





Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EG020F: Dissolved Metals by ICP-MS</b>								
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	11-Dec-2021	05-Jun-2022	✓
<b>EG020T: Total Metals by ICP-MS</b>								
<b>Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	11-Dec-2021	05-Jun-2022	✓	11-Dec-2021	05-Jun-2022	✓
<b>EK040P: Fluoride by PC Titrator</b>								
<b>Clear Plastic Bottle - Natural (EK040P)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	08-Dec-2021	04-Jan-2022	✓
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Sulfuric Acid (EK055G)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	12-Dec-2021	04-Jan-2022	✓
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Natural (EK057G)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	07-Dec-2021	09-Dec-2021	✓
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Sulfuric Acid (EK059G)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	12-Dec-2021	04-Jan-2022	✓
<b>EP005: Total Organic Carbon (TOC)</b>								
<b>Amber TOC Vial - Sulfuric Acid (EP005)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	10-Dec-2021	04-Jan-2022	✓
<b>EP025FD: Field Dissolved Oxygen</b>								
<b>Field Test Dummy Bottle (EN67 PK)</b> SWP1 - Point 1, SWC_UP - Point 20, SWC_DOWN_2 - Point 22,	SWC_2 - Point 19, SWC_Down - Point 21, Duplicate	07-Dec-2021	----	----	----	07-Dec-2021	----	----



## Quality Control Parameter Frequency Compliance

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

Matrix: **WATER** Evaluation: \* = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	4	32	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Alkalinity by PC Titrator	ED037-P	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by Discrete Analyser	ED041G	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	18	16.67	15.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	3	18	16.67	15.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	32	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER** Evaluation: \* = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Method Blanks (MB) - Continued</b>							
Nitrite as N by Discrete Analyser	EK057G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	32	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	16	0.00	5.00	*	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	32	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard



## Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of 'non-filterable' residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)



<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G. Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ammonium as N	EK055G-NH4	WATER	Ammonium in the sample is reported as the ionised / unionised fractions by the use of a nomograph and the initial pH and Temperature. Ammonia is determined by direct colorimetry by Discrete Analyser according to APHA 4500-NH3 G. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)
Field Tests - Port Kembla	EN67 PK	WATER	Field determinations as per methods described in APHA. The analysis is performed in the field by ALS samplers. ALS NATA accreditation apply for this service.
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM Schedule B(3)
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)



# CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney: 277 Woodpark Rd, Smithfield NSW 2176  
Ph: 02 8794 9595 E: samples.sydney@alsenviro.com

Brisbane: 32 Shand St, Stafford QLD 4063  
Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com

Melbourne: 2-4 Werra Rd, Springvale VIC 3171  
Ph: 03 8549 8800 E: samples.melbourne@alsenviro.com

Perth: 10 Hood Way, Mirreya WA 6020  
Ph: 08 9206 7869 E: samples.perth@alsenviro.com

Newcastle: 5 Rosegum Rd, Waratah NSW 2304  
Ph: 02 4968 3433 E: samples.newcastle@alsenviro.com

Townsville: 14-15 Dasma Ct, Esplanade QLD 4810  
Ph: 07 4708 0900 E: townsville.environmental@alsenviro.com

Adelaide: 111 Burma Rd, Plympton SA 5009  
Ph: 08 8366 0900 E: adelaide@alsenviro.com

Launceston: 27 Wellington St, Launceston TAS 7250  
Ph: 03 6331 2158 E: launceston@alsenviro.com

<b>CLIENT:</b>	Shellharbour City Council	<b>TURNAROUND REQUIREMENTS:</b>	<input type="checkbox"/> Standard TAT (List due date):	<b>FOR LABORATORY USE ONLY (Circle)</b> Custody Seal Intact? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No N/A Free ice / frozen ice blocks present upon receipt? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No N/A Random Sample Temperature on Receipt: <input checked="" type="checkbox"/> C Other comment: 68							
<b>OFFICE:</b>	41 Burrell St WOLLONGONG NSW 2500	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	<input type="checkbox"/> Non Standard or urgent TAT (List due date):								
<b>PROJECT:</b>	Dunmore Quarterly Leachate	<b>ALS QUOTE NO.:</b>	WO/030/19 TENDER								
<b>ORDER NUMBER:</b>		<b>COC SEQUENCE NUMBER (Circle)</b>									
<b>PROJECT MANAGER:</b>	Joel Culton	COC: <table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr></table>		1	2	3	4	5	6	7	
1	2	3	4	5	6	7					
<b>SAMPLER:</b>	Robert Dankis	<b>SAMPLER MOBILE:</b>		<b>RECEIVED BY:</b>							
<b>COC emailed to ALS? (YES / NO)</b>		<b>EDD FORMAT (or default):</b>		ANETS							
<b>Email Reports to:</b>		<b>RELINQUISHED BY:</b>									
<b>Email Invoice to:</b>		RD									
		<b>DATE/TIME:</b>									
		7.12.21 15:40		7.12.21							
<b>COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:</b>		<b>CC reports to:</b>									

LAB ID	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).					Additional Information Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Ammonia	NT-2A (Alka, So4, Cl, F1) Filtered Ca, K	TOC	Total Fe & Mn	NT-4 (NO2, NO3)	
	Leachate Storage Tank - LP1	7.12.21 12:10	W			✓	✓	✓	✓	✓	Field Tests - pH, EC, Temp & DO
					<b>TOTAL</b>	10					

Environmental Division  
Wollongong  
Work Order Reference  
**EW2105182**

Telephone : 02 42253125

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic  
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

## CERTIFICATE OF ANALYSIS

<b>Work Order</b>	: <b>EW2105182</b>	Page	: 1 of 4
<b>Amendment</b>	: <b>1</b>	<b>Laboratory</b>	: Environmental Division NSW South Coast
<b>Client</b>	: <b>SHELLHARBOUR CITY COUNCIL</b>	<b>Contact</b>	: Aneta Prosaroski
<b>Contact</b>	: Joel Coulton	<b>Address</b>	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
<b>Address</b>	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	<b>Telephone</b>	: +61 2 4225 3125
<b>Telephone</b>	: ----	<b>Date Samples Received</b>	: 07-Dec-2021 16:05
<b>Project</b>	: Dunmore Quarterly Leachate Tank EPL	<b>Date Analysis Commenced</b>	: 07-Dec-2021
<b>Order number</b>	: 138956	<b>Issue Date</b>	: 12-Jan-2022 12:58
<b>C-O-C number</b>	: ----	  <p style="font-size: small; margin-top: 5px;">Accreditation No. 825 Accredited for compliance with ISO/IEC 17025 - Testing</p>	
<b>Sampler</b>	: Robert DaLio		
<b>Site</b>	: DUNMORE LANDFILL TENDER		
<b>Quote number</b>	: WO/030/19 TENDER LEACHATE		
<b>No. of samples received</b>	: 1		
<b>No. of samples analysed</b>	: 1		

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Robert DaLio	Sampler	Laboratory - Wollongong, 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.  
~ = Indicates an estimated value.

- **Analytical work for this work order will be conducted at ALS Sydney.**
- EK059G: LOR raised for NOx on sample no:1 due to sample matrix.
- LOR raised due to sample matrix.
- 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.
- Temperature performed by ALS Wollongong via in-house method EA116 and EN67 PK.
- 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.
- Sampling completed by ALS Wollongong in accordance with in-house sampling method EN/67.10 Wastewaters
- 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.





## Analytical Results

Sub-Matrix: WATER  
 (Matrix: WATER)

Sample ID

				Leachate Storage Tank LP1	----	----	----	----
				Sampling date / time	07-Dec-2021 12:10	----	----	----
Compound	CAS Number	LOR	Unit	EW2105182-001	-----	-----	-----	-----
				Result	----	----	----	----
<b>EA005FD: Field pH</b>								
pH	----	0.1	pH Unit	<b>8.4</b>	----	----	----	----
<b>EA010FD: Field Conductivity</b>								
Electrical Conductivity (Non Compensated)	----	1	µS/cm	<b>12400</b>	----	----	----	----
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>								
Total Dissolved Solids @180°C	----	10	mg/L	<b>5220</b>	----	----	----	----
<b>EA116: Temperature</b>								
Temperature	----	0.1	°C	<b>24.9</b>	----	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<b>171</b>	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<b>4180</b>	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<b>4350</b>	----	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	----	----	----	----
<b>ED045G: Chloride by Discrete Analyser</b>								
Chloride	16887-00-6	1	mg/L	<b>1760</b>	----	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	<b>84</b>	----	----	----	----
Potassium	7440-09-7	1	mg/L	<b>332</b>	----	----	----	----
<b>EG020T: Total Metals by ICP-MS</b>								
Manganese	7439-96-5	0.001	mg/L	<b>0.241</b>	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<b>1.24</b>	----	----	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<b>0.2</b>	----	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>1150</b>	----	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	14797-65-0	0.01	mg/L	<0.10	----	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<0.10	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								



## Analytical Results

Sub-Matrix: **WATER**  
 (Matrix: **WATER**)

				Sample ID	Leachate Storage Tank LP1	----	----	----	----
				Sampling date / time	07-Dec-2021 12:10	----	----	----	----
Compound	CAS Number	LOR	Unit		<b>EW2105182-001</b>	-----	-----	-----	-----
				Result		----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued</b>									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.10	----	----	----	----
<b>EP005: Total Organic Carbon (TOC)</b>									
Total Organic Carbon	----	1	mg/L		<b>500</b>	----	----	----	----
<b>EP025FD: Field Dissolved Oxygen</b>									
Dissolved Oxygen	----	0.01	mg/L		<b>3.38</b>	----	----	----	----
Dissolved Oxygen - % Saturation	----	0.1	% saturation		<b>42.1</b>	----	----	----	----

## Inter-Laboratory Testing

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

(WATER) ED093F: Dissolved Major Cations

(WATER) EP005: Total Organic Carbon (TOC)

(WATER) EK055G: Ammonia as N by Discrete Analyser

(WATER) EG020T: Total Metals by ICP-MS

(WATER) EK057G: Nitrite as N by Discrete Analyser

(WATER) EK058G: Nitrate as N by Discrete Analyser

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

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

(WATER) ED045G: Chloride by Discrete Analyser

(WATER) ED037P: Alkalinity by PC Titrator

(WATER) EK040P: Fluoride by PC Titrator

(WATER) ED041G: Sulfate (Turbidimetric) as SO<sub>4</sub><sup>2-</sup> by DA

## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>EW2105182</b>	<b>Page</b>	: 1 of 5
<b>Amendment</b>	: <b>1</b>		
<b>Client</b>	: <b>SHELLHARBOUR CITY COUNCIL</b>	<b>Laboratory</b>	: Environmental Division NSW South Coast
<b>Contact</b>	: Joel Coulton	<b>Contact</b>	: Aneta Prosaroski
<b>Address</b>	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	<b>Address</b>	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
<b>Telephone</b>	: ----	<b>Telephone</b>	: +61 2 4225 3125
<b>Project</b>	: Dunmore Quarterly Leachate Tank EPL	<b>Date Samples Received</b>	: 07-Dec-2021
<b>Order number</b>	: 138956	<b>Date Analysis Commenced</b>	: 07-Dec-2021
<b>C-O-C number</b>	: ----	<b>Issue Date</b>	: 12-Jan-2022
<b>Sampler</b>	: Robert DaLio		
<b>Site</b>	: DUNMORE LANDFILL TENDER		
<b>Quote number</b>	: WO/030/19 TENDER LEACHATE		
<b>No. of samples received</b>	: 1		
<b>No. of samples analysed</b>	: 1		



Accreditation No. 825  
Accredited for compliance with  
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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

### 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Robert DaLio	Sampler	Laboratory - Wollongong, 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.

Key :  
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot  
 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  
 RPD = Relative Percentage Difference  
 # = Indicates failed QC

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 4069066)</b>									
ES2144638-009	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	1540	1520	1.8	0% - 20%
EW2105228-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	209	208	0.0	0% - 20%
<b>ED037P: Alkalinity by PC Titrator (QC Lot: 4063525)</b>									
ES2144718-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	44	43	3.8	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	44	43	3.8	0% - 20%
EW2105180-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	286	323	12.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	286	323	12.0	0% - 20%
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 4063539)</b>									
ES2143451-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EW2105180-004	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	69	68	0.0	0% - 20%
<b>ED045G: Chloride by Discrete Analyser (QC Lot: 4063550)</b>									
EW2105244-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	35	36	0.0	0% - 20%
EW2105180-004	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	57	56	0.0	0% - 20%
<b>ED093F: Dissolved Major Cations (QC Lot: 4071197)</b>									
ES2143451-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	6	5	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EW2105180-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	123	124	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	37	37	0.0	0% - 20%
<b>EG020T: Total Metals by ICP-MS (QC Lot: 4070564)</b>									



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>EG020T: Total Metals by ICP-MS (QC Lot: 4070564) - continued</b>									
ES2145239-001	Anonymous	EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.43	0.45	3.4	No Limit
ES2145311-004	Anonymous	EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.077	0.086	11.9	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.11	<0.11	0.0	No Limit
<b>EK040P: Fluoride by PC Titrator (QC Lot: 4063530)</b>									
EW2105180-007	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.1	<0.1	0.0	No Limit
<b>EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4070852)</b>									
EW2105180-005	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	8.87	9.05	2.0	0% - 20%
EW2105184-004	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	1.28	1.30	1.3	0% - 20%
<b>EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4063548)</b>									
EW2105244-003	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EW2105180-004	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4070851)</b>									
ES2144538-003	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.10	<0.10	0.0	No Limit
EW2105181-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.10	<0.10	0.0	No Limit
<b>EP005: Total Organic Carbon (TOC) (QC Lot: 4067358)</b>									
EW2105180-005	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	26	25	0.0	0% - 20%
EW2105184-005	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	9	9	0.0	No Limit



## Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Acceptable Limits (%)	
						LCS	Low	High	
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 4069066)</b>									
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	101	87.0	109	
				<10	293 mg/L	107	75.2	126	
				<10	2835 mg/L	107	83.0	124	
<b>ED037P: Alkalinity by PC Titrator (QCLot: 4063525)</b>									
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	91.5	81.0	111	
				----	50 mg/L	97.2	80.0	120	
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4063539)</b>									
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	82.0	122	
				<1	500 mg/L	103	82.0	122	
<b>ED045G: Chloride by Discrete Analyser (QCLot: 4063550)</b>									
ED045G: Chloride	16887-00-6	1	mg/L	<1	50 mg/L	94.8	80.9	127	
				<1	1000 mg/L	102	80.9	127	
<b>ED093F: Dissolved Major Cations (QCLot: 4071197)</b>									
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	96.4	80.0	114	
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	91.3	85.0	113	
<b>EG020T: Total Metals by ICP-MS (QCLot: 4070564)</b>									
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	95.0	85.0	113	
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.1	85.0	117	
<b>EK040P: Fluoride by PC Titrator (QCLot: 4063530)</b>									
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	97.0	82.0	116	
<b>EK055G: Ammonia as N by Discrete Analyser (QCLot: 4070852)</b>									
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	96.2	90.0	114	
<b>EK057G: Nitrite as N by Discrete Analyser (QCLot: 4063548)</b>									
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	105	82.0	114	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4070851)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.3	91.0	113	
<b>EP005: Total Organic Carbon (TOC) (QCLot: 4067358)</b>									
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	100	72.0	120	

## Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.



Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 4063539)</b>							
ES2143451-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	108	70.0	130
<b>ED045G: Chloride by Discrete Analyser (QCLot: 4063550)</b>							
EW2105180-004	Anonymous	ED045G: Chloride	16887-00-6	50 mg/L	129	70.0	130
<b>EG020T: Total Metals by ICP-MS (QCLot: 4070564)</b>							
ES2145239-002	Anonymous	EG020A-T: Manganese	7439-96-5	1 mg/L	98.1	70.0	130
<b>EK040P: Fluoride by PC Titrator (QCLot: 4063530)</b>							
EW2105180-008	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	93.4	70.0	130
<b>EK055G: Ammonia as N by Discrete Analyser (QCLot: 4070852)</b>							
EW2105180-005	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
<b>EK057G: Nitrite as N by Discrete Analyser (QCLot: 4063548)</b>							
EW2105180-004	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	122	70.0	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4070851)</b>							
ES2144538-003	Anonymous	EK059G: Nitrite + Nitrate as N	----	5 mg/L	92.6	70.0	130
<b>EP005: Total Organic Carbon (TOC) (QCLot: 4067358)</b>							
EW2105180-006	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	103	70.0	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EW2105182	Page	: 1 of 7
Amendment	: 1		
Client	: SHELLHARBOUR CITY COUNCIL	Laboratory	: Environmental Division NSW South Coast
Contact	: Joel Coulton	Telephone	: +61 2 4225 3125
Project	: Dunmore Quarterly Leachate Tank EPL	Date Samples Received	: 07-Dec-2021
Site	: DUNMORE LANDFILL TENDER	Issue Date	: 12-Jan-2022
Sampler	: Robert DaLio	No. of samples received	: 1
Order number	: 138956	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

### Summary of Outliers

#### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

#### Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

#### Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.





### Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: WATER

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
<b>Matrix Spike (MS) Recoveries</b>							
EK055G: Ammonia as N by Discrete Analyser	EW2105180--005	Anonymous	Ammonia as N	7664-41-7	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

### Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: WATER

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA005FD: Field pH</b>							
Field Test Dummy Bottle (EN67 PK) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	07-Dec-2021	----	----
<b>EA010FD: Field Conductivity</b>							
Field Test Dummy Bottle (EN67 PK) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	07-Dec-2021	----	----
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>							
Clear Plastic Bottle - Natural (EA015H) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	10-Dec-2021	14-Dec-2021	✓
<b>EA116: Temperature</b>							
Field Test Dummy Bottle (EN67 PK) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	07-Dec-2021	----	----
<b>ED037P: Alkalinity by PC Titrator</b>							
Clear Plastic Bottle - Natural (ED037-P) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	08-Dec-2021	21-Dec-2021	✓
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>							
Clear Plastic Bottle - Natural (ED041G) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	08-Dec-2021	04-Jan-2022	✓
<b>ED045G: Chloride by Discrete Analyser</b>							
Clear Plastic Bottle - Natural (ED045G) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	08-Dec-2021	04-Jan-2022	✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>ED093F: Dissolved Major Cations</b>							
Clear Plastic Bottle - Natural (ED093F) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	13-Dec-2021	14-Dec-2021	✓
<b>EG020T: Total Metals by ICP-MS</b>							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) Leachate Storage Tank - LP1	07-Dec-2021	11-Dec-2021	05-Jun-2022	✓	11-Dec-2021	05-Jun-2022	✓
<b>EK040P: Fluoride by PC Titrator</b>							
Clear Plastic Bottle - Natural (EK040P) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	08-Dec-2021	04-Jan-2022	✓
<b>EK055G: Ammonia as N by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK055G) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	12-Dec-2021	04-Jan-2022	✓
<b>EK057G: Nitrite as N by Discrete Analyser</b>							
Clear Plastic Bottle - Natural (EK057G) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	08-Dec-2021	09-Dec-2021	✓
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>							
Clear Plastic Bottle - Sulfuric Acid (EK059G) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	12-Dec-2021	04-Jan-2022	✓
<b>EP005: Total Organic Carbon (TOC)</b>							
Amber TOC Vial - Sulfuric Acid (EP005) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	10-Dec-2021	04-Jan-2022	✓
<b>EP025FD: Field Dissolved Oxygen</b>							
Field Test Dummy Bottle (EN67 PK) Leachate Storage Tank - LP1	07-Dec-2021	----	----	----	07-Dec-2021	----	----



## Quality Control Parameter Frequency Compliance

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

Matrix: **WATER** Evaluation: \* = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
Alkalinity by PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Alkalinity by PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	3	20	15.00	15.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER** Evaluation: \* = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Matrix Spikes (MS) - Continued</b>							
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard



## Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)



<i>Analytical Methods</i>			
	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Field Tests - Port Kembla	EN67 PK	WATER	Field determinations as per methods described in APHA. The analysis is performed in the field by ALS samplers. ALS NATA accreditation apply for this service.
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM Schedule B(3)
<i>Preparation Methods</i>			
	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)

# Appendix C

## Laboratory Chain of Custody (COC) & Certificates of Analysis (COA) – Dust Samples



# CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd. Smithfield NSW 2176  
Ph: 02 8784 8555 E: samples.sydney@alsenviro.com

☐ Brisbane: 32 Strand St. St. Leonards QLD 4052  
Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com

☐ Melbourne: 2-4 Westall Rd. Springvale VIC 3171  
Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com

☐ Perth: 10 Hed Way, Malaga WA 6060  
Ph: 08 9209 7655 E: samples.perth@alsenviro.com

☐ Newcastle: 5 Rosegum Rd. Warabrook NSW 2304  
Ph: 02 4068 9433 E: samples.newcastle@alsenviro.com

☐ Townsville: 14-15 Deema Ct. Bohle QLD 4813  
Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com

☐ Adelaide: 2-1 Burma Rd. Para Hills SA 5095  
Ph: 08 8359 0890 E: adelaide@alsenviro.com

☐ Launceston: 27 Wellington St. Launceston TAS 7250  
Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: Shellharbour City Council	TURNAROUND REQUIREMENTS : <input type="checkbox"/> Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle) Custody Seal intact? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A Free ice / frozen ice blocks present upon receipt? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A Random Sample Temperature on Receipt: 6.8 °C Other comment:
OFFICE: Dunmore	(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):	
PROJECT: Dunmore Dust	ALS QUOTE NO.: WO/030/19 TENDER	
ORDER NUMBER:		
PROJECT MANAGER: Joel Culton		
SAMPLER: Robert DeLis	SAMPLER MOBILE:	
COC emailed to ALS? ( YES / NO)	EDD FORMAT (or default):	
Email Reports to :	RELINQUISHED BY: P. 12.21	RECEIVED BY: Aneta
Email Invoice to :	DATE/TIME: RNL 15:30	DATE/TIME: 7.12.21
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: CC reports to:		

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	
	DDG1	7.12.21 12:55	AIR		10	
	DDG2	12:50	AIR			
	DDG3	9:50	AIR			
	DDG4	10:40	AIR			
					TOTAL	10

Environmental Division  
Wollongong  
Work Order Reference  
**EW2105183**



Telephone : 02 42253125

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic  
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



## CERTIFICATE OF ANALYSIS

**Work Order** : **EW2105183**  
**Client** : **SHELLHARBOUR CITY COUNCIL**  
**Contact** : Joel Coulton  
**Address** : LAMERTON HOUSE, LAMERTON CRESCENT  
 SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529  
  
**Telephone** : ----  
**Project** : Dunmore Landfill Dust  
**Order number** : 138956  
**C-O-C number** : ----  
**Sampler** : Robert DaLio  
**Site** : DUNMORE LANDFILL TENDER  
**Quote number** : WO/030/19 TENDER DUST  
**No. of samples received** : 4  
**No. of samples analysed** : 4

**Page** : 1 of 2  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Aneta Prosaroski  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia  
  
**Telephone** : +61 2 4225 3125  
**Date Samples Received** : 07-Dec-2021 16:01  
**Date Analysis Commenced** : 09-Dec-2021  
**Issue Date** : 16-Dec-2021 15:26



Accreditation No. 825  
 Accredited for compliance with  
 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Jennifer Targett	Quality Coordinator	Newcastle - Inorganics, Mayfield West, 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.  
 ~ = Indicates an estimated value.

- Analytical work for this work order will be conducted at ALS Newcastle.
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m<sup>2</sup>.mth.
- Sampling completed by ALS Wollongong in accordance with in-house sampling method EN/66.1 Sampling and Siting of Dust Deposition Gauges.
- Sample exposure period is 19 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

## Analytical Results

Sub-Matrix: DEPOSITIONAL DUST  
 (Matrix: AIR)

Sample ID

				DDG1 18/11/2021 - 07/12/2021	DDG2 18/11/2021 - 07/12/2021	DDG3 18/11/2021 - 07/12/2021	DDG4 18/11/2021 - 07/12/2021	----
Sampling date / time				07-Dec-2021 12:55	07-Dec-2021 12:50	07-Dec-2021 09:50	07-Dec-2021 10:40	----
Compound	CAS Number	LOR	Unit	EW2105183-001	EW2105183-002	EW2105183-003	EW2105183-004	-----
				Result	Result	Result	Result	----
<b>EA120: Ash Content</b>								
Ash Content	----	0.1	g/m <sup>2</sup> .month	0.6	0.6	1.3	2.1	----
Ash Content (mg)	----	1	mg	7	7	15	23	----
<b>EA125: Combustible Matter</b>								
Combustible Matter	----	0.1	g/m <sup>2</sup> .month	0.5	0.3	0.8	0.8	----
Combustible Matter (mg)	----	1	mg	5	3	9	9	----
<b>EA141: Total Insoluble Matter</b>								
Total Insoluble Matter	----	0.1	g/m <sup>2</sup> .month	1.1	0.9	2.1	2.9	----
Total Insoluble Matter (mg)	----	1	mg	12	10	24	32	----

## Inter-Laboratory Testing

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(AIR) EA125: Combustible Matter

(AIR) EA120: Ash Content

(AIR) EA141: Total Insoluble Matter

## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>EW2105183</b>	Page	: 1 of 3
Client	: <b>SHELLHARBOUR CITY COUNCIL</b>	Laboratory	: Environmental Division NSW South Coast
Contact	: Joel Coulton	Contact	: Aneta Prosaroski
Address	: LAMERTON HOUSE, LAMERTON CRESCENT SHELL HARBOUR CITY CENTRE NSW, AUSTRALIA 2529	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
Telephone	: ----	Telephone	: +61 2 4225 3125
Project	: Dunmore Landfill Dust	Date Samples Received	: 07-Dec-2021
Order number	: 138956	Date Analysis Commenced	: 09-Dec-2021
C-O-C number	: ----	Issue Date	: 16-Dec-2021
Sampler	: Robert DaLio		
Site	: DUNMORE LANDFILL TENDER		
Quote number	: WO/030/19 TENDER DUST		
No. of samples received	: 4		
No. of samples analysed	: 4		



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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

### 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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Jennifer Targett	Quality Coordinator	Newcastle - Inorganics, Mayfield West, 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.

Key :  
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot  
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  
RPD = Relative Percentage Difference  
# = Indicates failed QC

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**



---

### ***Method Blank (MB) and Laboratory Control Sample (LCS) Report***

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

### ***Matrix Spike (MS) Report***

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**
-

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: <b>EW2105183</b>	Page	: 1 of 4
Client	: <b>SHELLHARBOUR CITY COUNCIL</b>	Laboratory	: Environmental Division NSW South Coast
Contact	: Joel Coulton	Telephone	: +61 2 4225 3125
Project	: Dunmore Landfill Dust	Date Samples Received	: 07-Dec-2021
Site	: DUNMORE LANDFILL TENDER	Issue Date	: 16-Dec-2021
Sampler	: Robert DaLio	No. of samples received	: 4
Order number	: 138956	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

### Summary of Outliers

#### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

#### Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

#### Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**



## Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: AIR

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EA120: Ash Content</b>								
<b>Dust Gauge (Bottle) - Copper Sulfate (EA120)</b> DDG1 - 18/11/2021 - 07/12/2021, DDG3 - 18/11/2021 - 07/12/2021,	DDG2 - 18/11/2021 - 07/12/2021, DDG4 - 18/11/2021 - 07/12/2021	07-Dec-2021	----	----	----	09-Dec-2021	05-Jun-2022	✓
<b>EA125: Combustible Matter</b>								
<b>Dust Gauge (Bottle) - Copper Sulfate (EA125)</b> DDG1 - 18/11/2021 - 07/12/2021, DDG3 - 18/11/2021 - 07/12/2021,	DDG2 - 18/11/2021 - 07/12/2021, DDG4 - 18/11/2021 - 07/12/2021	07-Dec-2021	----	----	----	09-Dec-2021	05-Jun-2022	✓
<b>EA141: Total Insoluble Matter</b>								
<b>Dust Gauge (Bottle) - Copper Sulfate (EA141)</b> DDG1 - 18/11/2021 - 07/12/2021, DDG3 - 18/11/2021 - 07/12/2021,	DDG2 - 18/11/2021 - 07/12/2021, DDG4 - 18/11/2021 - 07/12/2021	07-Dec-2021	----	----	----	09-Dec-2021	05-Jun-2022	✓



## ***Quality Control Parameter Frequency Compliance***

- **No Quality Control data available for this section.**
-





## Brief Method Summaries

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

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Ash Content (AC)	EA120	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Ash content in deposited dust.
Combustible Matter (CM)	EA125	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Combustible Matter in deposited dust.
Total Insoluble Matter (TIM)	EA141	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Total Insoluble solids in deposited dust.

# Appendix D

## Surface Gas (Methane) Field Sheets



# CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd. Smithfield NSW 2178  
Ph: 02 8794 8595 E: samples.sydney@alsenviro.com

☐ Brisbane: 32 Shand St. Stafford QLD 4053  
Ph: 07 3849 7212 E: samples.brisbane@alsenviro.com

☐ Melbourne: 2-4 Waddell Rd. Springvale VIC 3171  
Ph: 03 4949 0630 E: samples.melbourne@alsenviro.com

☐ Perth: 10 Hod Way. Molega WA 6200  
Ph: 08 9209 7655 E: samples.perth@alsenviro.com

☐ Newcastle: 5 Roseglen Rd. Warabook NSW 2334  
Ph: 02 4906 3433 E: samples.newcastle@alsenviro.com

☐ Townsville: 14-15 Desma Ct. Bohle QLD 4815  
Ph: 07 4706 0830 E: townsville.environmental@alsenviro.com


☐ Adelaide: 2-4 Burma Rd. Poonah SA 5096  
Ph: 08 7359 0900 E: see arag@alsenviro.com

☐ Launceston: 37 Wellington St. Launceston TAS 7250  
Ph: 03 6331 2155 E: launceston@alsenviro.com

<b>CLIENT:</b>	Shellharbour City Council	<b>TURNAROUND REQUIREMENTS :</b> (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	<input type="checkbox"/> Standard TAT (List due date):							<b>FOR LABORATORY USE ONLY (Circle)</b> Custody Seal Intact? Yes No Freeze / frozen ice bricks present upon receipt? Yes No Random Sample Temperature on Receipt: C Other comment:
<b>OFFICE:</b>	41 Burelli St WOLLONGONG NSW 2500		<input type="checkbox"/> Non Standard or urgent TAT (List due date):							
<b>PROJECT:</b>	Dunmore Quarterly Methane Testing	<b>ALS QUOTE NO.:</b>	WO/030/19 TENDER				<b>COC SEQUENCE NUMBER (Circle)</b>			
<b>ORDER NUMBER:</b>										
<b>PROJECT MANAGER:</b>	Joel Culton									
<b>SAMPLER:</b>		<b>SAMPLER MOBILE:</b>		<b>RELINQUISHED BY:</b>	<b>RECEIVED BY:</b>			<b>RELINQUISHED BY:</b>	<b>RECEIVED BY:</b>	
<b>COC emailed to ALS? ( YES / NO)</b>		<b>EDD FORMAT (or default):</b>		Robert	Aneta					
<b>Email Reports to :</b>				DATE/TIME:	DATE/TIME:			DATE/TIME:	DATE/TIME:	
<b>Email Invoice to :</b>				22/12/21	22/12/21					

ALC USE ONLY		SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Surface Methane Testing								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	Methane	17/12/21	W			✓	✓							
					<b>TOTAL</b>	10								

Environmental Division  
Wollongong  
Work Order Reference  
**EW2105532**



Telephone : 02 42253125

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Landfill Emissions Report



Client: Shellharbour City Council  
 Site: Dunmore

Date: 17/12/2021  
 Sampler(s) Robert DaLio, Megan Gould

Transact / Location	Point	GPS North	GPS East	CH4 Conc (ppm)	Comments
A					No Vehicle Access, Very Overgrown (Snake Haszrd and uneven footing)
B	1	6168 021	302 330	0.4	
B	2	6168 052	302 334	3.1	Methane Cage
B	3	6168 077	302 334	0.6	
B	4	6168 102	302 332	0.8	
B	5-8				No Vehicle Access, Very Overgrown (Snake Haszrd and uneven footing)
C	1	6168 244	302 275	0.8	
C	2	6168 133	302 303	0.8	
C	3	6168 076	302 313	4.0	
C	4	6167 980	302 319	0.8	
C	5	6167 905	302 306	0.5	
C	6	6168 857	302 299	0.6	
C	7	6168 840	302 294	0.4	
D	1	6167 944	302 282	1.8	
D	2	6167 955	302 283	1.9	
D	3	6168 977	302 277	1.2	
D	4-9				No Vehicle Access, Very Overgrown (Snake Haszrd and uneven footing)
E	1	6168 023	302 230	1.4	
E	2	6168 032	302 227	1.6	
E	3	6168 050	302 223	1.8	
E	4	6167 994	302 244	1.6	
E	5	6167 948	302 266	1.4	
F	1	6167 939	302 248	1.0	
F	2	6167 962	302 237	0.8	
F	3	6167 986	302 227	1.3	

F	4	6168 013	302 214	0.8	
F	5				No Vehicle Access, Very Overgrown (Snake Haszrd and uneven footing)
F	6				No Vehicle Access, Very Overgrown (Snake Haszrd and uneven footing)
G	1	6168 218	302 180	1.1	
G	2	6168 233	302 193	1.0	
G	3	6168 241	302 207	1.0	
G	4	6168 268	302 247	1.0	
H	1	6168 189	302 450	1.1	
H	2	6168 146	302 443	1.3	
H	3	6168 046	302 447	1.8	
H	4	6168 016	302 468	1.7	
H	5	6167 964	302 494	1.4	
H	6	6167 917	302 513	1.3	
H	7	6168 885	301 508	1.7	
H	8	6167 892	301 475	1.9	
H	9	6167 928	302 450	2.1	
H	10	6167 741	302 386	1.7	
H	11	6168 800	302 391	2.0	
H	12	6167 857	302 398	1.6	
H	13	6167 921	302 407	1.1	
H	14	6167 972	302 413	0.7	
H	15	6167 037	302 419	0.7	
H	16	6167 093	302 425	0.7	
H	17	6167 172	302 434	0.6	
H	18	6167 271	302 370	0.6	
H	19	6167 286	302 221	0.7	
H	20	6167 227	302 144	0.9	
H	21	6167 158	302 072	1.0	
H	22	6167 101	302 017	1.3	
H	23	6167 006	301 971	0.7	
H	24	6167 895	302 968	0.8	
H	25	6167 844	302 996	1.8	
H	26	6168 801	301 42	5.1	
H	27	6168 773	302 067	1.8	
H	28	6168 969	302 145	1.8	

H	29	6168 679	301 204	1.9
H	30	6167 682	302 261	1.6
H	31	6167 697	302 328	1.8
H	32	6167 712	302 378	1.9
I	1	6167 932	301 154	1.4
I	2	6167 933	302 104	1.6
I	3	6167 939	302 049	1.5
I	4	6167 952	301 995	1.4
J	1	6168 147	302 100	1.6
J	2	6168 084	302 124	1.5
J	3	6168 008	302 153	1.5
J	4	6167 970	302 164	1.5
J	5	6167 938	302 166	1.5
K	1	6168 333	302 287	0.4
K	2	6168 350	302 337	0.4
K	3	6168 390	302 343	0.6
K	4	6168 396	302 301	0.4
K	5	6168 364	302 276	0.5
L	1	6168 568	302 232	0.6
L	2	6168 563	302 203	0.7
L	3	6168 437	302 175	0.8
L	4	6168 377	302 125	0.6
L	5	6168 340	302 068	0.9
L	6	6168 301	302 034	0.9
Compressor Shed	1			2.1
Office	1			2.8
Community Recycling Centre	1			2.1
OLD Weighbridge	1			0.5
OLD Weighbridge Toilet	1			3.4
Revolve Shop	1			1.8

Building Truckwash	1		0.6	
New Weighbridge	1		2.1	
Methane Blank (Pre testing )			1.0	Taken at entrance to Dunmore site before main gate
Methane Blank (Post testing )			0.9	Taken at entrance to Dunmore site before main gate
Comments: Sampling performed in accordance to EPA Environmental Guidelines Solid Waste Landfills, Second Edition, 2016 Gas concentrations are reported as raw values without correction for background concentration.				

# Appendix E

## Laboratory Chain of Custody (COC) & Certificates of Analysis (COA) – Overflow Event



# Appendix F

## Calibration Certificates

Date: 21.6.21

Attn: MeeLan Liew  
Air-Met Scientific Pty. Ltd.  
7-11 Ceylon Street  
Nunawading  
Vic. 3131

O/N 728865

### Calibration Verification Certificate # 5193

Manufacture/Model : Gazomat Inspectra Laser CH4 analyser  
S/N : 5070713  
Gases Monitored : CH4, 0-100%

		Specification +/-10%
Gas used N2 BOC High Purity reads	: 0.0ppm	
Gas used CAC 10ppm CH4 in Air reads	: 10.7ppm	(9-11ppm) Conforms
Gas used CAC 500ppm CH4 in Air reads	: 540ppm	(450-550ppm) Conforms
Gas used CAC 2500ppm CH4 in Air reads	: 2548ppm	(2250-2750ppm) Conforms
Gas used CAC 1.0% CH4 in Air reads	: 10433ppm (1.0%)	(0.9-1.1%) Conforms
Gas used CAC 2.5% CH4 in Air reads	: 2.6%	(2.25-2.75%) Conforms
Gas used Linde 99.9% CH4 reads	: 105.8%	(90-110%) Conforms

Comments : Calibration OK

Next Service/calibration Due : 21.6.22

Stephen Hurst  
ANRI Instruments & Controls Pty Ltd



# **Appendix G**

## **Gas Flare reports**



## PROJECT PROFILE

### DUNMORE, NSW

We are **people engineering** a clean energy, zero carbon future, achieving our mission of **expediting the transformation to renewables by delivering clean energy and lower carbon solutions, reliability, effectively, commercially** for our customers.

To achieve our vision and mission we put people first and this makes us different from all the rest.



#### BIOGAS CAPTURED

20.4 million m<sup>3</sup>



#### CARBON ABATEMENT

194 thousand tonnes  
(T CO<sub>2</sub>e abated in total)



#### SEEDLINGS PLANTED

3.2 million seedlings planted  
for 10 years.



#### CARS OFF THE ROAD

6,800 (for the last 12 months of  
carbon abatement)

### BIOGAS CAPTURE AND ABATEMENT FROM LANDFILL PROJECT

- Long-term contract with Shellharbour City Council to recover and beneficially reuse biogas.
- LGI 1000 ERF compliant biogas flare and gas extraction infrastructure installed in 2015.
- Council benefits from a bespoke biogas management system at minimal cost.
- LGI collaborates closely with the Council regarding the design, installation and expansion of the biogas collection and management system.
- LGI supplies operation & maintenance, monitoring and reporting of the biogas collection and management systems to provide the best environmental outcome for Council from the landfill at their Dunmore Waste Management Facility.



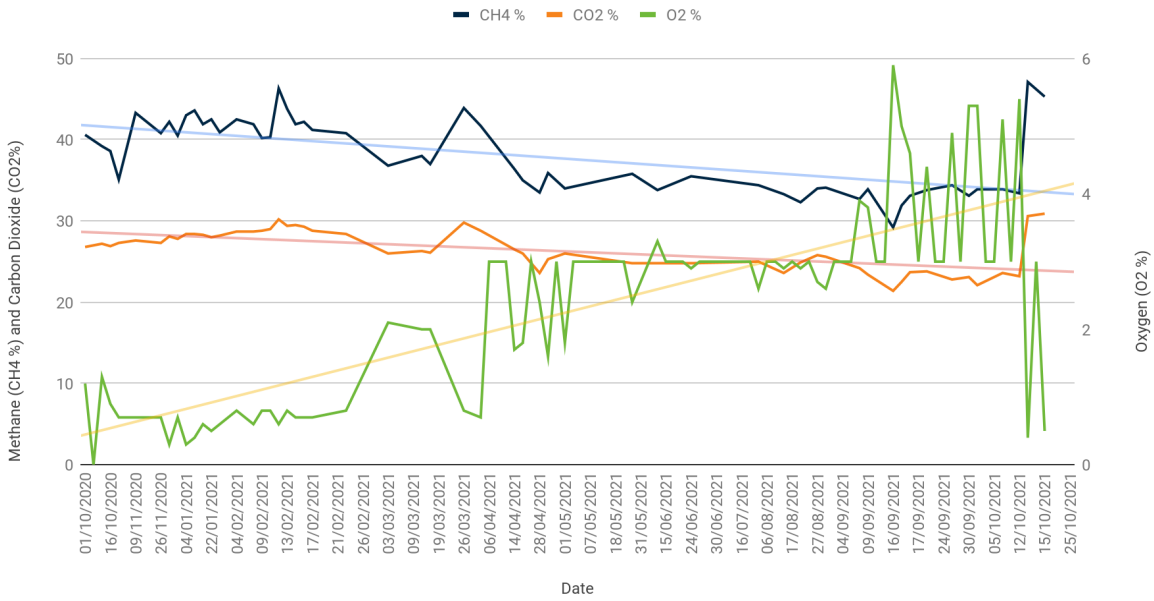
<b>Site:</b>	Dunmore	<b>Report issue date:</b>	07/11/2021
<b>Report month:</b>	October 2021	<b>Prepared by:</b>	Patrick Bloomer and Grace Tap
<b>Prepared for:</b>	Shellharbour City Council	<b>Checked by:</b>	Jarryd Doran

<b>Comments on changes to existing system:</b>	<p><b>January 2016</b> - LGI disconnected the 4 lateral wells and 8 vertical wells.</p> <p><b>April 2016</b> - LGI reconnected 8 vertical wells in the SE corner and 4 lateral wells.</p> <p><b>June 2016</b> - LGI disconnected the extended gas capture system to assist council.</p> <p><b>September 2016</b> - LGI disconnected the extended gas capture system to assist council.</p> <p><b>November 2016</b> - LGI commissioned the connection to leachate sump 6 as of 23-11-2016.</p> <p><b>May 2017</b> - LGI installed an additional 10 vertical wells to the existing LFG system</p> <p><b>November 2019</b> - LGI on site to move mainline up batter and reconnected infrastructure that had been previously disconnected. Including 4 wells on the dimple and 160mm leachate riser.</p> <p><b>April 2020</b> - LGI installed flowline to sump 6 after earlier disconnection.</p> <p><b>February 2021</b> - LGI installed 13 new vertical wells, including a new submain</p>
<b>Comments on operation / maintenance:</b>	Blower speed was increased this month to facilitate a more efficient tune, bringing more suction toward the rear of the field. Jtrap 10 had approximately 1000L pumped out and subsequently returned to operation.
<b>Recommendations:</b>	LGI and Council are scheduled to meet through the month of November to discuss capping, leachate management, and options to expand the biogas recovery system.

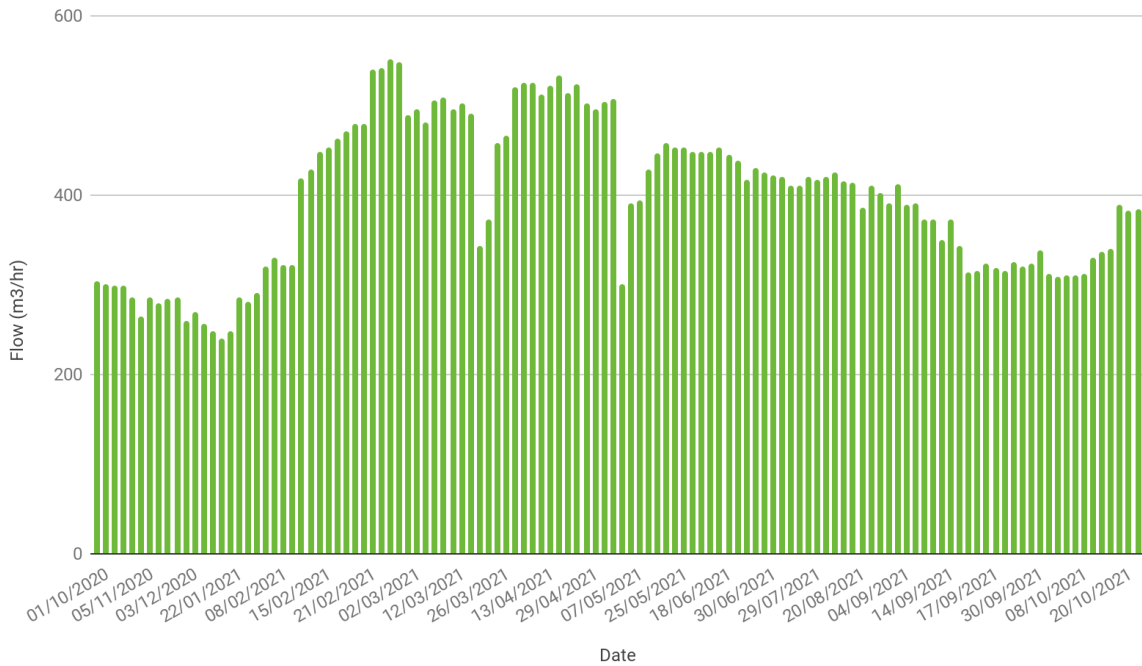
**Flare Operational Data:**

Date	CH4 %	CO2 %	O2 %	STACK TEMP C	CUMULATIVE FLOW m3	FLOW m3/h
07/10/2021	33.9	23.6	5.1	599	20,185,179	310
14/10/2021	47.1	30.6	0.4	611	20,238,578	329
20/10/2021	-	-	-	617	20,291,745	389
25/10/2021	-	-	-	599	20,336,557	383
<b>Average</b>	<b>40.5</b>	<b>27.1</b>	<b>2.75</b>	<b>607</b>	-	<b>352.75</b>

### Dunmore- Methane, Carbon Dioxide & Oxygen

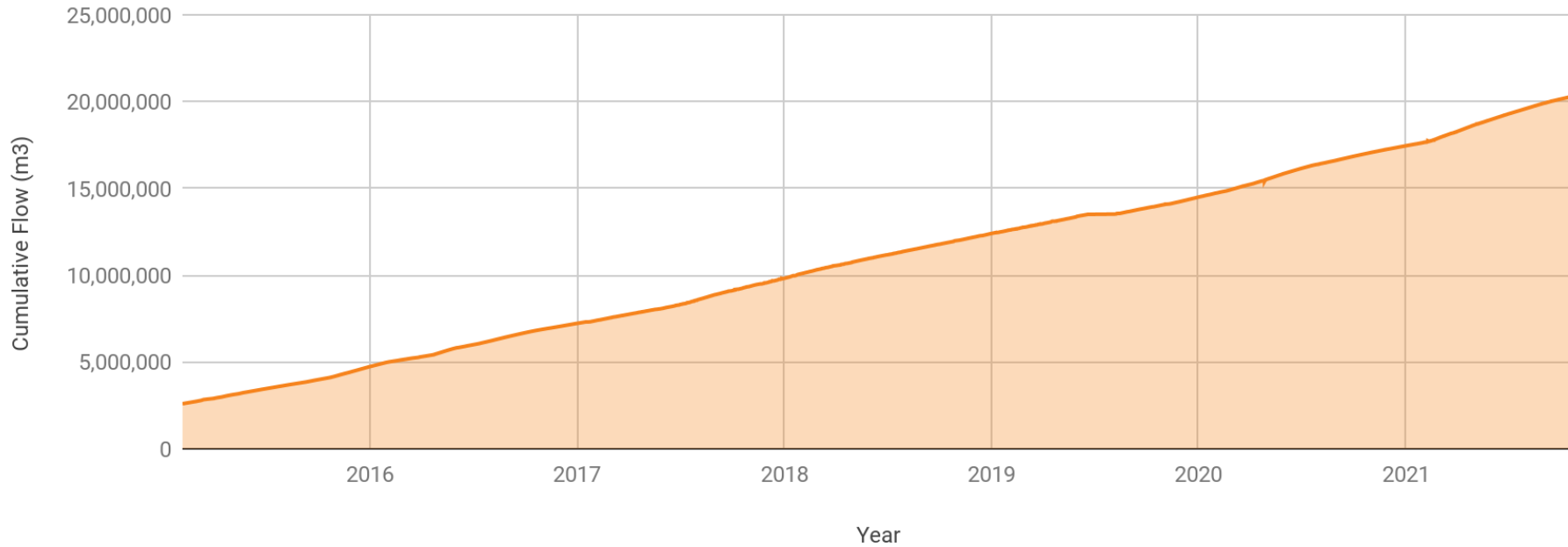


### Dunmore - Flow Rate





**Dunmore - Cumulative Flow**



- 20,390,391 of flared landfill gas up to 1 November 2021, which represents;
  - 193,660 tonnes of CO2 equivalent (total methane abated by gas capture system to date).
  - 3,227,663 seedlings planted for 10 years
  - 6,812 (cars off the road for the last 12 months)
- Biogas captured is the cumulative flow reading at the last day of the month.



**Please note:**

This report has been prepared by LGI Limited (LGI) with all reasonable skill, care and diligence, and taking account of the human power and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from LGI. LGI disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Where LGI has been accorded gas rights under the terms and conditions of the agreement with the client, the data contained in this report represents confidential commercial information and should not be copied or disseminated in any form to a third party without prior consent from LGI.



## PROJECT PROFILE

### DUNMORE, NSW

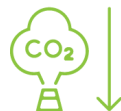
We are **people engineering a clean energy, zero carbon future**, achieving our mission of **expediting the transformation to renewables by delivering clean energy and lower carbon solutions, reliability, effectively, commercially for our customers.**

To achieve our vision and mission we put people first and this makes us different from all the rest.



#### BIOGAS CAPTURED

20.7 million m<sup>3</sup>



#### CARBON ABATEMENT

196 thousand tonnes  
(T CO<sub>2</sub>e abated in total)



#### SEEDLINGS PLANTED

3.3 million seedlings planted  
for 10 years.



#### CARS OFF THE ROAD

7,000 (for the last 12 months of  
carbon abatement)

### BIOGAS CAPTURE AND ABATEMENT FROM LANDFILL PROJECT

- Long-term contract with Shellharbour City Council to recover and beneficially reuse biogas.
- LGI 1000 ERF compliant biogas flare and gas extraction infrastructure installed in 2015.
- Council benefits from a bespoke biogas management system at minimal cost.
- LGI collaborates closely with the Council regarding the design, installation and expansion of the biogas collection and management system.
- LGI supplies operations & maintenance, monitoring and reporting of the biogas collection and management systems to provide the best environmental outcome for Council from the landfill at their Dunmore Waste Management Facility.

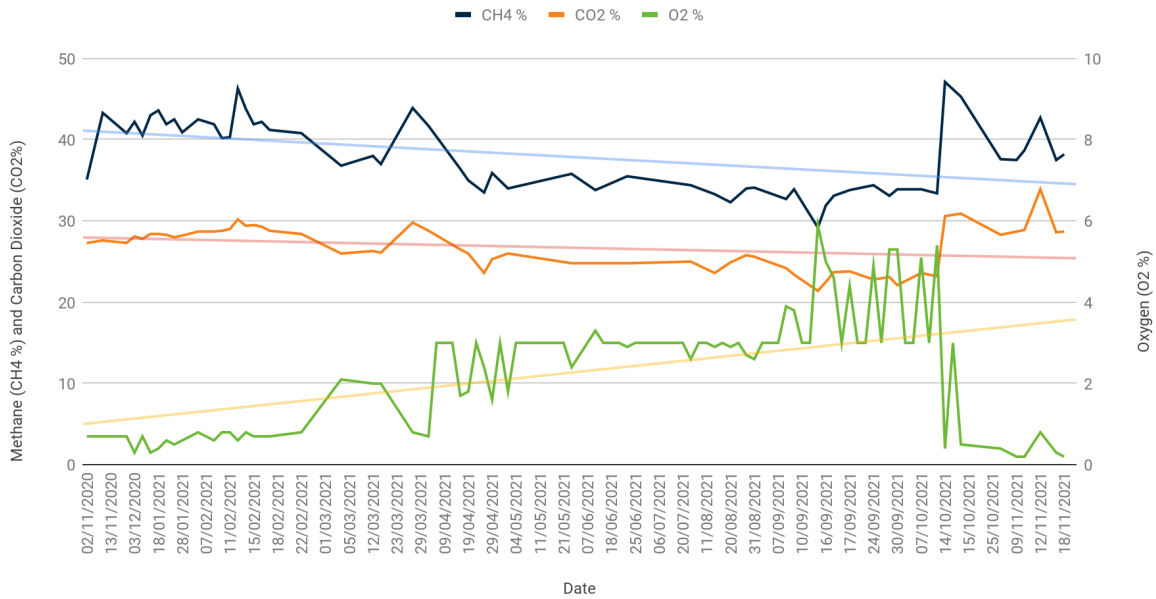
<b>Site:</b>	Dunmore	<b>Report issue date:</b>	10/12/2021
<b>Report month:</b>	November 2021	<b>Prepared by:</b>	Grace Tap
<b>Prepared for:</b>	Shellharbour City Council	<b>Checked by:</b>	Jessica North

<b>Comments on changes to existing system:</b>	<p><b>January 2016</b> - LGI disconnected the 4 lateral wells and 8 vertical wells.</p> <p><b>April 2016</b> - LGI reconnected 8 vertical wells in the SE corner and 4 lateral wells.</p> <p><b>June 2016</b> - LGI disconnected the extended gas capture system to assist council.</p> <p><b>September 2016</b> - LGI disconnected the extended gas capture system to assist council.</p> <p><b>November 2016</b> - LGI commissioned the connection to leachate sump 6 as of 23-11-2016.</p> <p><b>May 2017</b> - LGI installed an additional 10 vertical wells to the existing LFG system</p> <p><b>November 2019</b> - LGI on site to move mainline up batter and reconnected infrastructure that had been previously disconnected. Including 4 wells on the dimple and 160mm leachate riser.</p> <p><b>April 2020</b> - LGI installed flowline to sump 6 after earlier disconnection.</p> <p><b>February 2021</b> - LGI installed 13 new vertical wells, including a new submain</p>
<b>Comments on operation / maintenance:</b>	<p>Site infrastructure was pumped to remove water to improve suction and clear blocked lines.</p> <p>0hrs of down time seen for this month.</p>
<b>Recommendations:</b>	LGI and Council agree to progress with gas infrastructure improvements. LGI to propose a plan for a pumping trial to remove leachate from flooded wells and infrastructure.

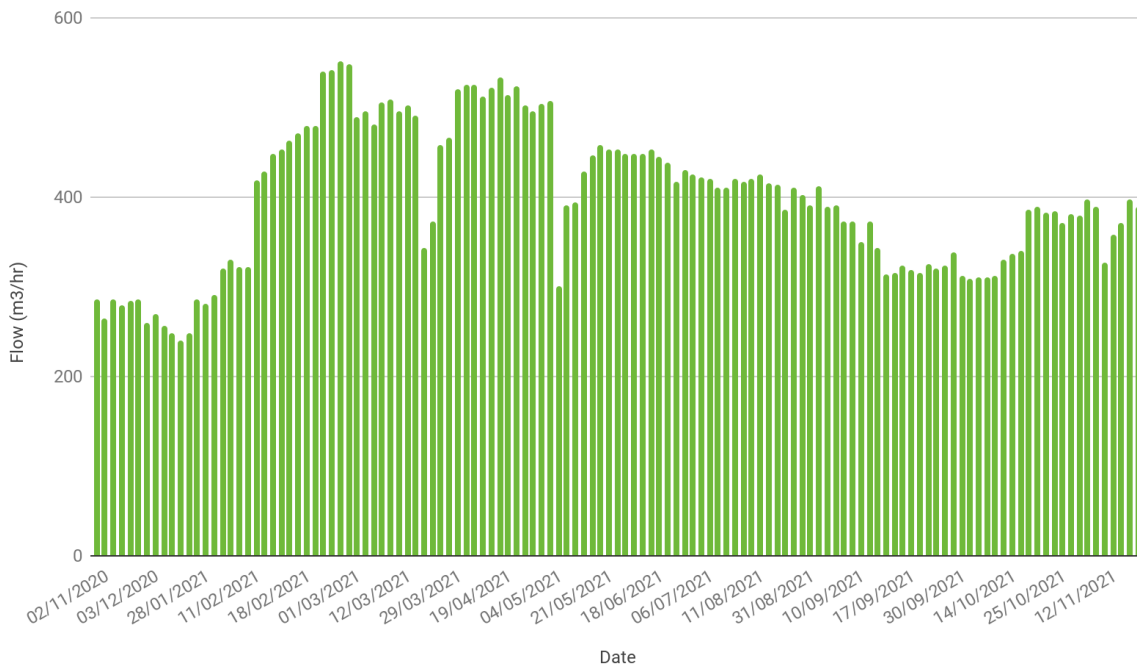
**Flare Operational Data:**

Date	CH4 %	CO2 %	O2 %	STACK TEMP C	CUMULATIVE FLOW m3	FLOW m3/h
09/11/2021	37.5	28.7	0.2	531	20,473,002	379
18/11/2021	37.5	28.6	0.3	566	20,552,503	370
26/11/2021	40	32.4	1.1	495	20,623,710	307
30/11/2021	100	-	3	561	20,656,649	343
<b>Average</b>	<b>53.75</b>	<b>29.9</b>	1.15	<b>538</b>	-	<b>350</b>

### Dunmore- Methane, Carbon Dioxide & Oxygen

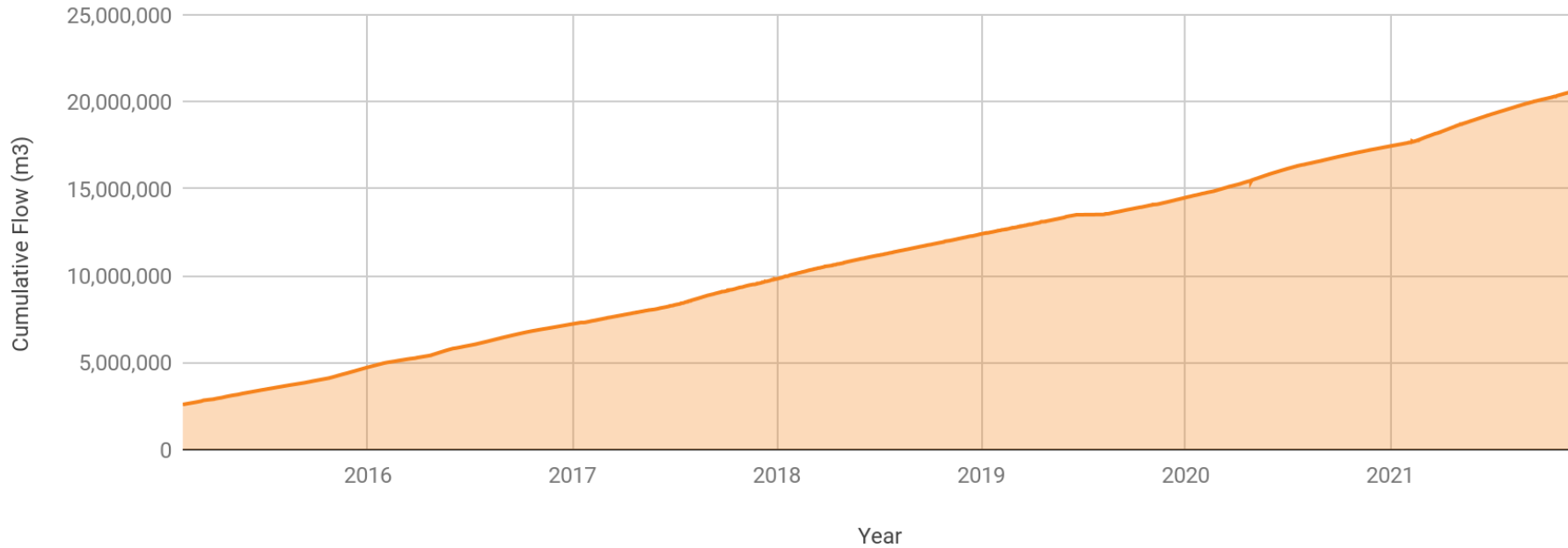


### Dunmore - Flow Rate





**Dunmore - Cumulative Flow**



- 20,661,941 of flared landfill gas up to 1 December 2021, which represents;
  - 196,239 tonnes of CO2 equivalent (total methane abated by gas capture system to date).
  - 3,270,648 seedlings planted for 10 years
  - 6,958 (cars off the road for the last 12 months)
- Biogas captured is the cumulative flow reading at the last day of the month.

**Please note:**

This report has been prepared by LGI Limited (LGI) with all reasonable skill, care and diligence, and taking account of the human power and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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## PROJECT PROFILE

### DUNMORE, NSW

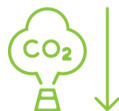
We are **people engineering** a clean energy, zero carbon future, achieving our mission of **expediting the transformation to renewables by delivering clean energy and lower carbon solutions, reliability, effectively, commercially for our customers.**

To achieve our vision and mission we put people first and this makes us different from all the rest.



#### BIOGAS CAPTURED

20.9 million m3



#### CARBON ABATEMENT

199 thousand tonnes  
(T CO2e abated in total)



#### SEEDLINGS PLANTED

3.3 million seedlings planted  
for 10 years.



#### CARS OFF THE ROAD

7,100 (for the last 12 months of  
carbon abatement)

### BIOGAS CAPTURE AND ABATEMENT FROM LANDFILL PROJECT

- Long-term contract with Shellharbour City Council to recover and beneficially reuse biogas.
- LGI 1000 ERF compliant biogas flare and gas extraction infrastructure installed in 2015.
- Council benefits from a bespoke biogas management system at minimal cost.
- LGI collaborates closely with the Council regarding the design, installation and expansion of the biogas collection and management system.
- LGI supplies operations & maintenance, monitoring and reporting of the biogas collection and management systems to provide the best environmental outcome for Council from the landfill at their Dunmore Waste Management Facility.

<b>Site:</b>	Dunmore	<b>Report issue date:</b>	12/01/2022
<b>Report month:</b>	December 2021	<b>Prepared by:</b>	Grace Tap
<b>Prepared for:</b>	Shellharbour City Council	<b>Checked by:</b>	Jarryd Doran

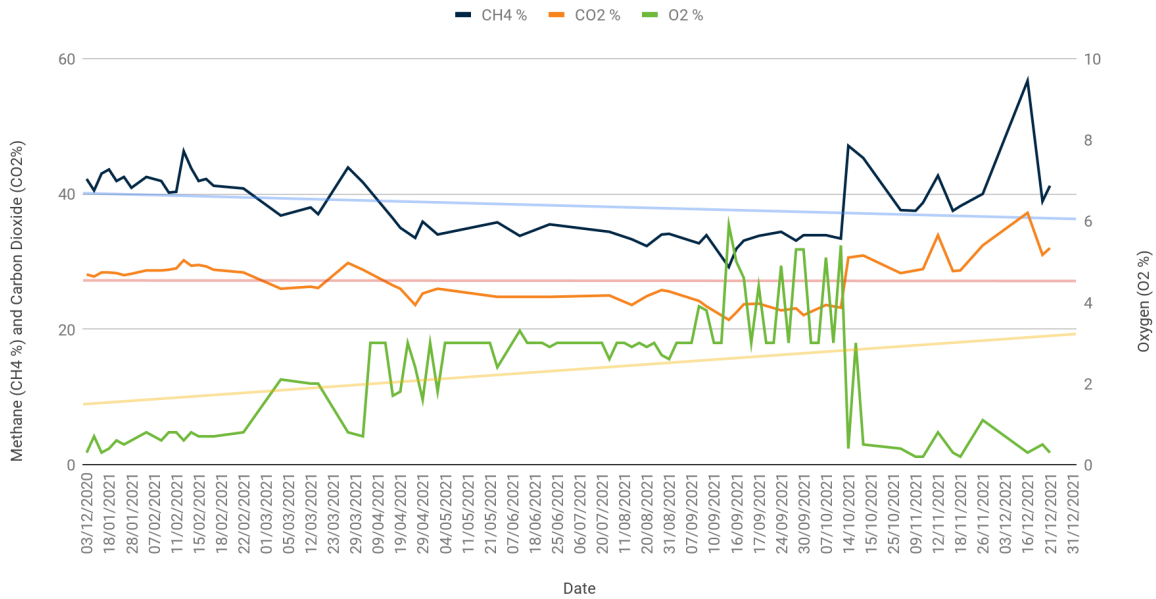
<b>Comments on changes to existing system:</b>	<p><b>January 2016</b> - LGI disconnected the 4 lateral wells and 8 vertical wells.</p> <p><b>April 2016</b> - LGI reconnected 8 vertical wells in the SE corner and 4 lateral wells.</p> <p><b>June 2016</b> - LGI disconnected the extended gas capture system to assist council.</p> <p><b>September 2016</b> - LGI disconnected the extended gas capture system to assist council.</p> <p><b>November 2016</b> - LGI commissioned the connection to leachate sump 6 as of 23-11-2016.</p> <p><b>May 2017</b> - LGI installed an additional 10 vertical wells to the existing LFG system</p> <p><b>November 2019</b> - LGI on site to move mainline up batter and reconnected infrastructure that had been previously disconnected. Including 4 wells on the dimple and 160mm leachate riser.</p> <p><b>April 2020</b> - LGI installed flowline to sump 6 after earlier disconnection.</p> <p><b>February 2021</b> - LGI installed 13 new vertical wells, including a new submain</p>
<b>Comments on operation / maintenance:</b>	<p>Availability - 98.15%</p> <p>Shutdowns: 13hrs 45min</p> <p>- due to an electrical network fault.</p> <p>Field Tuned:</p> <p>- 21/12/2021</p>
<b>Recommendations:</b>	LGI and Council agree to progress with gas infrastructure improvements. LGI to propose a plan for a pumping trial to remove leachate from flooded wells and infrastructure

**Flare Operational Data:**

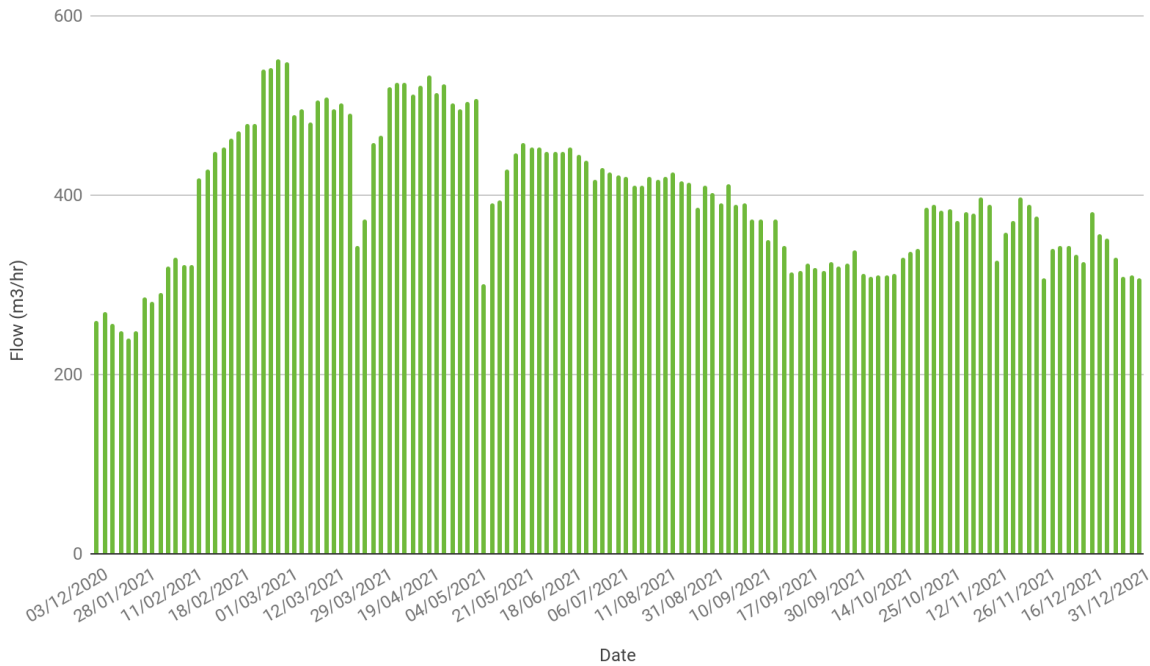
Date	CH4 %	CO2 %	O2 %	STACK TEMP C	CUMULATIVE FLOW m3	FLOW m3/h
07/12/2021	-	-	-	568	20,713,533	333
16/12/2021	56.7	37.2	0.3	960	20,778,390	380
21/12/2021	41.2	32	0.3	681	20,821,583	330
31/12/2021	-	-	-	663	20,895,795	306
<b>Average</b>	<b>48.95</b>	<b>34.6</b>	0.3	<b>718</b>	-	<b>337</b>



### Dunmore- Methane, Carbon Dioxide & Oxygen

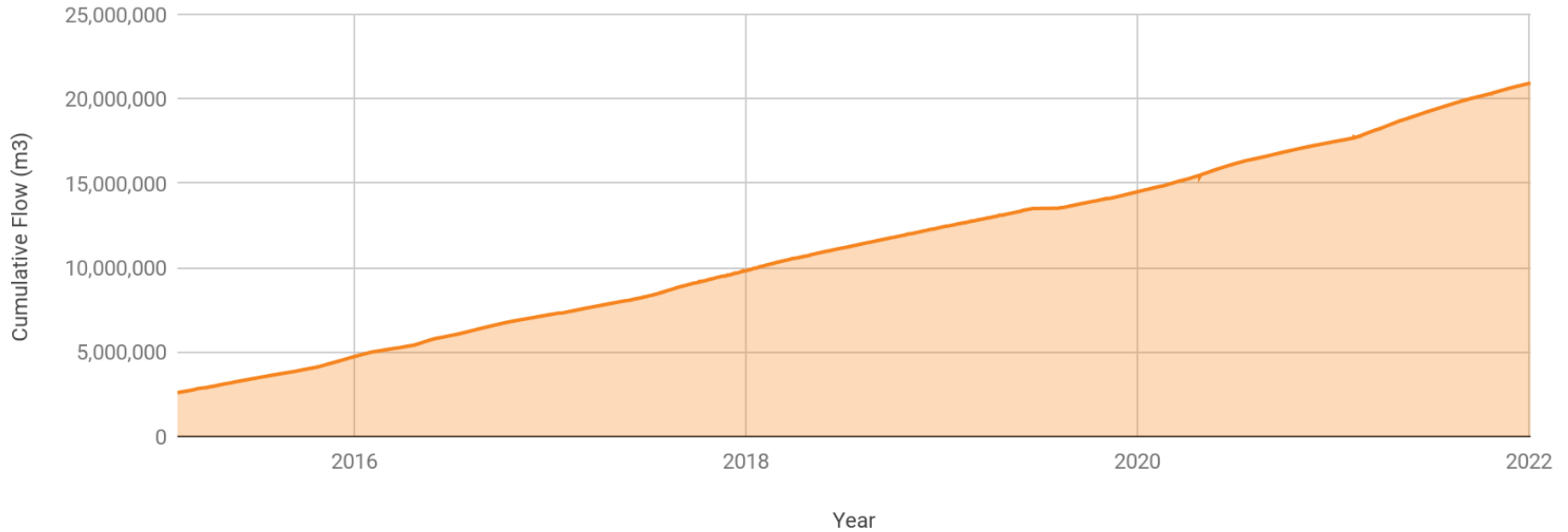


### Dunmore - Flow Rate





**Dunmore - Cumulative Flow**



- 20,900,967 of flared landfill gas up to 1 January 2022, which represents;
  - 198,509 tonnes of CO2 equivalent (total methane abated by gas capture system to date).
  - 3,308,484 seedlings planted for 10 years
  - 7,132 (cars off the road for the last 12 months)
- Biogas captured is the cumulative flow reading at the last day of the month.

**Please note:**

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