BlueSphere
ENVIRONMENTAL

Environmental Investigation into Deans Marsh, Pennyroyal and Matthews Creeks Upstream of the Bambra Fault

Surrounding Environment Investigation Follow Up Works

Prepared for:

Barwon Water

55-67 Ryrie Street
Geelong VIC 3220

18 June 2025

Environmental Investigation into Deans Marsh, Pennyroyal and Matthews Creeks Upstream of the Bambra Fault

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1 Introduction

1.1 Background

In 2022/2023 BlueSphere Environmental Pty Ltd (BlueSphere) was engaged by Barwon Water to conduct two hydrogeological assessments, one covering the Barwon Downs Sub-Basin and the other the Kawarren Sub-Basin. These works were conducted as part of Barwon Water's Surrounding Environment Investigation, which aimed to determine whether the historical management of Barwon Water's groundwater pumping activities resulted in any other unintended environmentally significant adverse impacts within the broader environment, in addition to those already confirmed within Big Swamp and the lower reaches of Boundary Creek (Barwon Water, 2025).

However, due to the paucity of data relating to the degree of groundwater/surface water interaction in areas along Deans Marsh, Matthews and Pennyroyal Creeks where they flow over Lower Tertiary Aquifer (LTA) outcrops up-stream of the Bambra Fault (i.e. where potential impacts could occur if there was connectivity between LTA sediments across the fault), further work was recommended to further establish the likely degree of groundwater/surface water interaction (if any) in these areas and potential for significant adverse impacts on naturally occurring acid sulfate soils in these areas.

The location of these areas is shown in **Figure F1** with a detailed view of each area presented in **Figure F2** - **Figure F5**.

1.2 Defining Acid Sulfate Soils

Acid sulfate soils (ASS) is the term used to describe soils/sediments that are naturally rich in sulfide minerals such as pyrite. They are of interest, as they generally form in saturated or sedimentary environments, and when they are exposed to air by either natural or anthropogenic processes (for example, drought, climate, land use change, drainage enhancement, groundwater/surface water extraction, physical disturbance etc), they can react, releasing acid and altering the soil and/or water chemistry.

Sulfide rich sediments are often deposited during a time of raised sea levels which provide the ideal environment for their formation due to the abundance of sulfate in seawater. They can also form from the weathering and sedimentation from sulfidic parent rocks, such as the upper portions of the Dilwyn Formation (Department of Minerals and Energy, 1984), as is inferred to be the case within the BDIA.

ASS can be classified as either a potential acid sulfate soil (PASS) or actual acid sulfate soil (AASS) depending on whether the soil has undergone oxidation. PASSs are sediments which contain sulfide minerals and have the potential to produce acid with oxidation while AASS are soils which have undergone oxidation and released acidity. PASS and AASS can co-occur where partial oxidation has occurred. For example, when ASS are exposed at the surface and not subject to permanent wetting, the upper soil profile can comprise both PASS and AASS, and the deeper sediments remain PASS. The amount of acid released and the magnitude of potential flow on effects are dependent on the reactivity of the soils/sediments, the soil moisture content and the nature of the disturbance. Further details pertaining to ASS within the Barwon Downs region is further presented in **Section 2.1.1**.

1.3 Purposes and Objectives

The objectives of these follow up works were to evaluate whether there is evidence of ASS oxidation and/or any environmentally significant impacts within the creeks that may be attributable to historical groundwater extraction from the borefield in the Barwon Downs area.

1.4 Scope of Work

The scope of this investigation included:

- Preparation of a Health, Safety and Environmental Management Plan, and arrangement of access to locations along the Pennyroyal, Deans Marsh, and Matthews Creeks;
- Completion of a two-day Site inspection to visit key locations within the focus areas along the three creek alignments and collect surface water samples;

- Completion of a soil sampling event with the collection of soil samples from 12 intrusive locations across the three creek alignments;
- Submission of soil and surface water samples to a National Association of Testing Authority (NATA) accredited laboratory for analysis;
- Analysis of the soil and surface water results to evaluate whether there is evidence of ASS oxidation and/or any environmentally significant impacts within the creeks that may be attributable to historical groundwater extraction from the borefield in the Barwon Downs area; and
- Preparation of this report.

1.5 Reference Guidelines

This investigation was conducted with reference to the Sullivan *et al* (2018a, 2018b) and EPA Victoria Publication 655.1 (2009).

2 Environmental Setting

2.1 Environmental Setting

Topography in the region is undulous with the Otway Ranges to the southeast peaking at approximately 600 m AHD and topography generally sloping towards the northwest. Topography within the investigation area varies between 160 m AHD within valleys and creeks lines and up to 270 m AHD in elevated hill areas.

Surface water features within the investigation area includes Matthews Creek in the southwest, Pennyroyal Creek in the central portion and Deans Marsh Creek in the northeast. All three creeks direct water from the elevated Otway Ranges in the southeast and ultimately discharge into the Barwon River to the northwest (**Figure F1**).

The investigation area apart of this ASS assessment is located along the southeastern boundary of the Barwon Downs Graben along the Bambra Fault (**Figure F1**). The regional surface geology and the Barwon Downs area is presented on **Figure 1** below. A geological cross section, showing the geology in cross section along the alignment denoted by A – A', is presented on **Figure 2** below. The ASS investigation area and expected surface geology is presented on **Figure F2**.

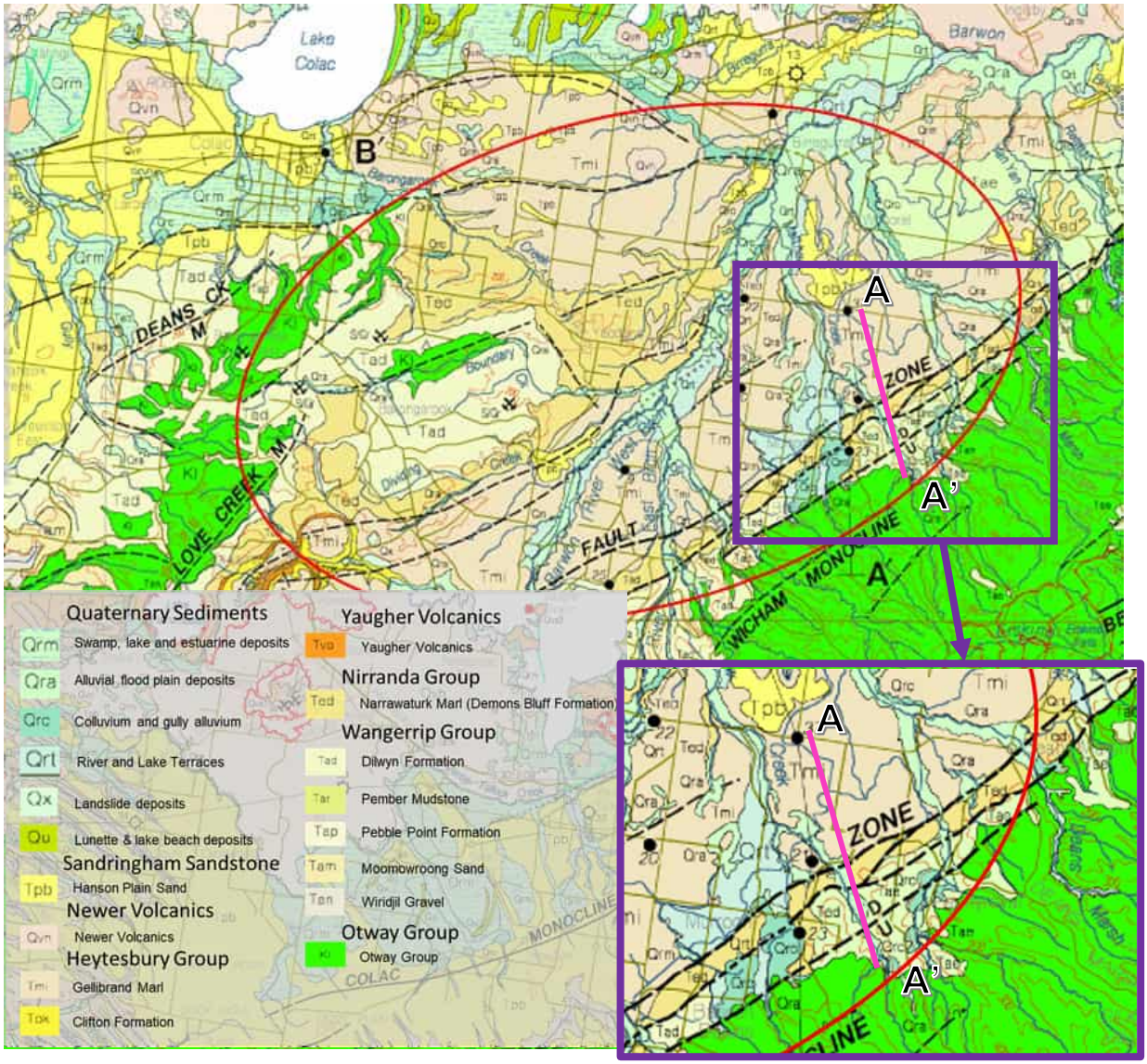

Figure 1 Regional Surface Geology (Colac 1:250,000 Geological Map) (approx. Barwon Downs area shown in red, ASS investigation area shown in purple and cross section A – A' alignment shown in pink)

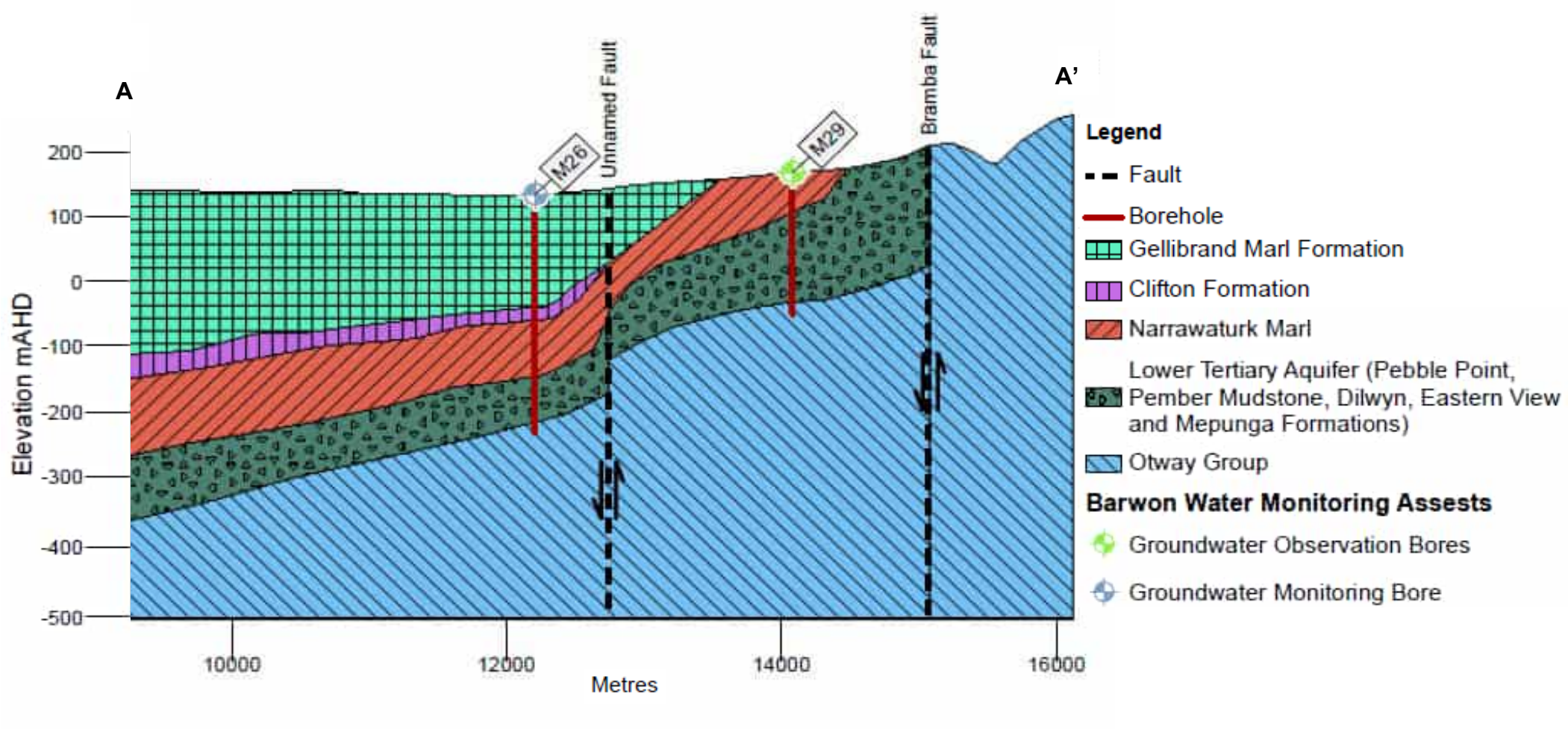

Figure 2 Geological Cross Section A – A' (adapted from BSE, 2025)

Surface geology within the investigation area comprises Quaternary aged alluvial sediments proximal to the creeks (Qra). These Quaternary aged sediments are expected to be underlain by the Dilwyn Formation (Tad) to the southeast of the Bambra Fault, Narrawaturk Marl (Ted) within the fault zone, and the Gellibrand Marl (Tmi) to the northwest of the Bambra Fault (**Figure 1**). To the south of the Bambra Fault are Cretaceous aged sediments of the Otway Group (shown in bright green) (**Figure 1**). The Quaternary sediments overlying Dilwyn Formation are expected to be derived from the adjacent parent rocks.

2.1.1 Potential for Acid Sulfate Soils

As previously identified in **Section 1.2**, ASSs are generally soils/sediments that are derived from sulfidic sediments. Sulfide rich sediments identified within the investigation area include the Tertiary aged Dilwyn Formation. A review of previously completed ASS investigations conducted within the Barwon Downs graben was completed as part of the hydrogeological assessment (BlueSphere, 2025). This review identified a correlation between the presence of ASS and Quaternary sediments within the Barwon Downs Area, more specifically those sediments likely sourced from the weathering of sediments such as those within the Lower Tertiary Aquifer (LTA) geologic group which are then deposited in waterlogged/wetland areas. The Tertiary aged Dilwyn Formation which is likely to outcrop within the investigation area, is a sub unit of the LTA (BSE, 2025).

Quaternary sediments within the investigation area overly the LTA along portions of Matthews Creek and Pennyroyal Creek and within close proximity to the LTA along Deans Marsh Creek (**Figure F2**). Sediments in these areas are likely derived from weathering of Dilwyn Formation outcrop and naturally sulfide rich.

Based on available information, there is a high probability of inland ASS where Quaternary sediments are observed within proximity to areas of Dilwyn Formation outcrop and in waterlogged/swamp like environments (BlueSphere, 2025).

2.2 Historical Setting

Prior to European colonisation, the area would have been vegetated with native forests which was subsequently cleared for farmland during early European settlement circa. 1930s (Mary Sheehan & Assoc., 2003). Townships were progressively developed from the 1860s (Mary Sheehan & Assoc., 2003). Rail was developed within the area in the 1880s which assisted the vegetable and livestock industry (Mary Sheehan & Assoc., 2003).

Vegetable crops were grown in the early 1900s on the Barwon River flats along with hops, which were also grown in the upper reaches of the Barwon River (Mary Sheehan & Assoc., 2003). Timber mills began in the area including Forrest and Barongarook in the early 1900s and continued before being rationalised in the 1980s.

The Barwon Downs area was first investigated as a potential water supply option to augment Geelong's drinking water during periods of drought in the 1960s (Blake, 1974). The borefield was developed in the 1970s and Geelong Waterworks and Sewerage Trust (now Barwon Water) was granted an extraction licence in 1975, however, extraction did not occur until after 1982 (Barwon Water, 2019). Extraction was undertaken periodically until 2016. The borefield was decommissioned in late 2024/early 2025.

3 Site Investigation

The sampling locations along Deans Marsh, Mathews and Pennyroyal Creeks were determined by completing a desktop assessment into areas where the creek alignments flow over outcrops of the LTA up-stream of the Bambra Fault (**Figure F2**).

A Site inspection was completed by BlueSphere and Barwon Water personnel across two days (25 – 26 November 2024). A summary of the locations accessed during this inspection and the observations made, is provided for each creek in the sections below.

3.1 Matthews Creek

Matthews Creek is the most western creek within the investigation area and discharges into the Barwon River further to the north. The investigation extent of Matthews Creek is shown on **Figure F3**. The investigation area is bound by the Otway Ranges to the south and extends up north to where Murroon Road crosses the creek. Land use along this portion of Matthews Creek is predominantly farmland utilised for livestock grazing, and residential properties. It is noted that a culvert managed by Barwon Water is present in the northern portion of the investigation area. This open culvert was observed to traverse from Matthews Creek in a westerly direction towards Murroon Road where it then transitioned to an underground service.

A total of six locations were accessed along Matthews Creek comprising MC_SW04, MC_SW06, MC_SW03, MC_SW02, MC_SW01 and MC_SW05 (listed in order from most upstream to downstream).

Observations made at each investigation location along Matthews Creek at the time of the Site inspection and surface water sampling are summarised below in **Table 1**. Soil observations made during the subsequent soil sampling program are discussed in **Section 6.1.1**. All sampling locations are shown on **Figure F3**.

Table 1 Matthews Creek Sampling Locations

Location ID	Location Description	Sample Analysis
MC_SW04	Most up-stream location with a boundary to the Otway Ranges state forest. Location was accessed from private property at 350 Pennyroyal-Wymbooliel Rd. This property is predominantly managed as a beef farm with large areas of grass land for cattle grazing. Very little water volume was observed in the creek at the time of the inspection. Outcropping geology was observed in the banks of the creek with some areas of exposed Quaternary sediments. The outcropping geology is inferred to be the Dilwyn Formation which is a part of the LTA. It is noted that cattle are likely to frequent this area of the creek with some observed at the time of the initial Site inspection. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - pH Screening - Chromium Suite
MC_SW06	Located down a private driveway at 310 Pennyroyal-Wymbooliel Rd. A formalised wooden bridge has been constructed across the creek with enough clearance as to not impede on creek flow. It is assumed that the property landholders utilise the grassland for livestock grazing. The creek water in this area appeared to be shallow and estimated to be approximately 0.3 m deep. The banks were quite incised with no visible outcropping geology.	**Surface Water:** - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - pH Screening - Chromium Suite

Location ID	Location Description	Sample Analysis
	Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	
MC_SW03	Accessed through Pennyroyal Raspberry Farm. Surrounding land use appeared to be mostly grassland utilised for livestock grazing. A small area up hill to the west of the sampling area was observed to be utilised for raspberry growing. Land to the east of Matthews Creek is noted to be used for cattle grazing with cows accessing the creek. Sampling area is located a small distance upstream from a pooled area where water is extracted by pump from the creek for use at the raspberry farm. Water in this area was observed to be brown to orange in colour and murky and may be indicative of the presence of iron-reducing bacteria, iron floc, or tannins from surrounding vegetation. Some remnants of a deceased cow were observed on the bank at this location. A slight sulfidic to stagnant decomposing odour was observed in the ambient air at this location associated with the deceased cow. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters **Soil:** - No analysis Soil samples were not collected from this location due to difficult access (steep decline), and lack of exposed soils within the creek alignment. A soil sample was collected approximately 150 m downstream (MC_SW02) where there was better access.
MC_SW02	Approximately 150 m downstream of location MC_SW03 and the creek extraction / pump point utilised by the raspberry farm. At the time of the Site inspection, remains of a second dead cow were observed approximately 5 m upstream of the sampling location. These bones appeared to have been disturbed and dislodged prior to the soil sampling event and were not observed at that time. Creek water at this location was approximately 1.0 m deep and was estimated by submerging the surface water sampling pole. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection and sampling activities. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - pH Screening - Chromium Suite
MC_SW01	Located at the junction between Matthews Creek and a culvert managed by Barwon Water. Surrounding land uses comprised grassed grazing areas with some cattle and a small passage of natural vegetation to the southwest. The flow of Matthews Creek is managed by a weir and is partially engineered at this location with concrete banks proximal to the weir and culvert outlet. At the time of the Site inspection, the water level was recorded on a stage to be 0.56 m deep. The water level was also recorded at the time of the soil investigation to be 0.68 m deep. Vegetation in the water and on the immediate banks appeared to be in good health with frogs observed within the water. No signs of die back, odours or sheens on the surface of the water were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters **Soil:** - pH Screening - Chromium Suite

Location ID	Location Description	Sample Analysis
MC_SW05	This was the most downstream sampling location, located at a bridge crossing of Murroon Road. The creek immediately below the bridge is engineered with rocks contained in mesh along the banks and loosely stacked rocks in the bed. Surface water and soil samples were collected to the north of the bridge past the edge of the engineered banks. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - pH Screening - Chromium Suite

Notes: Locations are presented in order of most upstream to most downstream. the measured surface water field parameters comprised: pH, redox, electrical conductivity (EC), temperature and dissolved oxygen (DO). The analysed pH screening comprised: pH_F (field pH); pH_{FOX} (pH of sample after oxidation); reaction intensity during oxidation, and calculation of the change in pH after oxidation (ΔpH).

3.2 Pennyroyal Creek

Pennyroyal Creek is the central creek within the investigation area and discharges into Deans Marsh Creek approximately 500 m to the north of Birregurra-Deans Marsh Road. The investigation extent of Pennyroyal Creek is shown on **Figure F4**. The investigation area is bound by the Otway Ranges to the south and extends up approximately 1 km past the Pennyroyal Station Road crossing. Land use along this reach of the Pennyroyal Creek is predominantly farmland utilised for livestock grazing and residential properties.

A total of six locations were accessed along Pennyroyal Creek comprising PC_SW01, PC_SW02, PC_SW04, PC_SW03, PC_SW05 and PC_SW06 (listed in order from most upstream to downstream). Observations made at each location at the time of the Site inspection and surface water sampling are summarised in **Table 2** below. Soil observations made during the soil sampling program are discussed in **Section 6.2.1**. All sampling locations are shown on **Figure F4**.

Table 2 Pennyroyal Creek Sampling Locations

Location ID	Location Description	Sample Analysis
PC_SW01	The most up-stream location on the edge of the Otway Ranges state forest. This sampling location was accessed from underneath a bridge crossing of Pennyroyal Valley Road. The banks proximal to this location were observed to be very steep with lots of vegetation. A moderate amount of water was present in the creek at the time of the investigation with approximately 20 cm of water observed. The banks were observed to be made of soil with no consolidated rock outcropping. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - pH Screening - Chromium Suite
PC_SW02	Located approximately 300 m downstream from PC_SW01 just out of the Otway Ranges. The area was accessed by passing through the front paddock of 540 Pennyroyal Valley Rd. At the time of the inspection, approximately 20 cm of water was present in the creek. No outcropping rock was observed at the sampling location with the banks being comprised of soils.	**Surface Water:** - Field parameters **Soil:** - pH Screening - Chromium Suite

Location ID	Location Description	Sample Analysis
	Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	
PC_SW04	The observed location was accessed by a creek crossing located near 490 Pennyroyal Valley Rd, where the creek enters the back of the property located at 51-55 Pennyroyal School Rd. It was noted at the time of the inspection that this area was immediately downstream of a site previously included in a Barwon Water sponsored PhD project. The creek is intercepted by a private access road with a trafficable stream crossing. The creek crossing comprises an asphalt surface which appeared to be in very poor condition. The road surface leading into and out of the creek was observed to comprise of gravel. During both the inspection and sampling program, creek water was observed to extend out laterally away from the inferred natural creek alignment, resulting in a large area of pooled water. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. A large amount of broken tree limbs were observed on the ground creating a sort of bank. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters **Soil:** - pH Screening - Chromium Suite
PC_SW03	Located slightly downstream of PC_SW04 and located on private property (51-55 Pennyroyal School Rd). This sampling location is down slope of paddocks located at the property which are used for grazing of farm animals. The creek at this location appeared to be heavily impacted by willow trees and was very densely vegetated. A large area of dead trees was observed further downstream. At the time of the inspection, the landholder informed Barwon Water and BlueSphere that they had previously applied herbicide as a way to manage both invasive trees and weeds along the creek. On the western side of the creek (51-55 Pennyroyal School Rd property side) there had been substantial areas of vegetation clearing while the opposite side (eastern bank) was still heavily vegetated by invasive species. Very few areas of water could be seen in the creek through the vegetation. No odours were observed at the time of the inspection and surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - No analysis
PC_SW05	Located at the road crossing of Pennyroyal Station Road near the junction with Pennyroyal Valley Road. The sampling location was immediately upstream of the bridge crossing. The creek was observed to be wider than at most other locations. The water was observed to be darker in colour than in other areas of the creek and an approximate depth was unable to be obtained. The water appeared to be relatively stagnant with a substantial amount of insect activity. Additionally, there was a mild stagnant / organic odour observed in the ambient air at the time of the inspection and surface water sampling. The vegetation is this area appeared to be in good condition with no significant dieback. The type of vegetation appeared to be quite variable with many grasses, weeds and non-native trees observed.	**Surface Water:** - Field parameters **Soil:** - pH Screening - Chromium Suite

Location ID	Location Description	Sample Analysis
PC_SW06	Most downstream location within the investigation area. It is accessed through a paddock that was accessed from Pennyroyal Valley Road. The banks of the creek were relatively level with the surrounding area, and no steep slopes were observed leading into the creek from the western side. There was a small slope towards the creek from the eastern side. Water within the creek was observed to be relatively dark in colour and no water level could be determined. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - pH Screening - Chromium Suite

Notes: Locations are presented in order of most upstream to most downstream. The measured surface water field parameters comprised: pH, redox, electrical conductivity (EC), temperature and dissolved oxygen (DO). The analysed pH screening comprised: pH_F (field pH); pH_{FOX} (pH of sample after oxidation); reaction intensity during oxidation, and calculation of the change in pH after oxidation (ΔpH).

3.3 Deans Marsh Creek

Deans Marsh Creek is the eastern most creek within the investigation area and discharges into the Barwon River to the north of the investigation area near Birregurra. The investigation extent of Deans Marsh Creek is shown on **Figure F5**. The investigation area is bound by the Otway Ranges to the southeast and tree plantations to the southwest and extends approximately 1.5 km southeast of Deans Marsh township. Land uses along this portion of Deans Marsh Creek are predominantly farmland utilised for livestock grazing and residential properties in the northern portions, and tree plantations in the southern portion.

A total of three locations were accessed along Deans Marsh Creek comprising DM_SW02, DM_SW01 and DM_SW03 (listed in order from most upstream to downstream). Two additional locations were attempted to be accessed but were unable to be safely accessed for sampling due to dense vegetation and snake sightings. Observations made at each sampled location at the time of the Site inspection and surface water sampling are summarised in **Table 3** below. Soil observations made during the soil sampling program are presented in **Section 6.3.1**. All sampling locations are shown on **Figure F5**.

Table 3 Deans Marsh Creek Sampling Locations

Location ID	Location Description	Sample Analysis
N/A	A further upstream location was attempted to be accessed within the pine plantation at the time of the Site inspection, however it could not be accessed safely. A second attempt was made during the soil sampling program which was also unsuccessful. A driving track on the western side of Deans Marsh Creek was traversed, however there was dense grass and blackberry bushes that restricted access to the creek. An additional track on the eastern side of the creek was traversed, however the topography was very steep with dense vegetation present which also restricted access. This location was abandoned due to poor access, dense vegetation and safety concerns regarding a snake sighting.	Not accessed for sampling
DM_SW02	This is the most upstream location that was able to be accessed and sampled. The sampled area was accessed through a pine plantation access track from Deans Marsh-Lorne Road.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations

Location ID	Location Description	Sample Analysis
	Samples were collected immediately downstream of a creek crossing located at the bottom of a hill area within the plantation. At the time of the Site inspection, small, isolated pools were observed within the creek alignment. The banks were a mix between loose rocks / boulders and exposed soils. During the soil sampling program a greater volume of water was observed, however isolated pooling of water was still observed further downstream. The track crossing comprises a bridge constructed of stacked rocks that is approximately 2 m above the bed of the creek. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Soil:** - pH Screening - Chromium Suite
DM_SW01	Location was accessed from a private residence at 145 Deans Marsh-Lorne Rd. Access to this residence for follow up soil sampling was unable to be obtained. This property appeared to be largely used for sheep and cattle grazing. This portion of Deans Marsh Creek is located at the base of a steep decline with deeply incised banks. The eastern banks appeared to have a steeper bank face with exposed loose sediments and soils. The exposed geology was inferred to be LTA, where observed on the western banks. More water was visible within the creek when compared to DM_SW02 further upstream. Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - No analysis
DM_SW03	This was the most downstream location along Deans Marsh Creek which could be accessed and sampled. Location is accessed through privately owned property to the immediate north of 145 Deans Marsh-Lorne Rd. This property has no residential buildings and is only used for cattle farming. The sampling location is at the bottom of the hill at a private creek crossing. A greater volume of water was observed here and a continuous stream of water was observed opposed to isolated pools of water. The width of the creek was unable to be observed due to the amount of reed / blackberry vegetation along the banks. Outcropping sections of rock were observed and assumed to be bedded sandstone and siltstone (LTA). Vegetation in and surrounding the creek was observed to be in good condition at the time of the inspection. No signs of vegetation die back, odours or sheens on the water surface were observed at the time of the inspection or surface water sampling.	**Surface Water:** - Field parameters - Dissolved and total metals, nitrogen species, major ions and major cations **Soil:** - pH Screening - Chromium Suite
N/A	Access to the creek was attempted from Smiths Lane however, due to a snake sighting within tall grass the creek was unable to be accessed.	Not accessed for sampling

Notes: Locations are presented in order of most upstream to most downstream. The measured surface water field parameters comprised: pH, redox, electrical conductivity (EC), temperature and dissolved oxygen (DO). The analysed pH screening comprised: pH_F (field pH); pH_{FOX} (pH of sample after oxidation); reaction intensity during oxidation, and calculation of the change in pH after oxidation (ΔpH).

4 Investigation Methodology

Field investigations were carried out by BlueSphere field staff in November and December 2024 and comprised the following activities:

- Site inspection and surface water sampling (25 – 26 November 2024); and
- Sampling of soil profiles from investigation locations advanced within creek alignments (9 – 11 December 2024).

Sampling locations were selected with consideration of creek / property access and spatial coverage. Soil and surface water investigation locations are shown on the attached **Figure F2**, with lithological logs provided in **Appendix A**.

4.1 Surface Water Sampling

4.1.1 Sampling Methodology

Surface water sampling was conducted by BlueSphere personnel with a representative from Barwon Water. The following general sampling procedure was adopted:

- Laboratory supplied sampling containers were attached to the end of an extending sampling pole for water collection. A sub-sample from each location was filtered in the field using a disposable 0.45 µm filter for analysis of dissolved metals/metalloids.
- Surface water field parameters were collected by submersing a calibrated multi-parameter water quality meter directly into the creek water. Measured field parameters included pH, electrical conductivity (EC), dissolved oxygen (DO), oxidation-reduction potential (ORP) and temperature. Field measurements are provided on field sheets (**Appendix A**) and are discussed in **Section 5.3**.
- Samples were placed in laboratory-supplied sample bottles and temporarily stored in ice-cooled containers for transport to the nominated laboratory under BlueSphere's Chain of Custody (COC) protocols.

The water quality meter was calibrated by the equipment provider prior to use, and calibration certificates are attached in **Appendix B**.

4.1.2 Scope of Laboratory Analysis

10 primary surface water samples and one duplicate sample were submitted to Australian Laboratory Services (ALS) for analysis. One triplicate sample was submitted to Envirolab Services for analysis to assess precision and comparability between different laboratories. All samples were analysed for typical ASS indicators comprising: major cations (calcium, magnesium, sodium, potassium), major anions (chloride, sulfate), alkalinity, nitrogen species, as well as both dissolved and total metals[1]. ALS and Envirolab Services are accredited by NATA for all analyses performed.

The analytical suite includes metals, specifically aluminium, iron and manganese, as metal concentrations in surface water can be indicators of ASS oxidation through acid production and metal mobilisation. Additionally, total alkalinity has been analysed to assist with understanding the natural acid neutralisation buffering capacity of the surface waters.

Laboratory reports including the sample COC, sample receipt notifications (SRN), certificate of analysis (COA) and laboratory quality analysis and quality control (QA/QC) reports are attached in **Appendix C**.

4.2 Soil Sampling

4.2.1 Sampling Methodology

Soil samples were collected by BlueSphere field staff during the second mobilisation to Site and the general sampling procedure comprised:

[1] Metals analysis included: Aluminium, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc.

- Advancement of each soil borehole within the creek bed by hand auger to approximately 1.0 meters below ground level (mbgl).
- Collection of soil samples from each borehole at approximately 0.25 m depth intervals throughout the soil profiles to the borehole termination depths.
- Soil samples were collected from the hand auger by BlueSphere field staff who were wearing disposable nitrile gloves that were changed prior to the collection of each sample.
- The hand auger was decontaminated between each soil sampling location using a three rinse system comprising of: 1 rinse in dilute detergent (Decon-90), 1 rinse in fresh potable water and 1 rinse in lab-supplied deionised water.
- Samples were transferred into zip-lock bags and immediately placed into an ice-cooled container for temporary storage and transport to the nominated laboratory under BlueSphere's COC protocols.

The lithology of each borehole was logged during sampling based on the inspection of drill cuttings and are described on the borehole logs attached in **Appendix A**.

Sub-surface conditions encountered during drilling are described in **Section 6**.

4.2.2 Scope of Laboratory Analysis

Sampling was done to provide a representative assessment of the various soil strata and depth profiles encountered. To do this, the pH of all primary soil samples (48 samples) were measured after the addition of distilled water (pH_F) and peroxide (pH_{FOX}). pH_F tests provide a preliminary indication of past oxidation of sulfides indicating the presence of AASS, whereas pH_{FOX} tests provide a preliminary indication of the presence of unoxidised sulfides and therefore PASS. The change in pH (ΔpH) is calculated by subtracting the pH_{FOX} from pH_F. This change in pH assists in the identification of PASS through the potential of acid production with oxidation of soils.

After preliminary assessment of the pH screening results and review of the sample lithologies, 31 primary samples were selected for more rigorous chromium suite analysis to provide further information regarding the presence of oxidisable sulfur arising from AASS and/or PASS. The criteria used to inform selection for laboratory analysis for chromium suite are provided in **Table 4**.

Screening and analytical testing was carried out by ALS with reference to the national guidelines (Sullivan et al 2018b). Laboratory reports, including COCs and SRNs are attached in **Appendix C**.

5 Framework for Assessment

5.1 Soil

Screening and analytical testing for the presence of oxidisable sulfur arising from actual ASS (AASS) and/or potential ASS (PASS) was carried out with reference to national guidelines for assessment of ASS (Sullivan *et al* 2018a, 2018b).

Soil screening test results (pH_F, pH_{FOX}) are used to indicate whether AASS or PASS are likely to be present and results were assessed based on the recommendations in Sullivan *et al* (2018b). Past oxidation of soil and therefore the presence of AASS is indicated by a pH_F<4. The presence of PASS is indicated where pH_{FOX}<3, combined with a pH_{FOX} reading at least one pH unit below pH_F, i.e. a ΔpH greater than one, and a strong oxidising reaction (>2). The screening test is an indicative measure only and is used to inform the need for more comprehensive testing.

The chromium suite of analysis provides further information regarding the presence of AASS and/or PASS. Results were assessed based on the recommendations in Sullivan *et al* (2018b) for identifying the presence of sulfidic soils (i.e. with a reduced inorganic sulfur content ≥0.01% by mass) and by assessing the acidity hazard, i.e. the net acidity as the sum of potential acidity (PASS) and actual acidity (AASS). The net acidity of samples was calculated by the sum of potential sulfidic acidity (Scr) and titratable actual acidity (TAA).

The reported Scr value is used to assist with determining the amount of potential acidity in soils which are stable under reducing conditions but will produce acidity under oxidising conditions (i.e. PASS). The reported TAA value is used to assist with determining if there is current acidity within the soils which is indicative of historical oxidating / acid producing conditions where sulfidic minerals are oxidised to produce acidity which is either released into the environment or retained in the soils (i.e. AASS).

Acid neutralisation capacity (ANC), or the buffering capacity of soils that are not yet acidic, is typically determined as part of the chromium suite of analyses. ANC is only determined when the pH_{KCL} is >6.5 on the basis that if the pH KCL is <6.5, then any acidity produced in the soil will not be able to be neutralised quickly enough in the soil to maintain a pH of 6.5 or above (Ahern et al., 2004). Where ANC has been able to be measured, because the source(s), nature, and relative availability of any ANC was not able to be determined via visual examination of the samples during field works, ANC has not been considered when assessing the acidity hazard.

5.2 Surface Water

For surface waters published indicators for ASS in waters have been considered, together with a qualitative assessment of surface water pH, relative concentrations of major cations (calcium, magnesium, sodium, potassium and sulfate). In addition, the surface water buffering capacity in the form of alkalinity has been included to provide an assessment of the likely oxidation state of surface water and any existing impact from acidification due to ASS conditions in the creeks. The significance of the other analytes tested for (e.g. metals and nutrients) has only been considered to the extent that they could be associated with the oxidation of ASS, consistent with the objectives of the investigation.

Low pH and elevated sulfate concentrations in groundwater are an indicator of pyritic oxidation in brackish or saline water (Mulvey 1993). The ratio of chloride to sulfate ions in water has therefore been used as a geochemical indicator of sulfide oxidation (e.g. from ASS). Surface water is typically dominated by chloride and contains little sulfate, such that the principal sources of sulfate are seawater and/or oxidation of pyrites, such as those found in ASS. However, sulfate concentrations in surface water increase as a result of sulfide oxidation in the soil and will alter this ratio. If the ratio is less than four and certainly less than two, it is usually a strong indicator that an additional source of sulfate, other than seawater, is present in the sub-surface. When compared with the groundwater pH, this assessment can also identify whether previous neutralisation of sulfuric acid has occurred (Mulvey 1993: Table 2).

5.3 Summary of Adopted Criteria

Relevant soil and surface water criteria for ASS investigations adopted as part of this investigation are presented below in **Table 4**.

Table 4 Summary of Guidelines for ASS Interpretation

Indicator	Criteria	Reference
Soil/sediment (ASS) – field pH_f, field pHfox and ΔpH	AASS: pHF<4; or PASS: pHF_{OX}<3; and ΔpH >1 and a 'volcanic' oxidising reaction	*Sullivan et al*., 2018a and EPA Publication 655.1, 2009[1]
Soil/sediment (ASS) – Existing + Potential Acidity excluding ANC[2]	Action criteria as per **Table 5** below	*Sullivan et al* 2018a, 2018b
Waters - Dissolved and total metals, nutrients	Default guideline values for 95% species protection Guidelines for the use of waters for agriculture, stock watering and irrigation purposes Guidelines for managing risk in recreational water	*ANZG* 2018 *ANZECC* (2000) *NHMRC* (2008)
Waters –ASS indicators	SO_4/Cl > 0.5 SO_4/alkalinity > 0.2 Alkalinity < 10 mg/L Al >1 mg/L	*Mulvey* 1993 *Sullivan et al*., 2018a (refer to Table 5.2)

Notes: **1.** Guideline values from *Sullivan et al* (2018) are considered to supersede those available in EPA Publication 655.1 (2009) given the more recent publication date and present as the most current understanding.

2. Acid neutralising capacity of the soil should not be considered when comparing to the action criteria for ASS unless it can be demonstrated that the ANC detected is sufficiently soluble to neutralise any acidity generated upon disturbance.

Table 5 Action criteria based on the texture and volume of material disturbed (after Sullivan et al., 2018b)

Type of material		Net Acidity[#]			
Texture range* (NCST 2009)	Approximate clay content (%)	1–1000 t materials disturbed		> 1000 t materials disturbed	
		% S-equiv. (oven-dried basis)	mol H^+/t (oven-dried basis)	% S-equiv. (oven-dried basis)	mol H^+/t (oven-dried basis)
Fine: light medium to heavy clays	> 40	≥ 0.10	≥ 62	≥ 0.03	≥ 18
Medium: clayey sand to light clays	5–40	≥ 0.06	≥ 36	≥ 0.03	≥ 18
Coarse and Peats: sands to loamy sands	< 5	≥ 0.03	≥ 18	≥ 0.03	≥ 18

Notes: * If bulk density values are not available for the conversion of cubic meters to tonnes of soil, then the default bulk densities, based on the soil texture in Table 5.1 of Sullivan et al., 2018b, may be used.

Net Acidity can only include a soil material's measured Acid Neutralising Capacity where this measure has been corroborated by other data (for example slab incubation data) that demonstrates the soil material does not experience acidification during complete oxidation under field conditions (Equation 3.1). Where the Acid Neutralising Capacity has not been corroborated, the Net Acidity must be determined using Equation 3.2.

All Net Acidity results are on an oven-dry basis.

Cell highlighted in grey represents the adopted criterion for soil/sediment.

A criterion of ≥ 0.06%S has been adopted for this investigation based on the lithology encountered- i.e. clayey silts to sandy silts, as part of the soil investigation. Further commentary on the observed lithologies within the three creeks is presented in **Section 6** and on the lithological logs provided in **Appendix A**.

6 Results and Discussion

6.1 Matthews Creek

6.1.1 Observations and Geology

A general description of each sampling location and the condition of vegetation and surface water within Matthews Creek is provided above in **Section 3.1**. In relation to the sub-surface profile, soils observed and sampled within Matthews Creek were dominated by fine materials (clay and silts) with secondary components of sands and gravels. Soils varied from dark grey to dark brown-grey in colour with red/orange mottling observed at depth at two locations (0.9 m bgl at MC_SW05 and 0.6 m bgl at MC_SW06). Soils sampled along Matthews Creek were noted to be waterlogged and wet from surface and throughout the soil profile.

Of the five locations where soil sampling was conducted, a hydrogen sulfide odour was noted in soils following disturbance during sampling, apart from one location (MC_SW04) which is the most up-stream location on Matthews Creek. This location was observed to contain a higher proportion of gravel compared to the other locations. No odours were observed prior to disturbance associated with sampling.

It is noted that monosulfidic black oozes (distinct black colour, gel consistence, or oily appearance) were not observed at any of the soil sampling locations at the time of the sampling.

6.1.2 Soils

A total of 17 soil samples were collected from five locations along Matthews Creek and initially analysed for the preliminary pH screening. This is used as a preliminary indicator of the likelihood of PASS and AASS, and to determine which soil samples to be further analysed to confirm the presence or absence of AASS and PASS. Laboratory reported pH screening results are presented in **Table T2**. A summary of the results is provided below in **Table 6** and on **Figure F6**.

Table 6 Summary of Preliminary pH Screening - Matthews Creek

Parameter	Range	Guideline Value	Comment
pH_F	6.2 – 7.4	<4	No samples reported a pH_F value below the adopted criterion indicating that it is unlikely for AASS to be present at the sampled locations.
pH_{FOX}	1.7 - 4.7	<3	4 samples reported pH_{FOX} values below the adopted criterion indicating that there is the potential for PASS to be present at those locations (MC_SW01, MC_SW02 and MC_SW06).
ΔpH	2.4 – 4.5	>1	All samples reported a ΔpH greater than the adopted criterion indicating that there is the potential for PASS to be present at these locations.
Reaction intensity	2 – 3	>2	A moderate (2) to strong (3) 'volcanic' reaction was observed at all locations indicating that gasses were released through the oxidation process which can be indicative of either ASS processes or reaction with organic material.

Based on the preliminary screening of soils, all locations are considered to have the potential to be PASS as per EPA 655.1 and *Sullivan et al.* guidelines. Due to the initial soil pH being greater than 4, soils are not likely to be AASS (Sullivan et al, 2018a).

In order to confirm the results of the preliminary pH screening, further analysis was requested on 11 of the above samples to better understand the acidification potential and confirm the presence of PASS. A summary of laboratory reported results of the 11 samples selected for further analysis is provided below in **Table 7**.

Table 7 Summary of Chromium Suite Analytical Results - Matthews Creek

Parameter	Range	Guideline Value	Comment
pH KCL	4.9 – 5.8	N/A	All samples reported a pH KCL less than 6.5 indicating that soils are acidic under neutral conditions and ANC is not readily available.
TAA (%S)	<0.02 – 0.06	0.06	Five samples reported detectable concentrations of TAA however all were below adopted criterion. This indicates that soils are not AASS.
Scr (%S)	0.011 – 0.118	0.06	All samples reported detectable concentrations of Scr indicating that all locations have the potential to produce acidity. Only one sample (MC_SW02_0.0) reported a Scr value above the adopted criterion indicating that soils are PASS.
ANC (%$CaCO_3$)	0.22 – 0.84	NA	All samples reported detectable concentrations of ANC, however the source is unknown and has not been considered in the calculation of net acidity.
Net Acidity (%S)	<0.02 – 0.16	0.06	Nine of the 11 samples reported detectable concentrations of net acidity with only two locations reporting concentrations above the adopted criterion (MC_SW02_0.0 and MC_SW06_0.0). Soils at these locations are considered to be PASS.

6.1.3 Surface Water

A summary of field parameters collected at the time of surface water sampling, in order of most upstream to downstream, is presented in **Table 8** below.

Table 8 Surface Water Field Parameters – Matthews Creek

Location ID	DO	EC	pH	ORP	Temperature
	mg/L	µS/cm	Units	mV	°C
MC_SW04	7.31	217	7.0	154.5	18.5
MC_SW06*	Not accessible at the time of the initial Site inspection – sampled during soil sampling event				
MC_SW03	0.77	2,137	6.6	117.0	15.7
MC_SW02	0.20	923	6.5	107.3	17.3
MC_SW01	5.45	570	6.6	136.8	19.3
MC_SW05	12.84	477	7.0	158.2	18.8

Notes: DO – Dissolved oxygen, EC – Electrical conductivity, ORP - oxidation-reduction potential

The field recorded surface water pH was observed to be neutral and relatively consistent from upstream to downstream. The dissolved oxygen (DO) concentrations in surface waters are indicative of oxidising conditions (DO >5 mg/L) with the exception of MC_SW03 and MC_SW02 which are indicative of a low oxygen environment. It is also noted that the electrical conductivity recorded at location MC_SW03 is comparably higher than other locations.

A summary of ASS indicators in surface water are provided below in **Table 9**, with additional metal and inorganic concentrations presented in **Table T1**. The analytes are below the adopted guidelines for ASS indicators as shown in **Table 9** and likely represent background conditions within the creek, apart from iron, manganese and sulfate/alkalinity at MC_SW02 (see discussion below).

Table 9 Summary of ASS indicators in Surface Water - Matthews Creek

Location ID	Aluminium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Total Alkalinity (mg/L)	Sulfate / Alkalinity ratio	Sulfate / Chloride ratio
ASS Indicator	1.0	-	-	<10	>0.2	0.5
MC_SW04	Total - 0.14 Dissolved - 0.02	Total - 0.54 Dissolved - 0.24	Total – 0.068 Dissolved - 0.057	54	0.06	0.06
MC_SW06	Total - 0.29 Dissolved - 0.04	Total - 0.91 Dissolved - 0.48	Total – 0.030 Dissolved - 0.021	46	0.09	0.10
MC_SW02	Total - 0.22 Dissolved - 0.07	Total – 6.63 Dissolved – 4.10	Total – 1.65 Dissolved – 1.54	50	**0.32**	0.05
MC_SW05	Total - 0.58 Dissolved - 0.03	Total – 2.09 Dissolved – 0.84	Total – 1.10 Dissolved – 1.05	69	0.04	0.02

Notes: Values in **bold** denote a criterion exceedance

At the time of the Site inspection in November 2024, observations which may be indicative of iron staining and flocculation were made at location MC_SW03, which is located approximately 150 m up-stream of location MC_SW02. When location MC_SW03 was accessed two weeks later in December 2024, the brown to orange colour (potentially indicative of iron staining) was no longer observed. **Figure 3** below shows the creek at the time of the inspection (left) and at the time of soil sampling (right).

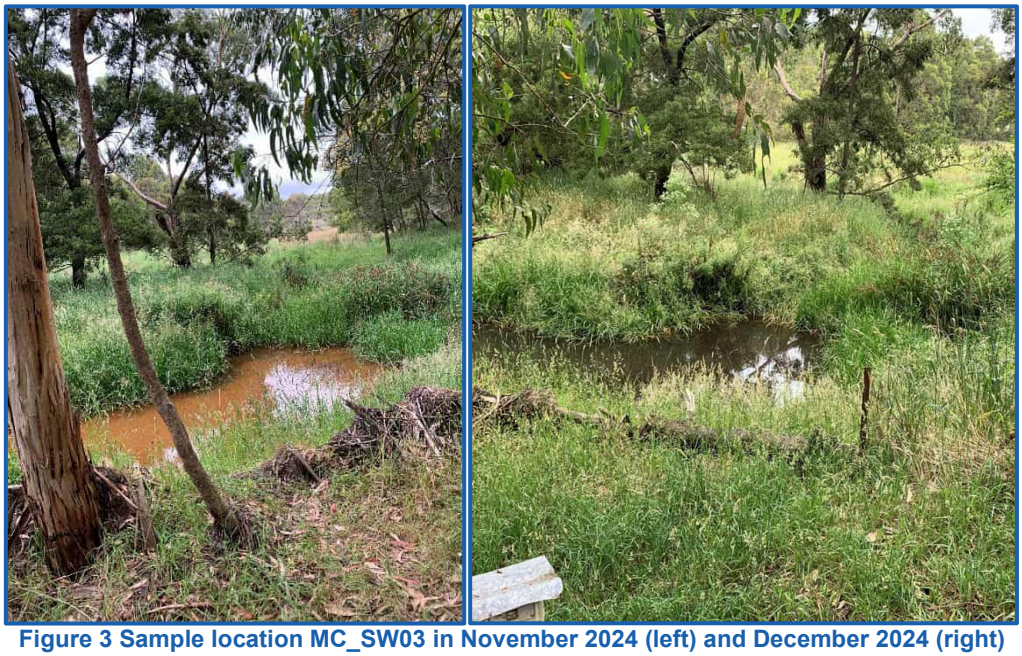

Figure 3 Sample location MC_SW03 in November 2024 (left) and December 2024 (right)

The surface water data at MC_SW02, which is located approximately 150 m down-stream of MC_SW03, indicates there had been some release of iron, sulfate and manganese to the water column at location MC_SW02 consistent with the observations at MC_SW03. In particular, the sulfate / alkalinity ratio reported at MC_SW02 (0.32) was above the ASS indicator value (of 0.2), and the iron and manganese concentrations were elevated compared to those reported elsewhere in Matthews Creek. As noted above, the dissolved oxygen was also low and electrical conductivity elevated relative the elsewhere in Matthews Creek.

However, acidic pH was not observed at either location. The data indicate that the surface waters appear to have sufficiently self-regulated and neutralised. In particular, total alkalinity concentrations in surface waters were reported above 10 mg/L at all locations indicating that there is natural buffering capacity within the creek waters (Sullivan et al, 2018a).

6.1.4 Summary

Mathews Creek is the most western creek within the investigation area and is a tributary to the Barwon River. Field observations made of sections along Matthews Creek at the time of BlueSphere's Site inspection (November 2024) and soil sampling program (December 2024), indicate that the creek is generally in good condition. No obvious signs of vegetation die back, or jarosite mineralisation were observed. Sulfidic odours were noted in soils at the time of disturbance associated with soil sampling, however no odours were observed prior to sediment disturbance.

The soil sampling did not identify any AASS in Mathews Creek, and of the four locations assessed, only the soil at sample location MC_SW02_0.0, which is located approximately 150 m down-stream of MC_SW03, would be classified as a PASS (Sullivan et al, 2018).

The surface water data at one location (MC_SW02) and field observations at nearby location MC_SW03 indicate that there has been some release of iron, sulfate and manganese to the water column, however, acidic pH was not observed. Given the lack of vegetation die back and the neutral pH reported in both soils and surface waters, the creek is considered to have sufficiently self-regulated and neutralised. It is important to note that the chemical indicators in surface water are subtle. This is consistent with the soil results that show that the soil would not be classified as AASS and therefore critically does not requirement management.

These data are consistent with a disturbance of ASS (either locally or upstream), for example, due to natural wetting/drying cycles, changes in hydrology, soil disturbance by stock trampling etc. In comparison, there is no evidence to suggest Barwon Water's historic groundwater pumping activities have resulted in any environmentally significant impacts with regard to ASS within the outcropping areas of Matthews Creek.

6.2 Pennyroyal Creek

6.2.1 Observations and Geology

A general description of each sampling location and the condition of vegetation and surface water in Pennyroyal Creek is provided above in **Section 3.2**. In relation to the sub-surface profile, soils observed and sampled within Pennyroyal Creek were dominated by fine materials (clay and silts) with secondary components of sands. An increase in sand content was observed between 0.2 – 0.9 m bgl at location PC_SW02. Soils were dark grey in colour with no mottling observed. Soils sampled along Pennyroyal Creek were noted to be waterlogged and wet from surface and throughout the soil profile excluding the surface sample collected from PC_SW06 (0.0) which was observed to be moist.

Of the five locations where soil sampling was conducted, sulfidic odours were noted in soils at all locations at the time of disturbance associated with soil sampling, however no odours were observed prior to sediment disturbance.

It is noted that monosulfidic black oozes (distinct black colour, gel consistence, or oily appearance) were not observed at any of the soil sampling locations at the time of the sampling.

6.2.2 Soils

A total of 24 soil samples were collected from five locations along Pennyroyal Creek and initially analysed for the preliminary pH screening. This is used as a preliminary indicator of the likelihood of PASS and AASS, and to determine which soil sampled to be further analysed to confirm the presence or absence of AASS and PASS. Laboratory reported pH screening results are presented in **Table T2**. A summary of the results is provided below in **Table 10** and on **Figure F6**:

Table 10 Summary of Preliminary pH Screening – Pennyroyal Creek

Parameter	Range	Guideline Value	Comment
pH_F	5.3 – 6.3	<4	No samples reported a pH_F value below the adopted criterion indicating that it is unlikely for AASS to be present at the sampled locations.
pH_{FOX}	1.6 – 4.1	<3	21 samples reported pH_{FOX} values below the adopted criterion indicating that there is the potential for PASS to be present all sampled locations.
ΔpH	2.2 – 4.6	>1	All samples reported a ΔpH greater than the adopted criterion indicating that there is the potential for PASS to be present at these locations.
Reaction intensity	2 – 4	>2	A moderate (2) to extreme (4) 'volcanic' reaction was observed at all locations indicating that gasses were released through the oxidation process which can be indicative of either ASS processes or reaction with organic material.

Based on the initial field screening of soils, all locations are considered to have the potential to be PASS as per EPA 655.1 and *Sullivan et al.* guidelines. Due to the initial pH being greater than 4, soils are not likely to be AASS (Sullivan et al, 2018a).

In order to confirm the results of the preliminary pH screening, further analysis was requested on 15 of the above samples to better understand the acidification potential and confirm the presence of PASS. A summary of laboratory reported results of the 15 samples selected for further analysis is provided below in **Table 11**.

Table 11 Summary of Chromium Suite Analytical Results - Pennyroyal Creek

Parameter	Range	Guideline Value	Comment
pH KCL	4.7 – 5.6	N/A	All samples reported a pH KCL less than 6.5 indicating that soils are acidic under neutral conditions and ANC is not readily available.
TAA (%S)	<0.02 – 0.08	0.06	All but one sample (PC_SW05_0.7) reported detectable concentrations of TAA. Two samples (PC_SW02_0.2 and PC_SW02_1.0) reported concentrations marginally above the adopted criterion with all other samples reported below the adopted criterion. This indicates that soils at most of the locations are not AASS, and the marginal exceedance at PC_SW02 is within expected error limits and not considered material.
Scr (%S)	0.014 – 0.068	0.06	All samples reported detectable concentrations of Scr indicating that all locations have the potential to produce acidity. Only one sample (PC_SW02_1.0) reported a Scr value above the adopted criterion indicating that soils are PASS.
ANC (%$CaCO_3$)	0.02 – 1	NA	All samples reported detectable concentrations of ANC, however the source is unknown and has not been considered in the calculation of net acidity.
Net Acidity (%S)	0.02 – 0.14	0.06	All 15 samples reported detectable concentrations of net acidity with eight samples reporting concentrations above the adopted criterion. At least one sample from locations PC_SW01, PC_SW02, PC_SW04 and PC_SW06 were reported above the adopted management criterion indicating that soils at these locations are considered to be PASS. While detectable values of net acidity were reported at location PC_SW05, all were below the adopted criterion and would not be considered as PASS.

6.2.3 Surface Water

A summary of field parameters collected at the time of surface water sampling, in order of most upstream to downstream, is presented in **Table 12** below.

Table 12 Surface Water Field Parameters - Pennyroyal Creek

Location ID	DO	EC	pH	ORP	Temperature
	mg/L	µS/cm	Units	mV	°C
PC_SW01	9.44	239	6.3	126.1	16.7
PC_SW02	8.25	238	6.3	130.8	16.6
PC_SW04	4.11	204	6.3	158.0	17.6
PC_SW03	4.34	216	6.4	153.0	17.6
PC_SW05	2.11	218	6.4	151.0	17.3
PC_SW06	3.96	216	6.4	151.6	18.5

Notes: DO – Dissolved oxygen, EC – Electrical conductivity, ORP - oxidation-reduction potential

The field recorded surface water pH was observed to be neutral and relatively consistent from upstream to downstream. The dissolved oxygen concentrations in surface waters are indicative of generally oxidising conditions (DO >2 mg/L) and decreases from upstream to downstream. The data indicate that this trend is not related to ASS but rather an alternative mechanism, for example, presence of Willow trees in the waterway which led to the consumption of oxygen. Electrical conductivity is noted to be relatively low and stable from upstream to downstream.

A summary of ASS indicators in surface water is provided below in **Table 13**, with additional metal and inorganic concentrations presented in **Table T1**. The analytes are below the adopted guidelines for ASS indicators as shown in **Table 13** and likely represent background conditions within the creek.

Table 13 Summary of ASS Indicators in Surface Water - Pennyroyal Creek

Location ID	Aluminium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Total Alkalinity (mg/L)	Sulfate / Alkalinity ratio	Sulfate / Chloride ratio
ASS Indicator	**1.0**	**-**	**-**	**<10**	**>0.2**	**0.5**
PC_SW01	Total - 0.49 Dissolved - 0.05	Total – 1.74 Dissolved - 0.87	Total – 0.028 Dissolved - 0.021	51	0.04	0.04
PC_SW03	Total - 0.23 Dissolved - 0.04	Total – 1.93 Dissolved – 1.02	Total – 0.116 Dissolved - 0.103	48	0.04	0.03
PC_SW06	Total - 0.06 Dissolved - 0.02	Total – 2.10 Dissolved – 1.01	Total – 0.695 Dissolved – 0.664	53	0.02	0.01

6.2.4 Summary

Pennyroyal Creek is the central creek within the investigation area and is a tributary of Deans March Creek. Field observations made of sections along Pennyroyal Creek at the time of BlueSphere's inspection (November 2024) and soil sampling program (December 2024), indicate that the creek is generally in good condition. No obvious signs of vegetation die back, iron staining / flocculation or jarosite mineralisation were observed. Sulfidic odours were noted in soils at the time of disturbance associated with soil sampling, however no odours were observed prior to sediment disturbance.

The soil sampling indicates that the soil at sample location PC_SW02 would be classified as PASS. A marginal exceedance of the criterion for AASS was reported at one location along Pennyroyal Creek, however, the result is within expected error limits and therefore not considered material.

Surface water samples collected from three locations along Pennyroyal Creek reported analytical results below the adopted ASS indicators. This suggests that there was no disturbance of ASS influencing surface water chemistry at the time of sampling at those locations.

6.3 Deans Marsh Creek

6.3.1 Observations and Geology

A general description of each sampling location and the condition of vegetation and surface water in Deans Marsh Creek is provided above in **Section 3.3**. In relation to the sub-surface profile, soils observed and sampled within Deans Marsh Creek were dominated by silt with secondary components of sands and clays. Soils varied from dark grey to dark brown in colour with light brown mottling observed between 0.2 – 0.5 m bgl at DM_SW02. Soils sampled along Deans Marsh Creek were noted to be waterlogged and wet from surface and throughout the soil profile.

Soils collected from both soil sampling locations were noted to have sulfidic odours in soil at the time of disturbance associated with soil sampling, however no odours were observed prior to sediment disturbance.

It is noted that monosulfidic black oozes (distinct black colour, gel consistence, or oily appearance) were not observed at any of the soil sampling locations at the time of the sampling.

6.3.2 Soils

A total of 7 soil samples were collected from two locations along Deans Marsh Creek and initially analysed for the preliminary pH screening. This is used as a preliminary indicator of the likelihood of PASS and AASS, and to determine which soil samples to be further analysed to confirm the presence or absence of AASS and PASS. Laboratory reported pH screening results are presented in **Table T2**. A summary of the results is provided below in **Table 14** and on **Figure F6**.

Table 14 Summary of Preliminary pH Screening – Deans Marsh Creek

Parameter	Range	Guideline Value	Comment
pH_F	6.4 – 7.3	<4	No samples reported a pH_F value below the adopted criterion indicating that it is unlikely for AASS to be present at the sampled locations.
pH_{FOX}	2.8 – 3.7	<3	2 samples collected from DM_SW02 reported pH_{FOX} values below the adopted criterion indicating that there is the potential for PASS to be present at that location.
ΔpH	3.3 – 4.0	>1	All samples reported a ΔpH greater than the adopted criterion indicating that there is the potential that PASS is present at these locations.
Reaction intensity	2 – 3	>2	A moderate (2) to strong (3) 'volcanic' reaction was observed at all locations indicating that gasses were released through the oxidation process which can be indicative of either ASS processes or reaction with organic material.

Results obtained from the initial field screening of soils, all locations are considered to have the potential to be PASS as per EPA 655.1 and *Sullivan et al.* guidelines. Due to the initial pH being greater than 4, soils are not likely to be AASS (Sullivan et al, 2018a).

Based on the results of the preliminary pH screening, further analysis was requested on 5 of the above samples to better understand the acidification potential and confirm the presence of PASS. A summary of laboratory reported results of the 5 samples selected for further analysis is provided below in **Table 15**.

Table 15 Summary of Chromium Suite Analytical Results – Deans Marsh Creek

Parameter	Range	Guideline Value	Comment
pH KCL	5.0 – 6.6	N/A	All but one sample (DM_SW03_0.2) reported a pH KCL less than 6.5 indicating that soils are acidic under neutral conditions and ANC is not readily available. The one sample where a pH KCL was reported greater than 6.5 indicates that ANC may be available.
TAA (%S)	<0.02 – 0.03	0.06	Two samples reported detectable concentrations of TAA however all were below adopted criterion. This indicates that soils are not AASS.
Scr (%S)	0.011 – 0.016	0.06	All samples reported detectable concentrations of Scr indicating that all locations have the potential to produce acidity. No samples reported a Scr value above the adopted criterion and are not considered to be PASS.
ANC (%$CaCO_3$)	0.08 – 0.85	NA	All samples reported detectable concentrations of ANC, however the source is unknown and has not been considered in the calculation of net acidity.
Net Acidity (%S)	<0.02 – 0.04	0.06	Two of the five samples reported detectable concentrations of net acidity with none reported above the adopted criterion. Soils at these sampled locations are not considered to be PASS.

6.3.3 Surface Water

A summary of field parameters at the time of surface water sampling, in order of most upstream to downstream, is presented in **Table 16** below.

Table 16 Surface Water Field Parameters – Deans Marsh Creek

Location ID	DO	EC	pH	ORP	Temperature
	mg/L	µS/cm	Units	mV	°C
DM_SW02	3.07	590	7.1	160.4	15.2
DM_SW01	3.46	1,808	6.9	140.5	17.3
DM_SW03	6.67	993	7.2	162.8	20.7

Notes: DO – Dissolved oxygen, EC – Electrical conductivity, ORP - oxidation-reduction potential

The field recorded surface water pH was observed to be neutral and relatively consistent from upstream to downstream. The dissolved oxygen concentrations in surface waters are indicative of generally oxidising conditions (DO >3mg/L). It is noted that the electrical conductivity recorded along Deans Marsh Creek is comparably higher than other creeks likely due to the isolated pooling of water observed within Deans Marsh Creek.

A summary of ASS indicators in surface water is provided below in **Table 17**, with additional metal and inorganic concentrations presented in **Table T1**. The analytes are below the adopted guidelines for ASS indicators as shown in **Table 17** and likely represent background conditions within the creek.

Table 17 Summary off ASS Indicators in Surface Water - Deans Marsh Creek

Location ID	Aluminium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Total Alkalinity (mg/L)	Sulfate / Alkalinity ratio	Sulfate / Chloride ratio
ASS Indicator	**1.0**	**-**	**--**	**<10**	**>0.2**	**0.5**
DM_SW02	Total – 0.60 Dissolved - 0.04	Total – 2.99 Dissolved – 1.25	Total – 0.635 Dissolved – 0.567	114	0.04	0.02
DM_SW01	Total - 0.14 Dissolved - <0.01	Total – 1.38 Dissolved - 0.26	Total – 2.50 Dissolved – 1.58	252	0.03	0.01
DM_SW03	Total - 0.16 Dissolved - <0.01	Total – 0.86 Dissolved – 0.26	Total – 0.591 Dissolved – 0.500	141	0.03	0.01

Notes: Values in **bold** denote a criterion exceedance

6.3.4 Summary

Deans Marsh Creek is the eastern most creek within the investigation area and is a tributary of the Barwon River. Field observations made of sections along Deans Marsh Creek at the time of BlueSphere's inspection (November 2024) and sampling program (December 2024), the creek is generally in good condition. No obvious signs of vegetation die back, iron staining / flocculation or jarosite mineralisation were observed. Sulfidic odours were noted in soils at the time of disturbance associated with soil sampling, however no odours were observed prior to sediment disturbance.

Soil sampling data indicate that the sediment would not be classified as PASS nor AASS. Surface water samples collected from three locations along Deans Marsh Creek reported analytical results below the adopted ASS indicators. This suggests that there was no disturbance of ASS influencing surface water chemistry at the time of sampling at those locations.

7 Conclusions

BlueSphere was previously engaged by Barwon Water to conduct a hydrogeological assessment of the BDIA, which was completed in February 2025 (BlueSphere, 2025). These works were conducted as part of Barwon Water's Surrounding Environment Investigation, which aimed to determine whether the historical management of Barwon Water's groundwater pumping activities resulted in any other unintended environmentally significant adverse impacts within the broader environment, in addition to those already confirmed within Big Swamp and the lower reaches of Boundary Creek (Barwon Water, 2025).

Due to the paucity of data relating to the degree of groundwater/surface water interaction in areas along Deans Marsh, Matthews and Pennyroyal Creeks where they flow over Lower Tertiary Aquifer (LTA) outcrops up-stream of the Bambra Fault (i.e. where potential impacts could occur if there was connectivity between LTA sediments across the fault), further work was recommended. This was specifically to further establish the likely degree of groundwater/surface water interaction (if any) and potential for significant adverse impacts on naturally occurring acid sulfate soils in these areas which may be attributable to historical activities within the Barwon Downs area.

Targeted surface water and creek sediment samples were collected from the creeks where Quaternary sediments were observed within proximity to or within outcrops of the LTA. A Site inspection and surface water sampling event was completed in November 2024, with a second mobilisation for soil sampling completed in December 2024. A total of 15 locations along the three creek alignments were accessed for a visual inspection. Of the 15 locations, surface water samples were collected and analysed from 10 locations and soil samples were collected and variably analysed from 12 locations.

The results of the sediment sampling indicate that sediment at one location along each of Matthews and Pennyroyal Creeks would be classified as potential acid sulfate soils (PASS), that is naturally occurring sediment that if materially disturbed, has the potential to generate acidity. A marginal exceedance of the criterion for actual acid sulfate soil (AASS) was reported at one location along Pennyroyal Creek, however, the result is within expected error limits and therefore not considered material.

The results for the surface water samples were all below indicator values for ASS and consistent with background levels, apart from one location in Matthews Creek where some relatively subtle release of iron, sulfate and manganese to the water column was evident. Acidic pH was not observed. Given the lack of vegetation die back and the neutral pH reported in both soils and surface waters at this location, the creek is considered to have sufficiently self-regulated and neutralised. These data are consistent with a localised disturbance of ASS (either locally or upstream), for example, due to natural wetting/drying cycles, changes in hydrology, soil disturbance by stock trampling etc.

Overall, the evidence confirms that whilst sulfidic sediments are present within the stream network area assessed, including PASS at two locations, there is no widescale evidence of past oxidation of ASS, nor evidence of associated environmentally significant impacts. It is expected that widescale impacts would be evident if regional groundwater extraction from the Barwon Downs borefield attributed to creek dewatering and thus oxidation of ASS.

The findings from this investigation further suggest that there is limited hydraulic conductivity across the Bambra Fault in the vicinity of Matthews, Pennyroyal and Deans March Creeks to the extent that there is no evidence of environmentally significant impacts on naturally occurring acid sulfate soils within these streams, which is consistent with the conceptual site model for the BDIA detailed in BlueSphere 2025.

8 Limitations

This report was prepared for the sole use of Barwon Water and should not be relied upon by any other person. None of BlueSphere Environmental Pty Ltd or any of its related entities, employees or directors (each a BlueSphere Person) owes a duty of care (whether in contract, tort, statute or otherwise) to any third party with respect to or in connection with this report and no BlueSphere Person accepts any liability for any loss or damage suffered or costs incurred arising out of or in connection with the use this report by any third party.

The report has been prepared with the objectives and scope of work outlined in the proposal dated 26 October 2023. The work was carried out in accordance with the existing contract between BlueSphere and Barwon Water.

The conclusions and recommendations provided in this report are based on available information (including third party data and reports) and it is possible that different conclusions and recommendations could be made should new information become available, or with changing site conditions over time. These opinions, conclusions and recommendations are subject to uncertainty given the potentially complex nature of any subsurface environment. Variation in soil and groundwater conditions may vary significantly between the specific sampling and testing locations and other locations at the site.

The report will not be updated if anything occurs after the date of this report and BlueSphere Environmental Pty Ltd will not be obliged to inform any person of any matter arising or coming to its attention after that date.

9 References

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Tables

Table T1 - Surface Water Analytical Results

			Metals																
			Aluminium	Aluminium (filtered)	Arsenic	Arsenic (filtered)	Cadmium	Cadmium (filtered)	Chromium (III+VI)	Chromium (III+VI) (filtered)	Copper	Copper (filtered)	Iron	Iron (filtered)	Lead	Lead (filtered)	Manganese	Manganese (filtered)	Mercury	Mercury (filtered)
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL			0.01	0.01	0.001	0.001	0.0001	0.0001	0.001	0.001	0.001	0.001	0.05	0.05	0.001	0.001	0.001	0.001	0.0001	0.0001
ANZECC (2000) Stock Watering			5	5	0.5	0.5	0.01	0.01	1	1	0.5	0.5			0.1	0.1			0.002	0.002
ANZG Ecosystems Fresh Water (95%)			0.055	0.055	0.013	0.013	0.0002	0.0002	0.001	0.001	0.0014	0.0014			0.0034	0.0034	1.9	1.9	0.00006	0.00006
Recreational Water Quality NHMRC (2008) (hierarchy guidelines)					0.1	0.1	0.02	0.02	0.05	0.05	20	20	0.014	0.014	0.1	0.1	5	5	0.01	0.01
Mulvey (1993) Management of Sulfidic Clays and Sands																				
Sullivan et al. (2018) National Acid Sulfate Soils Guideline			1	1																
ANZECC (2000) Irrigation Long Term Trigger Values			**5**	**5**	**0.1**	**0.1**	**0.01**	**0.01**	**0.1**	**0.1**	**0.2**	**0.2**	**0.2**	**0.2**	**2**	**2**	**0.2**	**0.2**	**0.002**	**0.002**
ANZECC (2000) Irrigation Short Term Trigger Values			*20*	*20*	*2*	*2*	*0.05*	*0.05*	*1*	*1*	*5*	*5*	*10*	*10*	*5*	*5*	*10*	*10*	*0.002*	*0.002*
Location Code	**Monitoring Zone**	**Date**																		
DM_SW01	Deans Marsh Creek	26 Nov 2024	0.10	<0.01	0.001	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**1.38**	**0.26**	<0.001	<0.001	**2.50**	**1.58**	<0.0001	<0.0001
DM_SW02	Deans Marsh Creek	26 Nov 2024	0.60	0.04	0.002	0.001	<0.0001	<0.0001	<0.001	<0.001	0.002	<0.001	**2.99**	**1.25**	<0.001	<0.001	**0.635**	**0.567**	<0.0001	<0.0001
DM_SW03	Deans Marsh Creek	26 Nov 2024	0.16	<0.01	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**0.86**	**0.26**	<0.001	<0.001	**0.591**	**0.500**	<0.0001	<0.0001
MC_SW02	Matthews Creek	26 Nov 2024	0.22	0.07	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**6.63**	**4.10**	<0.001	<0.001	**1.65**	**1.54**	<0.0001	<0.0001
MC_SW04	Matthews Creek	26 Nov 2024	0.14	0.02	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**0.54**	**0.24**	<0.001	<0.001	0.068	0.057	<0.0001	<0.0001
MC_SW05	Matthews Creek	26 Nov 2024	0.58	0.03	0.001	0.001	<0.0001	<0.0001	<0.001	<0.001	0.002	<0.001	**2.09**	**0.84**	<0.001	<0.001	**1.10**	**1.05**	<0.0001	<0.0001
MC_SW06	Matthews Creek	11 Dec 2024	0.29	0.04	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**0.91**	**0.48**	<0.001	<0.001	0.030	0.021	<0.0001	<0.0001
PC_SW01	Pennyroyal Creek	25 Nov 2024	0.49	0.05	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**1.74**	**0.87**	<0.001	<0.001	0.028	0.021	<0.0001	<0.0001
PC_SW03	Pennyroyal Creek	25 Nov 2024	0.23	0.04	0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**1.93**	**1.02**	<0.001	<0.001	0.116	0.103	<0.0001	<0.0001
PC_SW06	Pennyroyal Creek	25 Nov 2024	0.06	0.02	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	**2.10**	**1.01**	<0.001	<0.001	**0.695**	**0.664**	<0.0001	<0.0001

Environmental Standards
DoE, 2000, ANZECC (2000) Irrigation Long Term Trigger Values
DoE, 2000, ANZECC (2000) Irrigation Short Term Trigger Values

Table T1 - Surface Water Analytical Results

																Inorganics			
			Nickel	Nickel (filtered)	Zinc	Zinc (filtered)	Sulfate as SO4 - Turbidimetric (filtered)	Sulfate/Alkalinity Ratio	Sulfate/Chloride Ratio	Nitrite + Nitrate as N	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Anions Total	Calcium (filtered)	Cations Total	Chloride	Ionic Balance	Kjeldahl Nitrogen Total
			mg/L	mg/L	mg/L	mg/L	mg/L	-	-	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	meq/L	mg/L	%	mg/L
EQL			0.001	0.001	0.005	0.005	1	-	-	0.01	1	1	1	1	0.01	1	0.01	1	0.01	0.1
ANZECC (2000) Stock Watering			1	1	20	20	2,000									1,000				
ANZG Ecosystems Fresh Water (95%)			0.011	0.011	0.008	0.008														
Recreational Water Quality NHMRC (2008) (hierarchy guidelines)			0.2	0.2	3	3	5,000													
Mulvey (1993) Management of Sulfidic Clays and Sands									0.5											
Sullivan et al. (2018) National Acid Sulfate Soils Guideline								0.2						<10						
ANZECC (2000) Irrigation Long Term Trigger Values			**0.2**	**0.2**	**2**	**2**												**175**		
ANZECC (2000) Irrigation Short Term Trigger Values			*2*	*2*	*5*	*5*														
Location Code	**Monitoring Zone**	**Date**																		
DM_SW01	Deans Marsh Creek	26 Nov 2024	<0.001	<0.001	<0.005	<0.005	8	0.03	0.01	0.02	252	<1	<1	252	21.0	48	19.1	**562**	4.95	1.0
DM_SW02	Deans Marsh Creek	26 Nov 2024	0.002	0.001	<0.005	<0.005	4	0.04	0.02	0.09	114	<1	<1	114	7.55	27	7.21	**184**	2.29	2.7
DM_SW03	Deans Marsh Creek	26 Nov 2024	0.002	0.001	<0.005	<0.005	4	0.03	0.01	<0.01	141	<1	<1	141	11.8	30	11.0	**316**	3.78	0.8
MC_SW02	Matthews Creek	26 Nov 2024	0.006	0.006	0.007	<0.005	16	0.32	0.05	0.02	50	<1	<1	50	10.1	13	8.49	**311**	8.67	3.4
MC_SW04	Matthews Creek	26 Nov 2024	<0.001	<0.001	<0.005	<0.005	3	0.06	0.06	0.03	54	<1	<1	54	2.50	10	2.47	48	-	0.3
MC_SW05	Matthews Creek	26 Nov 2024	0.002	0.002	0.013	<0.005	3	0.04	0.02	0.04	69	<1	<1	69	5.50	15	5.17	144	3.11	0.6
MC_SW06	Matthews Creek	11 Dec 2024	<0.001	<0.001	<0.005	<0.005	4	0.09	0.10	-	46	<1	<1	46	2.16	6	1.84	41	-	-
PC_SW01	Pennyroyal Creek	25 Nov 2024	<0.001	<0.001	<0.005	<0.005	2	0.04	0.04	0.09	41	10	<1	51	2.50	8	2.42	51	-	0.4
PC_SW03	Pennyroyal Creek	25 Nov 2024	<0.001	<0.001	<0.005	<0.005	2	0.04	0.03	0.04	48	<1	<1	48	2.64	8	2.59	58	-	0.4
PC_SW06	Pennyroyal Creek	25 Nov 2024	<0.001	<0.001	<0.005	<0.005	<1	0.02	0.01	<0.01	53	<1	<1	53	3.06	9	3.04	71	0.32	0.4

Environmental Standards
DoE, 2000, ANZECC (2000) Irrigation Long Term Trigger Values
DoE, 2000, ANZECC (2000) Irrigation Short Term Trigger Values

Table T1 - Surface Water Analytical Results

	Magnesium (filtered)	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total)	Potassium (filtered)	Sodium (filtered)	Total Dissolved Solids (Lab)
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL	1	0.01	0.01	0.1	1	1	10
ANZECC (2000) Stock Watering		90	9				3,000
ANZG Ecosystems Fresh Water (95%)		2.4					
Recreational Water Quality NHMRC (2008) (hierarchy guidelines)		113	9.1				
Mulvey (1993) Management of Sulfidic Clays and Sands							
Sullivan et al. (2018) National Acid Sulfate Soils Guideline							
ANZECC (2000) Irrigation Long Term Trigger Values				**5**		**115**	
ANZECC (2000) Irrigation Short Term Trigger Values				*25*			
Location Code	**Monitoring Zone**	**Date**						
DM_SW01	Deans Marsh Creek	26 Nov 2024	52	0.02	<0.01	1.0	5	**282**	-
DM_SW02	Deans Marsh Creek	26 Nov 2024	23	0.09	<0.01	2.8	4	89	-
DM_SW03	Deans Marsh Creek	26 Nov 2024	31	<0.01	<0.01	0.8	3	**157**	-
MC_SW02	Matthews Creek	26 Nov 2024	17	0.02	<0.01	3.4	2	**147**	-
MC_SW04	Matthews Creek	26 Nov 2024	7	0.03	<0.01	0.3	2	31	-
MC_SW05	Matthews Creek	26 Nov 2024	14	0.04	<0.01	0.6	2	74	-
MC_SW06	Matthews Creek	11 Dec 2024	5	-	-	-	2	24	143
PC_SW01	Pennyroyal Creek	25 Nov 2024	7	0.09	<0.01	0.5	2	32	-
PC_SW03	Pennyroyal Creek	25 Nov 2024	7	0.04	<0.01	0.4	2	36	-
PC_SW06	Pennyroyal Creek	25 Nov 2024	9	<0.01	<0.01	0.4	1	42	-

Environmental Standards
DoE, 2000, ANZECC (2000) Irrigation Long Term Trigger Values
DoE, 2000, ANZECC (2000) Irrigation Short Term Trigger Values

Table T2 - Acid Sulfate Soil Analytical Results

					pH Screening Results				Chromium Suite Results								
									Existing Acidity		Potential Acidity	Acid-Base Accounting				Liming Rate	
					pH_F	pH_{FOX}	ΔpH	Reaction Intensity (1,2,3,4)*	pH_{KCl}	Titratable Actual Acidity (TAA)	Chromium Reducible Sulfur (S_{CR})	Acid Neutralising Capacity (ANC)	Acid Neutralising Capacity (ANC)	Net Acidity	Net Acidity, excl. ANC	Liming Rate, 100%NV	Liming Rate, 100%NV excl. ANC
					pH Unit	pH Unit	pH Unit		pH Unit	%S	%S	% CaCO3	%S	%S	%S	kg CaCO3/t	kg CaCO3/t
Sullivan et al (2018a: Table 1.1) Action criteria (1 - 1,000t disturbed) - Medium Soils					**4**		**1**			**0.06**	**0.06**			**0.06**	**0.06**		
EPA Victoria Publication 655.1					4	3	2	2									
Location ID	**Depth (m bGL)**	**Sample Code**	**Lithology**	**Creek**													
DM_SW02	0.0	EB2444282044	Sandy Silt	Deans Marsh Creek	6.9	3.6	**3.3**	2	6.0	<0.02	0.011	0.85	0.27	<0.02	-	<1	<1
DM_SW02	0.2	EB2444282045	Clayey Silt	Deans Marsh Creek	7.0	3.3	**3.7**	2	-	-	-	-	-	-	-	-	-
DM_SW02	0.5	EB2444282046	Clayey Silt	Deans Marsh Creek	6.5	2.9	**3.6**	2	5.2	0.02	0.014	0.62	0.2	0.03	-	2	2
DM_SW02	0.7	EB2444282047	Clayey Silt	Deans Marsh Creek	6.6	3.0	**3.6**	2	-	-	-	-	-	-	-	-	-
DM_SW02	1.0	EB2444282048	Clayey Silt	Deans Marsh Creek	6.4	2.8	**3.6**	2	5.0	0.03	0.016	0.45	0.14	0.04	-	2	2
DM_SW03	0.0	EB2444282032	Clayey Silt	Deans Marsh Creek	7.1	3.1	**4.0**	2	5.9	<0.02	0.016	0.14	0.04	<0.02	-	<1	<1
DM_SW03	0.2	EB2444282033	Clayey Silt	Deans Marsh Creek	7.3	3.7	**3.6**	3	6.6	<0.02	0.014	0.08	0.03	<0.02	<0.02	<1	<1
MC_SW01	0.0	EB2444282021	Clayey Silt	Matthews Creek	6.6	2.6	**4.0**	3	5.8	0.02	0.021	0.77	0.24	0.04	-	2	2
MC_SW02	0.0	EB2444282015	Sandy Silt	Matthews Creek	6.3	2.1	**4.2**	3	5.3	0.04	**0.118**	0.55	0.18	**0.16**	-	8	8
MC_SW04	0.0	EB2444282022	Gravelly Silt	Matthews Creek	6.5	3.4	**3.1**	2	5.4	<0.02	0.013	0.45	0.14	0.03	-	1	1
MC_SW04	0.2	EB2444282023	Gravelly Silt	Matthews Creek	6.6	3.7	**2.9**	2	-	-	-	-	-	-	-	-	-
MC_SW04	0.5	EB2444282024	Gravelly Silt	Matthews Creek	6.5	3.8	**2.7**	2	4.9	0.02	0.013	0.84	0.27	0.04	-	2	2
MC_SW04	0.7	EB2444282025	Clayey Silt	Matthews Creek	6.4	3.7	**2.7**	2	5.0	<0.02	0.012	0.53	0.17	0.03	-	1	1
MC_SW04	1.0	EB2444282026	Gravelly Silt	Matthews Creek	6.5	4.1	**2.4**	2	-	-	-	-	-	-	-	-	-
MC_SW05	0.0	EB2444282039	Silty Clay	Matthews Creek	7.3	4.0	**3.3**	2	5.6	<0.02	0.013	0.63	0.2	0.02	-	1	1
MC_SW05	0.2	EB2444282040	Silty Clay	Matthews Creek	7.4	4.0	**3.4**	2	-	-	-	-	-	-	-	-	-
MC_SW05	0.5	EB2444282041	Silty Clay	Matthews Creek	7.3	4.3	**3.0**	2	5.8	<0.02	0.012	0.69	0.22	<0.02	-	<1	<1
MC_SW05	0.7	EB2444282042	Silty Clay	Matthews Creek	7.3	4.4	**2.9**	2	5.7	<0.02	0.011	0.69	0.22	<0.02	-	<1	<1
MC_SW05	1.0	EB2444282043	Silty Clay	Matthews Creek	7.2	4.7	**2.5**	2	-	-	-	-	-	-	-	-	-
MC_SW06	0.0	EB2444282034	Clayey Silt	Matthews Creek	6.2	1.7	**4.5**	3	5.0	0.06	0.032	0.81	0.26	**0.09**	-	4	4
MC_SW06	0.2	EB2444282035	Clayey Silt	Matthews Creek	6.2	2.6	**3.6**	3	4.9	0.03	0.014	0.22	0.07	0.05	-	2	2
MC_SW06	0.5	EB2444282036	Sandy Silt	Matthews Creek	6.6	3.2	**3.4**	2	-	-	-	-	-	-	-	-	-
MC_SW06	0.7	EB2444282037	Sandy Silt	Matthews Creek	7.0	4.1	**2.9**	2	-	-	-	-	-	-	-	-	-
MC_SW06	1.0	EB2444282038	Sandy Silt	Matthews Creek	6.9	3.7	**3.2**	2	5.3	<0.02	0.012	0.6	0.19	0.03	-	1	1
PC_SW01	0.0	EB2444282027	Sandy Silt	Pennyroyal Creek	6.2	4.0	**2.2**	3	5.2	0.02	0.02	0.22	0.07	0.04	-	2	2
PC_SW01	0.2	EB2444282028	Sandy Silt	Pennyroyal Creek	6.1	2.2	**3.9**	3	-	-	-	-	-	-	-	-	-
PC_SW01	0.5	EB2444282029	Sandy Silt	Pennyroyal Creek	6.0	1.9	**4.1**	3	4.8	0.05	0.014	0.2	0.06	**0.07**	-	3	3
PC_SW01	0.7	EB2444282030	Sandy Silt	Pennyroyal Creek	6.0	1.7	**4.3**	2	4.8	0.06	0.015	0.1	0.03	**0.07**	-	3	3
PC_SW01	1.0	EB2444282031	Clayey Silt	Pennyroyal Creek	6.3	2.9	**3.4**	2	-	-	-	-	-	-	-	-	-
PC_SW02	0.0	EB2444282001	Sandy Silt	Pennyroyal Creek	6.1	1.7	**4.4**	3	5.0	0.05	0.04	0.58	0.18	**0.09**	-	4	4
PC_SW02	0.2	EB2444282002	Sandy Silt	Pennyroyal Creek	6.1	1.6	**4.5**	4	4.8	**0.08**	0.042	0.56	0.18	**0.12**	-	6	6
PC_SW02	0.5	EB2444282003	Silty Sand	Pennyroyal Creek	6.1	2.7	**3.4**	2	-	-	-	-	-	-	-	-	-
PC_SW02	0.7	EB2444282004	Silty Sand	Pennyroyal Creek	6.3	1.7	**4.6**	3	-	-	-	-	-	-	-	-	-
PC_SW02	1.0	EB2444282005	Sandy Silt	Pennyroyal Creek	6.2	1.6	**4.6**	3	4.8	**0.07**	**0.068**	1	0.32	**0.14**	-	7	7
PC_SW04	0.0	EB2444282006	Sandy Silt	Pennyroyal Creek	5.9	2.2	**3.7**	3	5.0	0.03	0.018	0.19	0.06	0.05	-	2	2
PC_SW04	0.2	EB2444282007	Sandy Silt	Pennyroyal Creek	5.8	2.1	**3.7**	3	-	-	-	-	-	-	-	-	-
PC_SW04	0.5	EB2444282008	Sandy Silt	Pennyroyal Creek	5.9	2.2	**3.7**	3	5.0	0.03	0.016	0.02	<0.01	0.04	-	2	2
PC_SW04	0.7	EB2444282009	Sandy Silt	Pennyroyal Creek	5.9	2.1	**3.8**	3	4.7	0.05	0.018	0.08	0.02	**0.07**	-	3	3
PC_SW04	1.0	EB2444282010	Clayey Silt	Pennyroyal Creek	6.0	2.2	**3.8**	2	-	-	-	-	-	-	-	-	-
PC_SW05	0.0	EB2444282011	Silty Clay	Pennyroyal Creek	6.1	2.4	**3.7**	3	5.6	0.03	0.023	0.77	0.25	0.05	-	2	2
PC_SW05	0.2	EB2444282012	Silty Clay	Pennyroyal Creek	6.0	2.2	**3.8**	3	5.2	0.03	0.016	0.4	0.13	0.04	-	2	2
PC_SW05	0.5	EB2444282013	Silty Clay	Pennyroyal Creek	6.3	4.1	**2.2**	2	-	-	-	-	-	-	-	-	-
PC_SW05	0.7	EB2444282014	Sandy Gravel	Pennyroyal Creek	6.1	3.9	**2.2**	2	5.6	<0.02	0.016	0.03	<0.01	0.02	-	1	1
PC_SW06	0.0	EB2444282016	Clayey Silt	Pennyroyal Creek	5.3	2.2	**3.1**	3	5.0	0.06	0.018	0.5	0.16	**0.08**	-	4	4
PC_SW06	0.2	EB2444282017	Clayey Silt	Pennyroyal Creek	6.0	2.6	**3.4**	3	-	-	-	-	-	-	-	-	-
PC_SW06	0.5	EB2444282018	Clayey Silt	Pennyroyal Creek	6.0	2.4	**3.6**	2	5.0	0.04	0.025	0.07	0.02	0.06	-	3	3
PC_SW06	0.8	EB2444282019	Clayey Silt	Pennyroyal Creek	6.1	2.6	**3.5**	2	-	-	-	-	-	-	-	-	-
PC_SW06	1.0	EB2444282020	Clayey Silt	Pennyroyal Creek	6.1	2.9	**3.2**	2	4.9	0.04	0.024	0.07	0.02	**0.07**	-	3	3

Notes

- Not tested

Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme

Produced By: JH
Checked By: BS

Figures

PROJECT ID 31155.03
DATE 24/03/2025
CREATED BY AF

BlueSphere ENVIRONMENTAL

Legend

- Approximate Extent of ASS Investigation Areas
- Barwon Downs Graben
- SDL Catchment Areas
- Watercourse

N

0 1 2 3 4 5
Kilometres

1:110,000 when printed at A3
GDA 1994 MGA Zone 54
Imagery: Nearmap 2019

SITE SETTING PLAN

Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

Barwon Downs Sub-basin Area
Barwon Water

Figure F1

O:\3_VIC\31150 to 31169\31155_BW_Hydro_Loves_Creek\8.GIS\31155_Barwon.aprx.mxd

PROJECT ID	31155.03
DATE	24/03/2025
CREATED BY	EA
UPDATED BY	AF

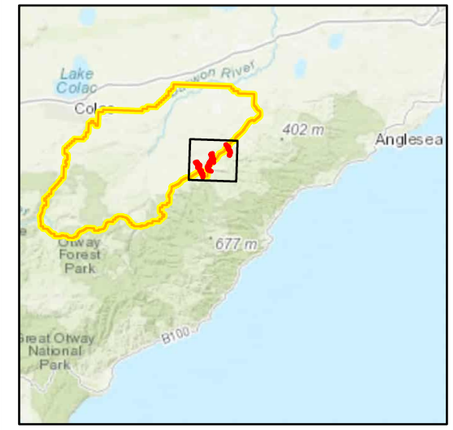
BlueSphere ENVIRONMENTAL

Legend

- Investigation Area
- Barwon Downs Graben
- LTA (Pebble Point, Dilwyn, Eastern View and Mepunga Sands Formations)
- Geological Faults
- Watercourse
- Surface Water Sampling Location (BSE, 2024)
- Surface Water and Soil Sampling Location (BSE, 2024)
- Inaccessible Location

Surface Geology (1:50,000) (DELWP)

- Quaternary Sediments
- Gellibrand Marl Formation
- Nirranda Group (Narrawaturk Marl)
- Lower Tertiary Aquifer (Pebble Point, Pember Mudstone, Dilwyn, Eastern View and Mepunga Formations)
- Otway Group



Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Imagery: Earthstar Geographics

N

0 0.25 0.5 0.75 1 1.25
Kilometres

1:25,000 when printed at A3
GDA 1994 MGA Zone 55

SITE LOCATION AND LAYOUT PLAN

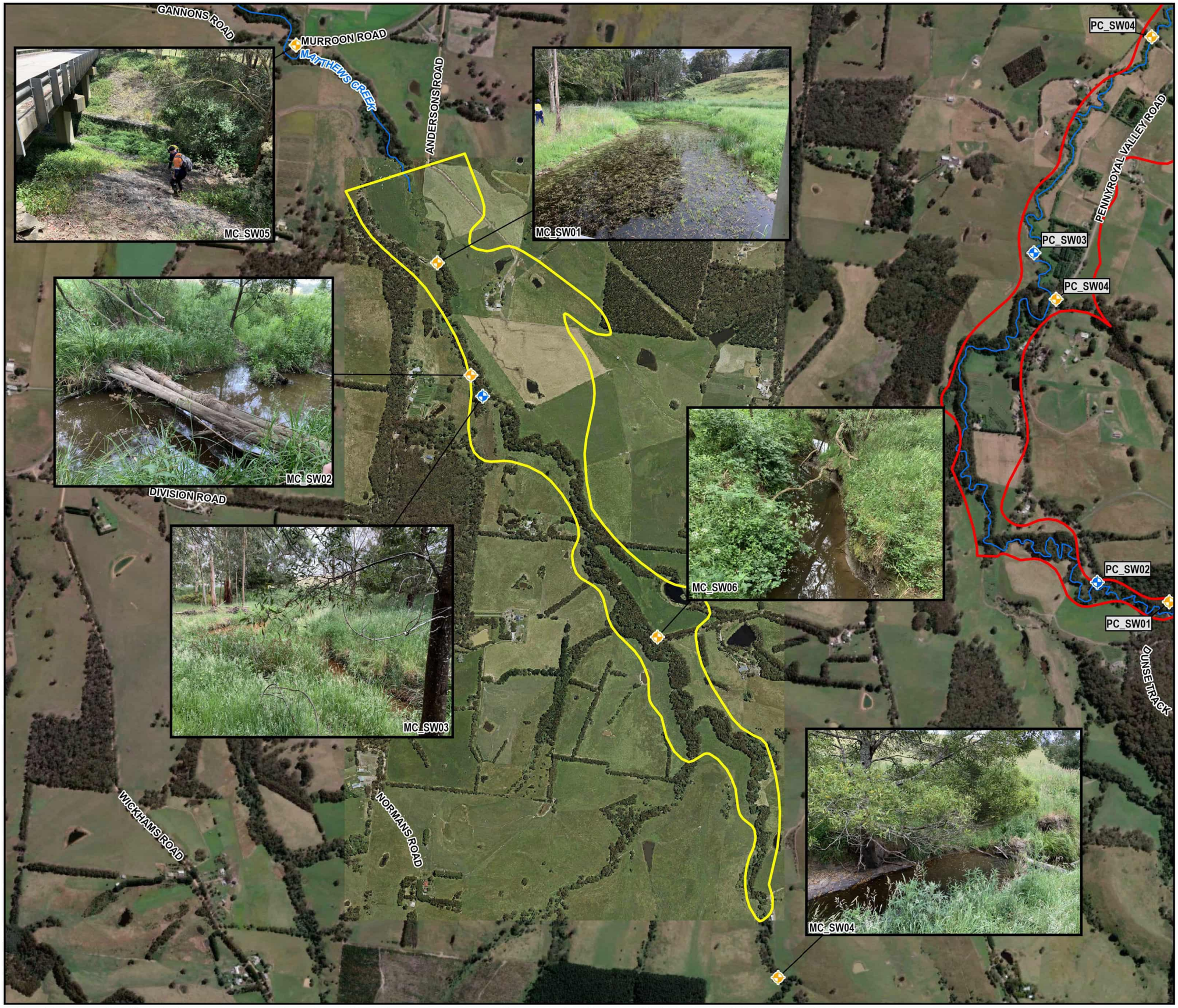
Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

DRAFT

Figure **F2**

Barwon Downs Sub-basin Area
Barwon Water

O:\3_VIC\31150 to 31169\31155_BW_Hydro_Loves_Creek\8.GIS\31155_Barwon.aprx.mxd



PROJECT ID 31155.03
DATE 26/06/2025
CREATED BY EA
UPDATED BY AF

BlueSphere ENVIRONMENTAL

Legend

- Area of Interest
- Investigation Area
- Watercourse
- Surface Water Sampling Location (BSE, 2024)
- Surface Water and Soil Sampling Location (BSE, 2024)

N

0 0.1 0.2 0.3 0.4 0.5
Kilometres

1:12,500 when printed at A3
GDA 1994 MGA Zone 55
Imagery: Barwon Water 02/12/2022

MATTHEWS CREEK SAMPLING PLAN

Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

DRAFT

Figure
F3

Barwon Downs Sub-basin Area
Barwon Water

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PROJECT ID 31155.03
DATE 26/06/2025
CREATED BY EA
UPDATED BY AF

BlueSphere ENVIRONMENTAL

Legend

- Area of Interest
- Investigation Area
- Watercourse
- Surface Water Sampling Location (BSE, 2024)
- Surface Water and Soil Sampling Location (BSE, 2024)

PENNYROYAL STATION ROAD
BUSHS ROAD
PENNYROYAL VALLEY ROAD
CARRONG TRACK
PENNYROYAL-WYMBOOLIEL ROAD
SINCOCKS ROAD

PC_SW01
PC_SW02
PC_SW03
PC_SW04
PC_SW05
PC_SW06
MC_SW06

N

0 0.1 0.2 0.3 0.4 0.5
Kilometres

1:12,000 when printed at A3
GDA 1994 MGA Zone 55
Imagery: Barwon Water 23/01/2024

PENNYROYAL CREEK SAMPLING PLAN

Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

DRAFT

Figure **F4**

Barwon Downs Sub-basin Area
Barwon Water

O:\3_VIC\31150 to 31169\31155_BW_Hydro_Loves_Creek\8.GIS\31155_Barwon.aprx.mxd

PROJECT ID 31155.03
DATE 26/06/2025
CREATED BY EA
UPDATED BY AF

BlueSphere ENVIRONMENTAL

Legend

- Area of Interest
- Watercourse
- Surface Water Sampling Location (BSE, 2024)
- Surface Water and Soil Sampling Location (BSE, 2024)
- Inaccessible Location

N

0 0.09 0.18 0.27 0.36 0.45

Kilometres

1:9,000 when printed at A3
GDA 1994 MGA Zone 55
Imagery: Barwon Water 23/01/2024

DEANS MARSH CREEK SAMPLING PLAN

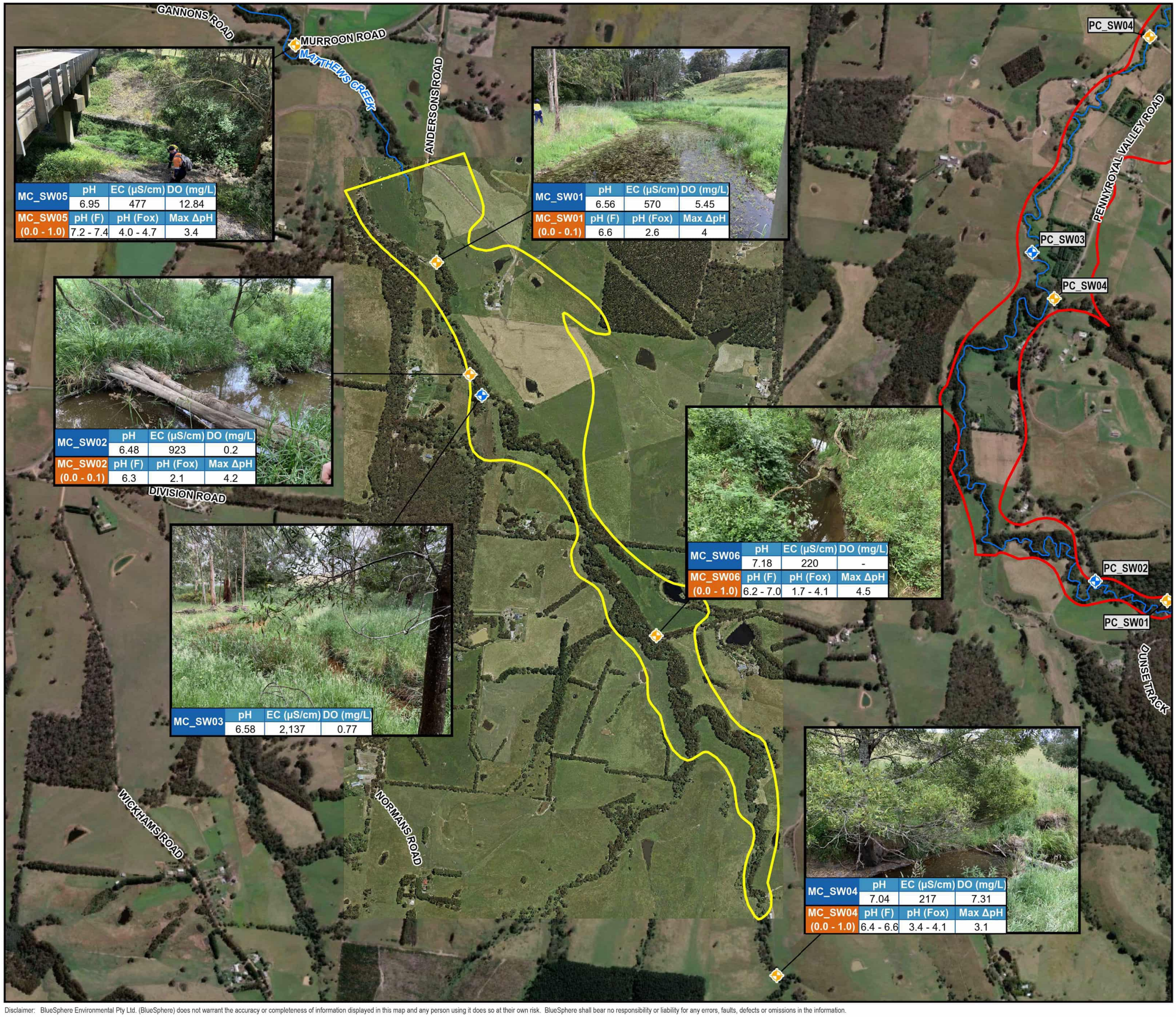
Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

DRAFT

Figure **F5**

Barwon Downs Sub-basin Area
Barwon Water

O:\3_VIC\31150 to 31169\31155_BW_Hydro_Loves_Creek\8.GIS\31155_Barwon.aprx.mxd



MC_SW05	pH	EC (µS/cm)	DO (mg/L)
	6.95	477	12.84
MC_SW05	pH (F)	pH (Fox)	Max ΔpH
(0.0 - 1.0)	7.2 - 7.4	4.0 - 4.7	3.4

MC_SW01	pH	EC (µS/cm)	DO (mg/L)
	6.56	570	5.45
MC_SW01	pH (F)	pH (Fox)	Max ΔpH
(0.0 - 0.1)	6.6	2.6	4

MC_SW02	pH	EC (µS/cm)	DO (mg/L)
	6.48	923	0.2
MC_SW02	pH (F)	pH (Fox)	Max ΔpH
(0.0 - 0.1)	6.3	2.1	4.2

MC_SW06	pH	EC (µS/cm)	DO (mg/L)
	7.18	220	-
MC_SW06	pH (F)	pH (Fox)	Max ΔpH
(0.0 - 1.0)	6.2 - 7.0	1.7 - 4.1	4.5

MC_SW03	pH	EC (µS/cm)	DO (mg/L)
	6.58	2,137	0.77

MC_SW04	pH	EC (µS/cm)	DO (mg/L)
	7.04	217	7.31
MC_SW04	pH (F)	pH (Fox)	Max ΔpH
(0.0 - 1.0)	6.4 - 6.6	3.4 - 4.1	3.1

PROJECT ID	31155.03
DATE	26/06/2025
CREATED BY	EA
UPDATED BY	AF

BlueSphere ENVIRONMENTAL

Legend

- Area of Interest
- Investigation Area
- Watercourse
- Surface Water Sampling Location (BSE, 2024)
- Surface Water and Soil Sampling Location (BSE, 2024)

Surface Water Location	Analyte
	Reported Concentration
Soil Location (Depth mbgl)	**Analyte**
	Reported Concentration

N

0 0.1 0.2 0.3 0.4 0.5

Kilometres

1:12,500 when printed at A3
GDA 1994 MGA Zone 55
Imagery: Barwon Water 02/12/2022

MATTHEWS CREEK ASS FIELD INDICATORS

Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

DRAFT

Figure
F6a

Barwon Downs Sub-basin Area
Barwon Water

O:\3_VIC\31150 to 31169\31155_BW_Hydro_Loves_Creek\8.GIS\31155_Barwon.aprx.mxd

PENNYROYAL STATION ROAD

BUSHS ROAD

PC_SW06

CARRONG TRACK

PENNYROYAL VALLEY ROAD

PENNYROYAL-WYMBOOLIEL ROAD

SINCOCKS ROAD

MC_SW06

PC_SW06	pH	EC (µS/cm)	DO (mg/L)
	6.44	216	3.96
PC_SW06 (0.0 - 1.0)	pH (F)	pH (Fox)	Max ΔpH
	5.3 - 6.1	2.2 - 2.9	3.6

PC_SW05	pH	EC (µS/cm)	DO (mg/L)
	6.44	218	2.11
PC_SW05 (0.0 - 0.7)	pH (F)	pH (Fox)	Max ΔpH
	6.0 - 6.3	2.2 - 4.1	3.8

PC_SW03	pH	EC (µS/cm)	DO (mg/L)
	6.42	216	4.34

PC_SW04	pH	EC (µS/cm)	DO (mg/L)
	6.26	204	4.11
PC_SW04 (0.0 - 1.0)	pH (F)	pH (Fox)	Max ΔpH
	5.8 - 6.0	2.1 - 2.2	3.8

PC_SW02	pH	EC (µS/cm)	DO (mg/L)
	6.32	238	8.25
PC_SW02 (0.0 - 1.0)	pH (F)	pH (Fox)	Max ΔpH
	6.1 - 6.3	1.6 - 2.7	4.6

PC_SW01	pH	EC (µS/cm)	DO (mg/L)
	6.34	239	9.44
PC_SW01 (0.0 - 1.0)	pH (F)	pH (Fox)	Max ΔpH
	6.0 - 6.3	1.7 - 4.0	4.3

Maxar

PROJECT ID 31155.03
DATE 26/06/2025
CREATED BY EA
UPDATED BY AF

BlueSphere ENVIRONMENTAL

Legend

- Area of Interest
- Investigation Area
- Watercourse
- Surface Water Sampling Location (BSE, 2024)
- Surface Water and Soil Sampling Location (BSE, 2024)

Surface Water Location	Analyte
	Reported Concentration
Soil Location (Depth mbgl)	**Analyte**
	Reported Concentration

N

0 0.1 0.2 0.3 0.4 0.5

Kilometres

1:12,000 when printed at A3
GDA 1994 MGA Zone 55
Imagery: Barwon Water 23/01/2024

PENNYROYAL CREEK ASS FIELD INDICATORS

Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

DRAFT

Figure **F6b**

Barwon Downs Sub-basin Area
Barwon Water

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PROJECT ID 31155.03
DATE 26/06/2025
CREATED BY EA
UPDATED BY AF

BlueSphere ENVIRONMENTAL

Legend

- Area of Interest
- Watercourse
- Surface Water Sampling Location (BSE, 2024)
- Surface Water and Soil Sampling Location (BSE, 2024)
- Inaccessible Location

Surface Water Location	Analyte
	Reported Concentration
Soil Location (Depth mbgl)	**Analyte**
	Reported Concentration

N

0 0.09 0.18 0.27 0.36 0.45

Kilometres

1:9,000 when printed at A3
GDA 1994 MGA Zone 55
Imagery: Barwon Water 23/01/2024

DEANS MARSH CREEK ASS FIELD INDICATORS

Barwon Downs Sub-Basin - Three Creeks Environmental Investigation

DRAFT

Figure **F6c**

Barwon Downs Sub-basin Area
Barwon Water

O:\3_VIC\31150 to 31169\31155_BW_Hydro_Loves_Creek\8.GIS\31155_Barwon.aprx.mxd

Appendix A
Lithological Logs

SOIL BORE

Location DM_SW02

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Nov 2024
Completion Date: 12 Nov 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 229351 mE, 5743900 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0.05			DM_SW02_0.0	Y	Natural Material		SANDY SILT brown, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining	0
0.1								
0.15								
0.2			DM_SW02_0.2	Y				
0.25					Natural Material		CLAYEY SILT dark brown, soft, wet, low plasticity, distinct hydrogen sulphide odour, no staining, some sands, some light brown mottling	0.2
0.3								
0.35								
0.4								
0.45								
0.5	Backfill		DM_SW02_0.5	Y				
0.55					Natural Material		CLAYEY SILT dark brown-dark grey, soft, wet, low plasticity, distinct hydrogen sulphide odour, no staining, some fine sands, becoming darker in colour and more grey	0.5
0.6								
0.65								
0.7			DM_SW02_0.7	Y				
0.75								
0.8								
0.85								
0.9								
0.95								
1			DM_SW02_1.0	Y				
							Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location DM_SW03

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Oct 2024
Completion Date: 12 Oct 2024
Total Depth: 0.2 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 229038 mE, 5744537 mN
Backfill: 0.0 - 0.2 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0.02	Backfill		DM_SW03_0.0	Y	Natural Material		CLAYEY SILT dark grey, soft, wet, non plastic, distinct hydrogen sulphide odour, no staining, with organic matter. Refusal on outcropping LTA geology	0
0.2			DM_SW03_0.2	Y			Termination Depth at:0.20 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location MC_SW01

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Oct 2024
Completion Date: 12 Oct 2024
Total Depth: 0.1 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 223785 mE, 5741494 mN
Backfill: 0.0 - 0.1 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0.02 0.04 0.06 0.08 0.1	Backfill		MC_SW01_0.0	Y	Natural Material		CLAYEY SILT dark grey, soft, wet, non plastic, distinct hydrogen sulphide odour, no staining, with organic matter	0
0.12 0.14 0.16 0.18 0.2 0.22 0.24 0.26 0.28 0.3 0.32 0.34 0.36 0.38 0.4 0.42 0.44 0.46 0.48							Termination Depth at:0.10 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location MC_SW02

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Sep 2024
Completion Date: 12 Sep 2024
Total Depth: 0.1 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 223902 mE, 5741101 mN
Backfill: 0.0 - 0.1 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0.02	Backfill		MC_SW02_0.0	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining	0
0.04								
0.06								
0.08								
0.1							Termination Depth at:0.10 m.	
0.12								
0.14								
0.16								
0.18								
0.2								
0.22								
0.24								
0.26								
0.28								
0.3								
0.32								
0.34								
0.36								
0.38								
0.4								
0.42								
0.44								
0.46								
0.48								

Logged by: BS
Checked by: JH

SOIL BORE

Location MC_SW04

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Oct 2024
Completion Date: 12 Oct 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 224977 mE, 5738993 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0			MC_SW04_0.0	Y	Natural Material		GRAVELLY SILT dark grey, loose, wet, profuse sub-angular fine gravels, no odour, no staining, profuse fine to coarse gravels, with organic matter	0
0.2			MC_SW04_0.2	Y				
0.5	Backfill		MC_SW04_0.5	Y	Natural Material		CLAYEY SILT dark grey, soft, wet, non plastic, no odour, no staining, may sub-angular fine to coarse grained gravels	0.5
0.7			MC_SW04_0.7	Y	Natural Material		GRAVELLY SILT dark grey, loose, wet, profuse sub-angular fine gravels, no odour, no staining, with clay, profuse fine to coarse gravels	0.7
1			MC_SW04_1.0	Y			Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location MC_SW05

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Nov 2024
Completion Date: 12 Nov 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 223289 mE, 5742257 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0.05			MC_SW05_0.0	Y	Natural Material		SILTY CLAY brown, soft, wet, low plasticity, distinct hydrogen sulphide odour, no staining	0
0.1								
0.15								
0.2			MC_SW05_0.2	Y	Natural Material		SILTY CLAY brown-grey, soft, wet, non plastic, distinct hydrogen sulphide odour, no staining, with fine grained sand, trace fine angular gravels	0.2
0.25								
0.3								
0.35								
0.4								
0.45								
0.5	Backfill		MC_SW05_0.5	Y				
0.55								
0.6								
0.65								
0.7			MC_SW05_0.7	Y				
0.75								
0.8								
0.85								
0.9					Natural Material		SILTY CLAY brown-grey, soft, wet, low plasticity, distinct hydrocarbon odour, no staining, some orange and red mottling	0.9
0.95								
1			MC_SW05_1.0	Y				
							Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location MC_SW06

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Nov 2024
Completion Date: 12 Nov 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 224554 mE, 5740185 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0			MC_SW06_0.0	Y	Natural Material		CLAYEY SILT dark brown-grey, soft, loose, wet, low plasticity, fine grained sand, distinct hydrogen sulphide odour, no staining, becoming lighter in colour	0
0.2			MC_SW06_0.2	Y				
0.4					Natural Material		SANDY SILT brown, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, with clay	0.4
0.5	Backfill		MC_SW06_0.5	Y				
0.6					Natural Material		SANDY SILT brown, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, some red / orange mottles	0.6
0.7			MC_SW06_0.7	Y				
1			MC_SW06_1.0	Y				
							Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location PC_SW01

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Oct 2024
Completion Date: 12 Oct 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 226347 mE, 5740308 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0.05	Backfill		PC_SW01_0.0	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining	0
0.1								
0.15								
0.2			PC_SW01_0.2	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, very few fine, sub-angular gravels	0.2
0.25								
0.3								
0.35								
0.4								
0.45								
0.5			PC_SW01_0.5	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, Very few fine, sub-angular gravels, less sandy and more clayey	0.5
0.55								
0.6								
0.65								
0.7			PC_SW01_0.7	Y	Natural Material		CLAYEY SILT dark grey, firm, wet, low plasticity, distinct hydrogen sulphide odour, no staining	0.8
0.75								
0.8								
0.85								
0.9								
0.95								
1			PC_SW01_1.0	Y			Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location PC_SW02

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Sep 2024
Completion Date: 12 Sep 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 226095 mE, 5740377 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0			PC_SW02_0.0	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, common organic matter	0
0.2			PC_SW02_0.2	Y	Natural Material		SILTY SAND dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining	0.2
0.5	Backfill		PC_SW02_0.5	Y	Natural Material		SILTY SAND dark grey, loose, wet, medium grained sand, very few sub-angular fine gravels, distinct hydrogen sulphide odour, no staining	0.5
0.7			PC_SW02_0.7	Y	Natural Material		SILTY SAND dark grey, loose, wet, medium grained sand, very few sub-angular fine gravels, distinct hydrogen sulphide odour, no staining, less gravels	0.7
0.9			PC_SW02_1.0	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining	0.9
1							Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location PC_SW04

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Sep 2024
Completion Date: 12 Sep 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 225951 mE, 5741367 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0			PC_SW04_0.0	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, Lots of rootlets and organic matter	0
0.2			PC_SW04_0.2	Y	Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, with some clays, common rootlets	0.2
0.5	Backfill		PC_SW04_0.5	Y				
0.7			PC_SW04_0.7	Y				
0.9					Natural Material		CLAYEY SILT dark grey, soft, wet, low plasticity, distinct hydrogen sulphide odour, no staining, no sand, trace rootlets	0.9
1			PC_SW04_1.0	Y				
							Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location PC_SW05

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Sep 2024
Completion Date: 12 Sep 2024
Total Depth: 0.8 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 226285 mE, 5742285 mN
Backfill: 0.0 - 0.8 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0	Backfill		PC_SW05_0.0	Y	Natural Material		SILTY CLAY dark grey, soft, loose, wet, low plasticity, distinct hydrogen sulphide odour, no staining, trace fine sands	0
0.2			PC_SW05_0.2	Y				
0.5			PC_SW05_0.5	Y				
0.6					Natural Material		SANDY SILT dark grey, loose, wet, fine grained sand, distinct hydrogen sulphide odour, no staining, with fine sub-angular gravels	0.6
0.7			PC_SW05_0.7	Y				
0.7					Natural Material		SANDY GRAVEL dark grey, loose, wet, medium grained sand, profuse sub-angular fine gravels, distinct hydrogen sulphide odour, no staining, with silts, refusal at 0.8 m on gravels	0.7
0.8							Termination Depth at:0.80 m.	

Logged by: BS
Checked by: JH

SOIL BORE

Location PC_SW06

Project Number: 31155.03
Project Name: Barwon Downs Acid Sulfate Soil Assessment
Client: Barwon Water
Site Address: Barwon Downs Investigation Area
Drilling Contractor: BSE
Drilling Method: Hand Auger

Start Date: 12 Sep 2024
Completion Date: 12 Sep 2024
Total Depth: 1.0 m(BGL)
Coord System: GDA2020 / MGA zone 55
Coord: 226533 mE, 5742727 mN
Backfill: 0.0 - 1.0 m(BGL)

Comments:

Depth (mBGL)	Abandonment	PID (ppm)	Sample ID	Analysed?	Interpreted Formation	Graphic Log	Soil Description	Contact Depth (mBGL)
0.05			PC_SW06_0.0	Y	Natural Material		CLAYEY SILT dark grey, soft, moist, non plastic, distinct hydrogen sulphide odour, no staining, High organic matter, taken from edge of creek under a tree	0
0.1								
0.15								
0.2			PC_SW06_0.2	Y				
0.25					Natural Material		CLAYEY SILT dark grey, soft, wet, low plasticity, distinct hydrogen sulphide odour, no staining, from within the water, high organic matter	0.2
0.3								
0.35								
0.4								
0.45								
0.5	Backfill		PC_SW06_0.5	Y				
0.55								
0.6								
0.65								
0.7								
0.75								
0.8			PC_SW06_0.8	Y				
0.85								
0.9								
0.95								
1			PC_SW06_1.0	Y				
							Termination Depth at:1.00 m.	

Logged by: BS
Checked by: JH

LEACHATE AND SURFACE WATER SAMPLING FIELD SHEET

BlueSphere ENVIRONMENTAL

Date:		Sampled By:	BS / JH
Project Number:	31155.03	Sample Method:	
Project Name:	Barwon Water ASS Assessment	Weather:	
Sampled By:			

Notes:
PC_SW01 most southern edge
PC_SW06 most northern edge

9.44

Location ID	Time	Photo Taken?	DO (mg/L)	EC (µS/cm)	pH	ORP (mV)	Temp (°C)	SWL (stage m)	Notes/Observations
PC_SW01	10.10	Y	101.7%	239	6.34	126.1	16.7	N/A	murky brown, Still.
PC-SW02	10.40	Y	6.4%/8.25	238	6.32	130.8	16.6	N/A	
PC-SW03	11.35	Y	51.4%/4.34	216	6.42	153.0	17.6	N/A	
PC_SW04	12.05	Y	4.11	204	6.26	158.0	17.6	N/A	clear, slight flow, no odour.
PC_SW05	12.55	Y	2.11	218	6.44	151.0	17.3	N/A	Anoxic odour, surface scum, khaki
PC_SW06	13:20	Y	3.96	216	6.44	151.6	18.5	N/A	slight sheen (not rainbow)
									Turbidity, Colour, Odour, Sheen, Other, air bubbles in vials, violent reactions

Sample ID	Type	Container	Analysis	Preservatives	Lab
PC_SW01	Prim	5p	Standard.	Acid, filter ice.	ALS.

LEACHATE AND SURFACE WATER SAMPLING FIELD SHEET

BlueSphere ENVIRONMENTAL

Date:		Sampled By:	BS / JH
Project Number:	31155.03	Sample Method:	
Project Name:	Barwon Water ASS Assessment	Weather:	
Sampled By:			

Notes:

Location ID	Time	Photo Taken?	DO (mg/L)	EC (µS/cm)	pH	ORP (mV)	Temp (°C)	SWL (stage m)	Notes/Observations
MC_SW01	14:35	Y	5.45	570	6.56	136.8	19.29	0.51m	clear no odour.
MC_SW02	10.10	Y	0.20	923	6.48	107.3	17.3	~1.0m est.	Stagnant odour. Noted dead carp.
MC_SW03	10.35	Y	2.12	2708	6.56	117.4	16.5	-	behind log btw banks
MC_SW03	10.40	Y	0.77	2137	6.58	117.0	15.7	-	in middle creek line.
MC_SW04	12:30	Y	7.31	217	7.04	154.5	18.47	-	clear, no odour.
MC_SW05	13:40	Y	12.84	477	6.95	158.2	18.76	~0.3m est	
									Turbidity, Colour, Odour, Sheen, Other, air bubbles in vials, violent reactions

Sample ID	Type	Container	Analysis	Preservatives	Lab

LEACHATE AND SURFACE WATER SAMPLING FIELD SHEET

BlueSphere ENVIRONMENTAL

Date:		Sampled By:	BS / JH
Project Number:	31155.03	Sample Method:	
Project Name:	Barwon Water ASS Assessment	Weather:	
Sampled By:			

Notes:

Location ID	Time	Photo Taken?	DO (mg/L)	EC (µS/cm)	pH	ORP (mV)	Temp (°C)	SWL (stage m)	Notes/Observations
DM_SW01	11:30	Y	3.46	~~1808~~ 1800	6.85	140.5	17.3	~0.5m est.	clear.
DM_SW02	15:10	Y	3.07	590	7.12	160.4	15.2	-	clear - light brown
DM-SW03	16:05		6.67	993	7.20	162.8	20.7	-	clear / light brown.
									Turbidity, Colour, Odour, Sheen, Other, air bubbles in vials, violent reactions

Sample ID	Type	Container	Analysis	Preservatives	Lab

Appendix B
Calibration Certificates

CHAIN OF CUSTODY RECORD

BlueSphere Environmental Pty Ltd
113 Ferrars Street
Southbank VIC 3006
Ph: (03) 9699 5286

Contact Name: Brigette Small	Lab Quote ID: EM2505ENV0014	Page: 1 of 3	ALS: 4 Westall Road, Springvale 3165
Project Manager: Jake Hopkins	Project Number: 31155.03	Purchase Order: 31155.03	M: 0438 924 166 Ph 03 8549 9601
e-mail for results: ESdat_AU+BlueSphereenviro@ESdatLabSync.net	Project Name: Barwon Water ASS assessment		Contact: Josh Alexander

Special Comments/Directions:
Email copy of results to bsmall@bluesphere-enviro.com.au and jhopkins@bluesphere-enviro.com.au

Lab ID	Sample ID	Date/Time	Matrix	Container	Analytes: Hold	Dissolved metals/metalloids (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Al, Mn & Fe	Total metals/metalloids (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Al, Mn & Fe	Ca, Mg, Na, K, Cl, SO4, Alkalinity (NT: 01 & 02)	pH Hanaflox (EA003)	pH (EA005), TDS
1	PC_SW02_0.0	9/12/2024	SOIL	1 BAG					X	
2	PC_SW02_0.2	9-Dec-24	SOIL	1BAG					X	
3	PC_SW02_0.5	9-Dec-24	SOIL	1BAG					X	
4	PC_SW02_0.7	9-Dec-24	SOIL	1BAG					X	
5	PC_SW02_1.0	9-Dec-24	SOIL	1BAG					X	
6	PC_SW04_0.0	9-Dec-24	SOIL	1BAG					X	
7	PC_SW04_0.2	9-Dec-24	SOIL	1BAG					X	
8	PC_SW04_0.5	9-Dec-24	SOIL	1BAG					X	
9	PC_SW04_0.7	9-Dec-24	SOIL	1BAG					X	
10	PC_SW04_1.0	9-Dec-24	SOIL	1BAG					X	
11	PC_SW05_0.0	9 Dec 24	SOIL	1BAG					X	
12	PC_SW05_0.2	9-Dec-24	SOIL	1BAG					X	
13	PC_SW05_0.5	9-Dec-24	SOIL	1BAG					X	
14	PC_SW05_0.7	9-Dec-24	SOIL	1BAG					X	
15	MC_SW02_0.0	9-Dec-24	SOIL	1BAG					X	
16	PC_SW06_0.0	9-Dec-24	SOIL	1BAG					X	
17	PC_SW06_0.2	9-Dec-24	SOIL	1BAG					X	
18	PC_SW06_0.5	9-Dec-24	SOIL	1BAG					X	
19	PC_SW06_0.8	9-Dec-24	SOIL	1BAG					X	
20	PC_SW06_1.0	9-Dec-24	SOIL	1BAG					X	
21	MC_SW01_0.0	10-Dec-24	SOIL	1BAG					X	
22	MC_SW04_0.0	10-Dec-24	SOIL	1BAG					X	
23	MC_SW04_0.2	10-Dec-24	SOIL	1BAG					X	
24	MC_SW04_0.5	10-Dec-24	SOIL	1BAG					X	
25	MC_SW04_0.7	10-Dec-24	SOIL	1BAG					X	
26	MC_SW04_1.0	10-Dec-24	SOIL	1BAG					X	
27	PC_SW01_0.0	10-Dec-24	SOIL	1BAG					X	
28	PC_SW01_0.2	10-Dec-24	SOIL	1BAG					X	
29	PC_SW01_0.5	10-Dec-24	SOIL	1BAG					X	
30	PC_SW01_0.7	10-Dec-24	SOIL	1BAG					X	
31	PC_SW01_1.0	10-Dec-24	SOIL	1BAG					X	
32	DM_SW03_0.0	10-Dec-24	SOIL	1BAG					X	
33	DM_SW03_0.2	10-Dec-24	SOIL	1BAG					X	
34	MC_SW06_0.0	11-Dec-24	SOIL	1BAG					X	
35	MC_SW06_0.2	11-Dec-24	SOIL	1BAG					X	
36	MC_SW06_0.5	11-Dec-24	SOIL	1BAG					X	
37	MC_SW06_0.7	11-Dec-24	SOIL	1BAG					X	
38	MC_SW06_1.0	11-Dec-24	SOIL	1BAG					X	
39	MC_SW05_0.0	11-Dec-24	SOIL	1BAG					X	
40	MC_SW05_0.2	11-Dec-24	SOIL	1BAG					X	
41	MC_SW05_0.5	11-Dec-24	SOIL	1BAG					X	
42	MC_SW05_0.7	11-Dec-24	SOIL	1BAG					X	
43	MC_SW05_1.0	11-Dec-24	SOIL	1BAG					X	
44	DM_SW02_0.0	11-Dec-24	SOIL	1BAG					X	
45	DM_SW02_0.2	11-Dec-24	SOIL	1BAG					X	
46	DM_SW02_0.5	11-Dec-24	SOIL	1BAG					X	
47	DM_SW02_0.7	11-Dec-24	SOIL	1BAG					X	
48	DM_SW02_1.0	11-Dec-24	SOIL	1BAG					X	
49	MC_SW05	11-Dec-24	Water	3p		X	X	X		X
50	QC03	10-Dec-24	SOIL	1BAG	X					

1. Relinquished By: James Jolings	LAB Received By	Turn around time: 24hr / 48hr / 5 day / Standard	
Date & Time: 12/12/2024	Date & Time		
Signature: via email	Signature		
2. Received By	Receipt Number	Method of Shipment: Courier / Hand Delivered	
Date & Time	Laboratory Comments		
Relinquished By			
Date & Time			
Signature			

Environmental Division
Brisbane
Work Order Reference
EB2444282

Telephone : + 61-7-3552-8686

Monica (ALS) 12/12, 13:30 MK 17/12/24 1100

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2444282**

Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Contact	: Josh Alexander
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: jhopkins@bluesphere-enviro.com.au	E-mail	: Josh.Alexander@alsglobal.com
Telephone	: ----	Telephone	: +61-7-3552-8685
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 31156.03 - Barwon Water ASS Assessment	Page	: 1 of 5
Order number	: 31156.03	Quote number	: EM2023ISGENV0014 (EM23ISGENV0014)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 17-Dec-2024 11:00	Issue Date	: 17-Dec-2024
Client Requested Due Date	: 02-Jan-2025	Scheduled Reporting Date	: **02-Jan-2025**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 4	Temperature	: 4.9°C, 4.0°C, 6.7°C - Ice present
Receipt Detail	: ESKY LARGE	No. of samples received / analysed	: 50 / 49

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - EA003 pH field/fox
EB2444282-001	09-Dec-2024 00:00	PC_SW02_0.0	✓
EB2444282-002	09-Dec-2024 00:00	PC_SW02_0.2	✓
EB2444282-003	09-Dec-2024 00:00	PC_SW02_0.5	✓
EB2444282-004	09-Dec-2024 00:00	PC_SW02_0.7	✓
EB2444282-005	09-Dec-2024 00:00	PC_SW02_1.0	✓
EB2444282-006	09-Dec-2024 00:00	PC_SW04_0.0	✓
EB2444282-007	09-Dec-2024 00:00	PC_SW04_0.2	✓
EB2444282-008	09-Dec-2024 00:00	PC_SW04_0.5	✓
EB2444282-009	09-Dec-2024 00:00	PC_SW04_0.7	✓
EB2444282-010	09-Dec-2024 00:00	PC_SW04_1.0	✓
EB2444282-011	09-Dec-2024 00:00	PC_SW05_0.0	✓
EB2444282-012	09-Dec-2024 00:00	PC_SW05_0.2	✓
EB2444282-013	09-Dec-2024 00:00	PC_SW05_0.5	✓
EB2444282-014	09-Dec-2024 00:00	PC_SW05_0.7	✓
EB2444282-015	09-Dec-2024 00:00	MC_SW02_0.0	✓
EB2444282-016	09-Dec-2024 00:00	PC_SW06_0.0	✓
EB2444282-017	09-Dec-2024 00:00	PC_SW06_0.2	✓
EB2444282-018	09-Dec-2024 00:00	PC_SW06_0.5	✓
EB2444282-019	09-Dec-2024 00:00	PC_SW06_0.8	✓
EB2444282-020	09-Dec-2024 00:00	PC_SW06_1.0	✓
EB2444282-021	10-Dec-2024 00:00	MC_SW01_0.0	✓
EB2444282-022	10-Dec-2024 00:00	MC_SW04_0.0	✓
EB2444282-023	10-Dec-2024 00:00	MC_SW04_0.2	✓
EB2444282-024	10-Dec-2024 00:00	MC_SW04_0.5	✓
EB2444282-025	10-Dec-2024 00:00	MC_SW04_0.7	✓
EB2444282-026	10-Dec-2024 00:00	MC_SW04_1.0	✓
EB2444282-027	10-Dec-2024 00:00	PC_SW01_0.0	✓
EB2444282-028	10-Dec-2024 00:00	PC_SW01_0.2	✓
EB2444282-029	10-Dec-2024 00:00	PC_SW01_0.5	✓
EB2444282-030	10-Dec-2024 00:00	PC_SW01_0.7	✓
EB2444282-031	10-Dec-2024 00:00	PC_SW01_1.0	✓
EB2444282-032	10-Dec-2024 00:00	DM_SW03_0.0	✓
EB2444282-033	10-Dec-2024 00:00	DM_SW03_0.2	✓
EB2444282-034	11-Dec-2024 00:00	MC_SW06_0.0	✓
EB2444282-035	11-Dec-2024 00:00	MC_SW06_0.2	✓

			SOIL - EA003 pH field/fox
EB2444282-036	11-Dec-2024 00:00	MC_SW06_0.5	✓
EB2444282-037	11-Dec-2024 00:00	MC_SW06_0.7	✓
EB2444282-038	11-Dec-2024 00:00	MC_SW06_1.0	✓
EB2444282-039	11-Dec-2024 00:00	MC_SW05_0.0	✓
EB2444282-040	11-Dec-2024 00:00	MC_SW05_0.2	✓
EB2444282-041	11-Dec-2024 00:00	MC_SW05_0.5	✓
EB2444282-042	11-Dec-2024 00:00	MC_SW05_0.7	✓
EB2444282-043	11-Dec-2024 00:00	MC_SW05_1.0	✓
EB2444282-044	11-Dec-2024 00:00	DM_SW02_0.0	✓
EB2444282-045	11-Dec-2024 00:00	DM_SW02_0.2	✓
EB2444282-046	11-Dec-2024 00:00	DM_SW02_0.5	✓
EB2444282-047	11-Dec-2024 00:00	DM_SW02_0.7	✓
EB2444282-048	11-Dec-2024 00:00	DM_SW02_1.0	✓

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	(On Hold) SOIL No analysis requested
EB2444282-050	10-Dec-2024 00:00	QC03	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA005P pH (Auto Titrator)	WATER - EA015H Total Dissolved Solids - Standard Level	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EG035F Dissolved Mercury	WATER - EG035T Total Mercury	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity
EB2444282-049	11-Dec-2024 00:00	MC_SW06	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EG020T Total Metals by ICP/MS (including digestion)
EB2444282-049	11-Dec-2024 00:00	MC_SW06	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA005-P: pH by Auto Titrator							
MC_SW06	Clear Plastic Bottle - Natural	----	11-Dec-2024	17-Dec-2024	×	----	----

Requested Deliverables

ALL INVOICES

- A4 - AU Tax Invoice (INV)	Email	Accounts@bluesphere-enviro.com.au

BRIGETTE SMALL

- *AU Certificate of Analysis - NATA (COA)	Email	bsmall@bluesphere-enviro.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bsmall@bluesphere-enviro.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bsmall@bluesphere-enviro.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bsmall@bluesphere-enviro.com.au
- Chain of Custody (CoC) (COC)	Email	bsmall@bluesphere-enviro.com.au
- EDI Format - ESDAT (ESDAT)	Email	bsmall@bluesphere-enviro.com.au

ESDAT REPORTS

- EDI Format - ESDAT (ESDAT)	Email	ESdat_AU+BlueSphereenviro@ESdatLabSync.net

JAKE HOPKINS

- *AU Certificate of Analysis - NATA (COA)	Email	jhopkins@bluesphere-enviro.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jhopkins@bluesphere-enviro.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jhopkins@bluesphere-enviro.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jhopkins@bluesphere-enviro.com.au
- Chain of Custody (CoC) (COC)	Email	jhopkins@bluesphere-enviro.com.au
- EDI Format - ESDAT (ESDAT)	Email	jhopkins@bluesphere-enviro.com.au

CERTIFICATE OF ANALYSIS

Work Order	: **EB2444282**	Page	: 1 of 14
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Contact	: Josh Alexander
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3552-8685
Project	: 31156.03 - Barwon Water ASS Assessment	Date Samples Received	: 17-Dec-2024 11:00
Order number	: 31156.03	Date Analysis Commenced	: 17-Dec-2024
C-O-C number	: ----	Issue Date	: 30-Dec-2024 15:53
Sampler	: ----		
Site	: ----		
Quote number	: EM23ISGENV0014		
No. of samples received	: 50		
No. of samples analysed	: 49		

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.

Signatories	*Position*	*Accreditation Category*
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Ionic Balance out of acceptable limits due to analytes not quantified in this report.
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW02_0.0	PC_SW02_0.2	PC_SW02_0.5	PC_SW02_0.7	PC_SW02_1.0
			Sampling date / time	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-001	EB2444282-002	EB2444282-003	EB2444282-004	EB2444282-005
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.1**	**6.1**	**6.1**	**6.3**	**6.2**
pH (Fox)	----	0.1	pH Unit	**1.7**	**1.6**	**2.7**	**1.7**	**1.6**
Reaction Rate	----	1	Reaction Unit	**3**	**4**	**2**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW04_0.0	PC_SW04_0.2	PC_SW04_0.5	PC_SW04_0.7	PC_SW04_1.0
			Sampling date / time	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-006	EB2444282-007	EB2444282-008	EB2444282-009	EB2444282-010
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.9**	**5.8**	**5.9**	**5.9**	**6.0**
pH (Fox)	----	0.1	pH Unit	**2.2**	**2.1**	**2.2**	**2.1**	**2.2**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**3**	**3**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW05_0.0	PC_SW05_0.2	PC_SW05_0.5	PC_SW05_0.7	MC_SW02_0.0
			Sampling date / time	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-011	EB2444282-012	EB2444282-013	EB2444282-014	EB2444282-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.1**	**6.0**	**6.3**	**6.1**	**6.3**
pH (Fox)	----	0.1	pH Unit	**2.4**	**2.2**	**4.1**	**3.9**	**2.1**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**2**	**2**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW06_0.0	PC_SW06_0.2	PC_SW06_0.5	PC_SW06_0.8	PC_SW06_1.0
			Sampling date / time	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-016	EB2444282-017	EB2444282-018	EB2444282-019	EB2444282-020
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.3**	**6.0**	**6.0**	**6.1**	**6.1**
pH (Fox)	----	0.1	pH Unit	**2.2**	**2.6**	**2.4**	**2.6**	**2.9**
Reaction Rate	----	1	Reaction Unit	**3**	**3**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MC_SW01_0.0	MC_SW04_0.0	MC_SW04_0.2	MC_SW04_0.5	MC_SW04_0.7
			Sampling date / time	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-021	EB2444282-022	EB2444282-023	EB2444282-024	EB2444282-025
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.6**	**6.5**	**6.6**	**6.5**	**6.4**
pH (Fox)	----	0.1	pH Unit	**2.6**	**3.4**	**3.7**	**3.8**	**3.7**
Reaction Rate	----	1	Reaction Unit	**3**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MC_SW04_1.0	PC_SW01_0.0	PC_SW01_0.2	PC_SW01_0.5	PC_SW01_0.7
			Sampling date / time	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-026	EB2444282-027	EB2444282-028	EB2444282-029	EB2444282-030
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.5**	**6.2**	**6.1**	**6.0**	**6.0**
pH (Fox)	----	0.1	pH Unit	**4.1**	**4.0**	**2.2**	**1.9**	**1.7**
Reaction Rate	----	1	Reaction Unit	**2**	**3**	**3**	**3**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW01_1.0	DM_SW03_0.0	DM_SW03_0.2	MC_SW06_0.0	MC_SW06_0.2
			Sampling date / time	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-031	EB2444282-032	EB2444282-033	EB2444282-034	EB2444282-035
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.3**	**7.1**	**7.3**	**6.2**	**6.2**
pH (Fox)	----	0.1	pH Unit	**2.9**	**3.1**	**3.7**	**1.7**	**2.6**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**3**	**3**	**3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MC_SW06_0.5	MC_SW06_0.7	MC_SW06_1.0	MC_SW05_0.0	MC_SW05_0.2
			Sampling date / time	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-036	EB2444282-037	EB2444282-038	EB2444282-039	EB2444282-040
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.6**	**7.0**	**6.9**	**7.3**	**7.4**
pH (Fox)	----	0.1	pH Unit	**3.2**	**4.1**	**3.7**	**4.0**	**4.0**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MC_SW05_0.5	MC_SW05_0.7	MC_SW05_1.0	DM_SW02_0.0	DM_SW02_0.2
			Sampling date / time	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2444282-041	EB2444282-042	EB2444282-043	EB2444282-044	EB2444282-045
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**7.3**	**7.3**	**7.2**	**6.9**	**7.0**
pH (Fox)	----	0.1	pH Unit	**4.3**	**4.4**	**4.7**	**3.6**	**3.3**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	DM_SW02_0.5	DM_SW02_0.7	DM_SW02_1.0	----	----
			Sampling date / time	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	----	----
Compound	CAS Number	LOR	Unit	EB2444282-046	EB2444282-047	EB2444282-048	--------	--------
				Result	Result	Result	----	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.5**	**6.6**	**6.4**	**----**	**----**
pH (Fox)	----	0.1	pH Unit	**2.9**	**3.0**	**2.8**	**----**	**----**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**2**	**----**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MC_SW06	----	----	----	----
				Sampling date / time	11-Dec-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2444282-049	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.18**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**143**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
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		**46**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**46**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**4**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**41**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**6**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**5**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**24**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**2**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.04**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.021**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MC_SW06	----	----	----	----
				Sampling date / time	11-Dec-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2444282-049	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Iron	7439-89-6	0.05	mg/L		**0.48**	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.29**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.030**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.91**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**2.16**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**1.84**	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: **EB2444282**	Page	: 1 of 7
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Contact	: Josh Alexander
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3552-8685
Project	: 31156.03 - Barwon Water ASS Assessment	Date Samples Received	: 17-Dec-2024
Order number	: 31156.03	Date Analysis Commenced	: 17-Dec-2024
C-O-C number	: ----	Issue Date	: 30-Dec-2024
Sampler	: ----		
Site	: ----		
Quote number	: EM23ISGENV0014		
No. of samples received	: 50		
No. of samples analysed	: 49		

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.

Signatories	*Position*	*Accreditation Category*
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA003 :pH (field/fox) (QC Lot: 6283480)									
EB2444282-001	PC_SW02_0.0	EA003: pH (F)	----	0.1	pH Unit	6.1	6.1	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	1.7	1.7	0.0	0% - 50%
EB2444282-011	PC_SW05_0.0	EA003: pH (F)	----	0.1	pH Unit	6.1	6.2	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	2.4	2.4	0.0	0% - 20%
EA003 :pH (field/fox) (QC Lot: 6283481)									
EB2444282-021	MC_SW01_0.0	EA003: pH (F)	----	0.1	pH Unit	6.6	6.6	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	2.6	2.6	0.0	0% - 20%
EB2444282-031	PC_SW01_1.0	EA003: pH (F)	----	0.1	pH Unit	6.3	6.4	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	2.9	3.2	7.8	0% - 20%
EA003 :pH (field/fox) (QC Lot: 6283482)									
EB2444282-041	MC_SW05_0.5	EA003: pH (F)	----	0.1	pH Unit	7.3	7.3	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	4.3	4.3	0.0	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 (%)
EA005P: pH by PC Titrator (QC Lot: 6267784)									
EB2444103-002	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.18	7.19	0.1	0% - 20%
EB2444324-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.01	7.10	1.3	0% - 20%
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 6270041)									
EB2444133-012	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	590	569	3.7	0% - 20%
EB2444211-010	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	<10	0.0	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 6267789)									

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED037P: Alkalinity by PC Titrator (QC Lot: 6267789) - continued									
EB2444103-002	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	666	668	0.3	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	666	668	0.3	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6268998)									
EB2444125-003	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	225	234	3.6	0% - 20%
EB2444354-003	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	191	194	1.5	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 6269002)									
EB2444125-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	214	211	1.2	0% - 20%
EB2444354-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	218	220	0.7	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 6268981)									
EB2444230-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	5	5	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	5	5	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EB2444350-007	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	6	5	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	1	1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	3	3	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 6268977)									
EB2444230-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	52 µg/L	0.050	5.0	0% - 50%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB2444350-007	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.025	0.025	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit

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 (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 6268977) - continued									
EB2444350-007	Anonymous	EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.08	0.07	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.12	0.12	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 6268343)									
EB2444071-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.013	0.013	0.0	0% - 50%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.011	0.011	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.07	0.07	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB2444264-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.1 µg/L	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<1 µg/L	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	6 µg/L	0.007	19.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	10 µg/L	0.010	0.0	0% - 50%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<1 µg/L	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	39 µg/L	0.040	0.0	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	8 µg/L	0.008	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	17 µg/L	0.017	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	4520 µg/L	4.16	8.2	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	4330 µg/L	5.04	15.1	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 6270548)									
EB2444253-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB2444321-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	0.0002	0.0002	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 6269696)									
EB2443855-006	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB2444264-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.1 µg/L	<0.0001	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 Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 6267784)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.0	102
				----	7 pH Unit	100	98.0	102
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 6270041)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	293 mg/L	109	70.0	130
				<10	2000 mg/L	95.9	80.9	118
				<10	2320 mg/L	106	80.6	119
ED037P: Alkalinity by PC Titrator (QCLot: 6267789)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	50 mg/L	107	80.0	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6268998)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	89.8	85.0	118
				<1	100 mg/L	94.4	85.0	118
ED045G: Chloride by Discrete Analyser (QCLot: 6269002)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.3	90.0	115
				<1	1000 mg/L	107	90.0	115
ED093F: Dissolved Major Cations (QCLot: 6268981)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	103	70.0	130
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	96.7	70.0	130
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	94.8	70.0	130
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	99.0	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 6268977)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	97.3	79.0	118
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100	88.0	116
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	97.8	88.0	108
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	98.3	87.0	113
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	99.5	88.0	114
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	95.7	89.0	110
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	97.8	89.0	120
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	97.2	89.0	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	97.7	87.0	113
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	107	82.0	114

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020T: Total Metals by ICP-MS (QCLot: 6268343)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	97.3	80.0	114
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100.0	88.0	112
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.2	88.0	111
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	98.1	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	96.4	88.0	116
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.5	89.0	112
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	97.2	88.0	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	93.7	88.0	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	93.4	84.0	114
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	99.0	82.0	118
EG035F: Dissolved Mercury by FIMS (QCLot: 6270548)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	104	84.0	118
EG035T: Total Recoverable Mercury by FIMS (QCLot: 6269696)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.0	84.0	118

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	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6268998)							
EB2444125-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	200 mg/L	94.4	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 6269002)							
EB2444125-001	Anonymous	ED045G: Chloride	16887-00-6	4000 mg/L	126	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 6268977)							
EB2444229-001	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	106	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	105	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	105	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	106	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	104	70.0	130
		EG020A-F: Manganese	7439-96-5	1 mg/L	106	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	104	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	114	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 6268343)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG020T: Total Metals by ICP-MS (QCLot: 6268343) - continued							
EB2444071-004	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	105	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	100	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	104	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	100	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	104	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	106	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	101	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	100	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 6270548)							
ET2406878-004	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	81.7	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 6269696)							
EB2444184-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	83.2	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2444282**	Page	: 1 of 8
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Telephone	: +61-7-3552-8685
Project	: 31156.03 - Barwon Water ASS Assessment	Date Samples Received	: 17-Dec-2024
Site	: ----	Issue Date	: 30-Dec-2024
Sampler	: ----	No. of samples received	: 50
Order number	: 31156.03	No. of samples analysed	: 49

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, where applicable to the methodology, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
MC_SW06	----	----	----	18-Dec-2024	11-Dec-2024	**7**

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: **SOIL**

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
EA003 :pH (field/fox)								
Snap Lock Bag - frozen (EA003)								
PC_SW02_0.0,	PC_SW02_0.2,	**09-Dec-2024**	**27-Dec-2024**	04-Sep-2027	✓	**27-Dec-2024**	27-Mar-2025	✓
PC_SW02_0.5,	PC_SW02_0.7,							
PC_SW02_1.0,	PC_SW04_0.0,							
PC_SW04_0.2,	PC_SW04_0.5,							
PC_SW04_0.7,	PC_SW04_1.0,							
PC_SW05_0.0,	PC_SW05_0.2,							
PC_SW05_0.5,	PC_SW05_0.7,							
MC_SW02_0.0,	PC_SW06_0.0,							
PC_SW06_0.2,	PC_SW06_0.5,							
PC_SW06_0.8,	PC_SW06_1.0							
Snap Lock Bag - frozen (EA003)								
MC_SW01_0.0,	MC_SW04_0.0,	**10-Dec-2024**	**27-Dec-2024**	05-Sep-2027	✓	**27-Dec-2024**	27-Mar-2025	✓
MC_SW04_0.2,	MC_SW04_0.5,							
MC_SW04_0.7,	MC_SW04_1.0,							
PC_SW01_0.0,	PC_SW01_0.2,							
PC_SW01_0.5,	PC_SW01_0.7,							
PC_SW01_1.0,	DM_SW03_0.0,							
DM_SW03_0.2								
Snap Lock Bag - frozen (EA003)								

Matrix: **SOIL**

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
EA003 :pH (field/fox) - Continued							
MC_SW06_0.0, MC_SW06_0.2, MC_SW06_0.5, MC_SW06_0.7, MC_SW06_1.0, MC_SW05_0.0, MC_SW05_0.2, MC_SW05_0.5, MC_SW05_0.7, MC_SW05_1.0, DM_SW02_0.0, DM_SW02_0.2, DM_SW02_0.5, DM_SW02_0.7, DM_SW02_1.0	11-Dec-2024	27-Dec-2024	06-Sep-2027	✓	27-Dec-2024	27-Mar-2025	✓

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
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P) MC_SW06	11-Dec-2024	----	----	----	18-Dec-2024	11-Dec-2024	×
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H) MC_SW06	11-Dec-2024	----	----	----	18-Dec-2024	18-Dec-2024	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) MC_SW06	11-Dec-2024	----	----	----	18-Dec-2024	25-Dec-2024	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) MC_SW06	11-Dec-2024	----	----	----	18-Dec-2024	08-Jan-2025	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) MC_SW06	11-Dec-2024	----	----	----	18-Dec-2024	08-Jan-2025	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) MC_SW06	11-Dec-2024	----	----	----	19-Dec-2024	08-Jan-2025	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) MC_SW06	11-Dec-2024	----	----	----	19-Dec-2024	09-Jun-2025	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) MC_SW06	11-Dec-2024	18-Dec-2024	09-Jun-2025	✓	23-Dec-2024	09-Jun-2025	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) MC_SW06	11-Dec-2024	----	----	----	18-Dec-2024	08-Jan-2025	✓

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
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)							
MC_SW06	**11-Dec-2024**	**----**	----	**----**	**18-Dec-2024**	08-Jan-2025	✓

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: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
pH field/fox	EA003	5	48	10.42	10.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	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
Major Cations - Dissolved	ED093F	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	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
Major Cations - Dissolved	ED093F	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by Auto Titrator	EA005-P	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	3	17	17.65	15.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	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
Major Cations - Dissolved	ED093F	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	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		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	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
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	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
pH field/fox	EA003	SOIL	In house: Referenced to Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.
pH by Auto Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)
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 Auto 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 thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
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.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. 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 1030E. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
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)

	Workorder	Sample #	Sample ID	Chromium Suite - Complete (EA033)	Acid Volatile Sulfur (EA038)
1	EB2444282	001	PC_SW02_0.0	X	
2	EB2444282	002	PC_SW02_0.2	X	
3	EB2444282	005	PC_SW02_1.0	X	X
4	EB2444282	006	PC_SW04_0.0	X	
5	EB2444282	008	PC_SW04_0.5	X	
6	EB2444282	009	PC_SW04_0.7	X	
7	EB2444282	011	PC_SW05_0.0	X	
8	EB2444282	012	PC_SW05_0.2	X	
9	EB2444282	014	PC_SW05_0.7	X	
10	EB2444282	015	MC_SW02_0.0	X	X
11	EB2444282	016	PC_SW06_0.0	X	
12	EB2444282	018	PC_SW06_0.5	X	
13	EB2444282	020	PC_SW06_1.0	X	
14	EB2444282	021	MC_SW01_0.0	X	
15	EB2444282	022	MC_SW04_0.0	X	
16	EB2444282	024	MC_SW04_0.5	X	
17	EB2444282	025	MC_SW04_0.7	X	
18	EB2444282	027	PC_SW01_0.0	X	
19	EB2444282	029	PC_SW01_0.5	X	
20	EB2444282	030	PC_SW01_0.7	X	
21	EB2444282	032	DM_SW03_0.0	X	
22	EB2444282	033	DM_SW03_0.2	X	
23	EB2444282	034	MC_SW06_0.0	X	
24	EB2444282	035	MC_SW06_0.2	X	
25	EB2444282	038	MC_SW06_1.0	X	
26	EB2444282	039	MC_SW05_0.0	X	
27	EB2444282	041	MC_SW05_0.5	X	
28	EB2444282	042	MC_SW05_0.7	X	
29	EB2444282	044	DM_SW02_0.0	X	
30	EB2444282	046	DM_SW02_0.5	X	
31	EB2444282	048	DM_SW02_1.0	X	X

Environmental Division
Brisbane
Work Order Reference
EB2500581

Telephone : +61-7-3552-8685

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2500581**

Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Contact	: John Pickering
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: jhopkins@bluesphere-enviro.com.au	E-mail	: john.pickering@alsglobal.com
Telephone	: ----	Telephone	: +61 7 3552 8634
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 31156.03 - Barwon Water ASS Assessment	Page	: 1 of 3
Order number	: ----	Quote number	: EM2017ISGENV0029 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 08-Jan-2025 14:42	Issue Date	: 08-Jan-2025
Client Requested Due Date	: 16-Jan-2025	Scheduled Reporting Date	: **16-Jan-2025**

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	: REBATCH	No. of samples received / analysed	: 31 / 31

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised ALS is unable to assign Acid Volatile Sulfur (EA038) as there are no suitable containers/volume. If you wish to discuss this further, please contact Client Services at ALSEnviro.Brisbane@alsglobal.com**
- **The samples in this work order have been re-batched from EB2444282.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA033 Chromium Suite for Acid Sulphate Soils
EB2500581-001	09-Dec-2024 00:00	PC_SW02_0.0	✓
EB2500581-002	09-Dec-2024 00:00	PC_SW02_0.2	✓
EB2500581-003	09-Dec-2024 00:00	PC_SW02_1.0	✓
EB2500581-004	09-Dec-2024 00:00	PC_SW04_0.0	✓
EB2500581-005	09-Dec-2024 00:00	PC_SW04_0.5	✓
EB2500581-006	09-Dec-2024 00:00	PC_SW04_0.7	✓
EB2500581-007	09-Dec-2024 00:00	PC_SW05_0.0	✓
EB2500581-008	09-Dec-2024 00:00	PC_SW05_0.2	✓
EB2500581-009	09-Dec-2024 00:00	PC_SW05_0.7	✓
EB2500581-010	09-Dec-2024 00:00	MC_SW02_0.0	✓
EB2500581-011	09-Dec-2024 00:00	PC_SW06_0.0	✓
EB2500581-012	09-Dec-2024 00:00	PC_SW06_0.5	✓
EB2500581-013	09-Dec-2024 00:00	PC_SW06_1.0	✓
EB2500581-014	10-Dec-2024 00:00	MC_SW01_0.0	✓
EB2500581-015	10-Dec-2024 00:00	MC_SW04_0.0	✓
EB2500581-016	10-Dec-2024 00:00	MC_SW04_0.5	✓
EB2500581-017	10-Dec-2024 00:00	MC_SW04_0.7	✓
EB2500581-018	10-Dec-2024 00:00	PC_SW01_0.0	✓
EB2500581-019	10-Dec-2024 00:00	PC_SW01_0.5	✓
EB2500581-020	10-Dec-2024 00:00	PC_SW01_0.7	✓
EB2500581-021	10-Dec-2024 00:00	DM_SW03_0.0	✓
EB2500581-022	10-Dec-2024 00:00	DM_SW03_0.2	✓
EB2500581-023	11-Dec-2024 00:00	MC_SW06_0.0	✓
EB2500581-024	11-Dec-2024 00:00	MC_SW06_0.2	✓
EB2500581-025	11-Dec-2024 00:00	MC_SW06_1.0	✓
EB2500581-026	11-Dec-2024 00:00	MC_SW05_0.0	✓
EB2500581-027	11-Dec-2024 00:00	MC_SW05_0.5	✓
EB2500581-028	11-Dec-2024 00:00	MC_SW05_0.7	✓
EB2500581-029	11-Dec-2024 00:00	DM_SW02_0.0	✓
EB2500581-030	11-Dec-2024 00:00	DM_SW02_0.5	✓
EB2500581-031	11-Dec-2024 00:00	DM_SW02_1.0	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ALL INVOICES

- A4 - AU Tax Invoice (INV)	Email	Accounts@bluesphere-enviro.com.au

ESDAT REPORTS

- EDI Format - ESDAT (ESDAT)	Email	ESdat_AU+BlueSphereenviro@ESdatLabSync.net

JAKE HOPKINS

- *AU Certificate of Analysis - NATA (COA)	Email	jhopkins@bluesphere-enviro.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jhopkins@bluesphere-enviro.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jhopkins@bluesphere-enviro.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jhopkins@bluesphere-enviro.com.au
- A4 - AU Tax Invoice (INV)	Email	jhopkins@bluesphere-enviro.com.au
- Chain of Custody (CoC) (COC)	Email	jhopkins@bluesphere-enviro.com.au
- EDI Format - ESDAT (ESDAT)	Email	jhopkins@bluesphere-enviro.com.au
- EDI Format - XTab (XTAB)	Email	jhopkins@bluesphere-enviro.com.au

CERTIFICATE OF ANALYSIS

Work Order	: **EB2500581**	Page	: 1 of 9
Amendment	: **1**		
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Contact	: John Pickering
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8634
Project	: 31156.03 - Barwon Water ASS Assessment	Date Samples Received	: 08-Jan-2025 14:42
Order number	: ----	Date Analysis Commenced	: 10-Jan-2025
C-O-C number	: ----	Issue Date	: 15-Jan-2025 14:02
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 31		
No. of samples analysed	: 31		

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.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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 Contract 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.

- **The samples in this work order have been re-batched from EB2444282.**
- ASS: EA033 (CRS Suite): Analysis is performed as per the Acid Sulfate Soils Laboratory Methods Guidelines (2004) and the updated National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT (2018)
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- Amendment (15/01/2025): This report has been amended and re-released to allow the reporting of additional analytical data, specifically EA033-C: Acid Neutralising Capacity as part of EA033 Chromium Suite for all samples.
- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW02_0.0	PC_SW02_0.2	PC_SW02_1.0	PC_SW04_0.0	PC_SW04_0.5
			Sampling date / time	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2500581-001	EB2500581-002	EB2500581-003	EB2500581-004	EB2500581-005
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**5.0**	**4.8**	**4.8**	**5.0**	**5.0**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**31**	**48**	**46**	**20**	**18**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.05**	**0.08**	**0.07**	**0.03**	**0.03**
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.040**	**0.042**	**0.068**	**0.018**	**0.016**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**25**	**26**	**43**	**11**	**10**
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**0.58**	**0.56**	**1.00**	**0.19**	**0.02**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**116**	**111**	**199**	**38**	<10
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**0.18**	**0.18**	**0.32**	**0.06**	<0.01
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	**0.09**	**0.12**	**0.14**	**0.05**	**0.04**
Net Acidity (acidity units)	----	10	mole H+ / t	**56**	**74**	**89**	**31**	**28**
Liming Rate	----	1	kg CaCO3/t	**4**	**6**	**7**	**2**	**2**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.09**	**0.12**	**0.14**	**0.05**	**0.04**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**56**	**74**	**89**	**31**	**28**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**4**	**6**	**7**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW04_0.7	PC_SW05_0.0	PC_SW05_0.2	PC_SW05_0.7	MC_SW02_0.0
			Sampling date / time	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2500581-006	EB2500581-007	EB2500581-008	EB2500581-009	EB2500581-010
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	4.7	5.6	5.2	5.6	5.3
Titratable Actual Acidity (23F)	----	2	mole H+ / t	32	17	17	5	28
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.05	0.03	0.03	<0.02	0.04
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.018	0.023	0.016	0.016	0.118
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	11	14	10	10	74
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.08	0.77	0.40	0.03	0.55
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	16	154	79	<10	110
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.02	0.25	0.13	<0.01	0.18
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.07	0.05	0.04	0.02	0.16
Net Acidity (acidity units)	----	10	mole H+ / t	43	32	27	15	101
Liming Rate	----	1	kg CaCO3/t	3	2	2	1	8
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.07	0.05	0.04	0.02	0.16
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	43	32	27	15	101
Liming Rate excluding ANC	----	1	kg CaCO3/t	3	2	2	1	8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PC_SW06_0.0	PC_SW06_0.5	PC_SW06_1.0	MC_SW01_0.0	MC_SW04_0.0
			Sampling date / time	09-Dec-2024 00:00	09-Dec-2024 00:00	09-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2500581-011	EB2500581-012	EB2500581-013	EB2500581-014	EB2500581-015
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**5.0**	**5.0**	**4.9**	**5.8**	**5.4**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**38**	**25**	**28**	**13**	**8**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.06**	**0.04**	**0.04**	**0.02**	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.018**	**0.025**	**0.024**	**0.021**	**0.013**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**11**	**15**	**15**	**13**	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**0.50**	**0.07**	**0.07**	**0.77**	**0.45**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**100**	**14**	**14**	**153**	**89**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**0.16**	**0.02**	**0.02**	**0.24**	**0.14**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	**0.08**	**0.06**	**0.07**	**0.04**	**0.03**
Net Acidity (acidity units)	----	10	mole H+ / t	**49**	**40**	**44**	**26**	**16**
Liming Rate	----	1	kg CaCO3/t	**4**	**3**	**3**	**2**	**1**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.08**	**0.06**	**0.07**	**0.04**	**0.03**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**49**	**40**	**44**	**26**	**16**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**4**	**3**	**3**	**2**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MC_SW04_0.5	MC_SW04_0.7	PC_SW01_0.0	PC_SW01_0.5	PC_SW01_0.7
			Sampling date / time	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00	10-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2500581-016	EB2500581-017	EB2500581-018	EB2500581-019	EB2500581-020
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	4.9	5.0	5.2	4.8	4.8
Titratable Actual Acidity (23F)	----	2	mole H+ / t	15	11	13	34	37
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.02	<0.02	0.02	0.05	0.06
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.013	0.012	0.020	0.014	0.015
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	13	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.84	0.53	0.22	0.20	0.10
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	168	106	45	40	20
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.27	0.17	0.07	0.06	0.03
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.04	0.03	0.04	0.07	0.07
Net Acidity (acidity units)	----	10	mole H+ / t	23	18	25	42	46
Liming Rate	----	1	kg CaCO3/t	2	1	2	3	3
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.04	0.03	0.04	0.07	0.07
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	23	18	25	42	46
Liming Rate excluding ANC	----	1	kg CaCO3/t	2	1	2	3	3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	DM_SW03_0.0	DM_SW03_0.2	MC_SW06_0.0	MC_SW06_0.2	MC_SW06_1.0
			Sampling date / time	10-Dec-2024 00:00	10-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2500581-021	EB2500581-022	EB2500581-023	EB2500581-024	EB2500581-025
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**5.9**	**6.6**	**5.0**	**4.9**	**5.3**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**2**	<2	**35**	**21**	**12**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	**0.06**	**0.03**	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.016**	**0.014**	**0.032**	**0.014**	**0.012**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	**20**	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**0.14**	**0.08**	**0.81**	**0.22**	**0.60**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**28**	**17**	**162**	**43**	**121**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**0.04**	**0.03**	**0.26**	**0.07**	**0.19**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	**0.09**	**0.05**	**0.03**
Net Acidity (acidity units)	----	10	mole H+ / t	**12**	<10	**55**	**30**	**19**
Liming Rate	----	1	kg CaCO3/t	<1	<1	**4**	**2**	**1**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	**0.09**	**0.05**	**0.03**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**12**	<10	**55**	**30**	**19**
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	**4**	**2**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	MC_SW05_0.0	MC_SW05_0.5	MC_SW05_0.7	DM_SW02_0.0	DM_SW02_0.5
			Sampling date / time	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00	11-Dec-2024 00:00
Compound	CAS Number	LOR	Unit	EB2500581-026	EB2500581-027	EB2500581-028	EB2500581-029	EB2500581-030
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**5.6**	**5.8**	**5.7**	**6.0**	**5.2**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**6**	**4**	**4**	**3**	**13**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	**0.02**
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.013**	**0.012**	**0.011**	**0.011**	**0.014**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<10	<10
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**0.63**	**0.69**	**0.69**	**0.85**	**0.62**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**127**	**138**	**138**	**171**	**124**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**0.20**	**0.22**	**0.22**	**0.27**	**0.20**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	**0.02**	<0.02	<0.02	<0.02	**0.03**
Net Acidity (acidity units)	----	10	mole H+ / t	**14**	**12**	**11**	<10	**22**
Liming Rate	----	1	kg CaCO3/t	**1**	<1	<1	<1	**2**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.02**	<0.02	<0.02	<0.02	**0.03**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**14**	**12**	**11**	<10	**22**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**1**	<1	<1	<1	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	DM_SW02_1.0	----	----	----	----
			Sampling date / time	11-Dec-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2500581-031	--------	--------	--------	--------
				Result	----	----	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**5.0**	----	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**16**	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.03**	----	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.016**	----	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**10**	----	----	----	----
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**0.45**	----	----	----	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**90**	----	----	----	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**0.14**	----	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	**0.04**	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	**26**	----	----	----	----
Liming Rate	----	1	kg CaCO3/t	**2**	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.04**	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**26**	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	**2**	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: **EB2500581**	Page	: 1 of 4
Amendment	: **1**		
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Contact	: John Pickering
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8634
Project	: 31156.03 - Barwon Water ASS Assessment	Date Samples Received	: 08-Jan-2025
Order number	: ----	Date Analysis Commenced	: 10-Jan-2025
C-O-C number	: ----	Issue Date	: 15-Jan-2025
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 31		
No. of samples analysed	: 31		

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.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 6302164)									
EB2500581-001	PC_SW02_0.0	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.05	0.05	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	31	32	0.0	0% - 50%
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.0	5.0	0.0	0% - 20%
EB2500581-011	PC_SW06_0.0	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.06	0.06	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	38	38	0.0	0% - 50%
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.0	5.0	0.0	0% - 20%
EA033-A: Actual Acidity (QC Lot: 6302165)									
EB2500581-021	DM_SW03_0.0	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	2	2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.9	5.9	0.0	0% - 20%
EB2500581-031	DM_SW02_1.0	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.03	0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	16	15	8.4	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.0	5.0	0.0	0% - 20%
EA033-B: Potential Acidity (QC Lot: 6302164)									
EB2500581-001	PC_SW02_0.0	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.040	0.045	11.5	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	25	28	11.5	No Limit
EB2500581-011	PC_SW06_0.0	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.018	0.016	10.5	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	11	10	10.5	No Limit
EA033-B: Potential Acidity (QC Lot: 6302165)									
EB2500581-021	DM_SW03_0.0	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.016	0.019	19.3	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA033-B: Potential Acidity (QC Lot: 6302165) - continued									
EB2500581-021	DM_SW03_0.0	EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	12	18.2	No Limit
EB2500581-031	DM_SW02_1.0	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.016	0.016	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	10	10	0.0	No Limit
EA033-C: Acid Neutralising Capacity (QC Lot: 6302164)									
EB2500581-001	PC_SW02_0.0	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.58	0.68	16.7	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.18	0.22	16.7	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	116	137	16.7	0% - 50%
EB2500581-011	PC_SW06_0.0	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.50	0.42	17.8	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.16	0.13	17.8	0% - 50%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	100	84	17.8	0% - 50%
EA033-C: Acid Neutralising Capacity (QC Lot: 6302165)									
EB2500581-021	DM_SW03_0.0	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.14	0.16	16.8	0% - 50%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.04	0.05	0.0	No Limit
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	28	33	16.8	No Limit
EB2500581-031	DM_SW02_1.0	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.45	0.42	6.6	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.14	0.13	0.0	0% - 50%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	90	84	6.6	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: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 6302164)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.7 pH Unit	98.8	80.0	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	23.5 mole H+ / t	103	80.0	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-A: Actual Acidity (QCLot: 6302165)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.7 pH Unit	98.8	80.0	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	23.5 mole H+ / t	112	80.0	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 6302164)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.283 % S	104	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-B: Potential Acidity (QCLot: 6302165)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.283 % S	104	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 6302164)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	98.5	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 6302165)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	100	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

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	: **EB2500581**	Page	: 1 of 6
Amendment	: **1**		
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAKE HOPKINS	Telephone	: +61 7 3552 8634
Project	: 31156.03 - Barwon Water ASS Assessment	Date Samples Received	: 08-Jan-2025
Site	: ----	Issue Date	: 15-Jan-2025
Sampler	: ----	No. of samples received	: 31
Order number	: ----	No. of samples analysed	: 31

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, where applicable to the methodology, 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: **SOIL**

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
EA033-A: Actual Acidity							
80* dried soil (EA033) PC_SW02_0.0, PC_SW02_0.2, PC_SW02_1.0, PC_SW04_0.0, PC_SW04_0.5, PC_SW04_0.7, PC_SW05_0.0, PC_SW05_0.2, PC_SW05_0.7, MC_SW02_0.0, PC_SW06_0.0, PC_SW06_0.5, PC_SW06_1.0	**09-Dec-2024**	**10-Jan-2025**	09-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW01_0.0, MC_SW04_0.0, MC_SW04_0.5, MC_SW04_0.7, PC_SW01_0.0, PC_SW01_0.5, PC_SW01_0.7, DM_SW03_0.0, DM_SW03_0.2	**10-Dec-2024**	**10-Jan-2025**	10-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW06_0.0, MC_SW06_0.2, MC_SW06_1.0, MC_SW05_0.0, MC_SW05_0.5, MC_SW05_0.7, DM_SW02_0.0, DM_SW02_0.5, DM_SW02_1.0	**11-Dec-2024**	**10-Jan-2025**	11-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓

Matrix: **SOIL**

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
EA033-B: Potential Acidity							
80* dried soil (EA033) PC_SW02_0.0, PC_SW02_0.2, PC_SW02_1.0, PC_SW04_0.0, PC_SW04_0.5, PC_SW04_0.7, PC_SW05_0.0, PC_SW05_0.2, PC_SW05_0.7, MC_SW02_0.0, PC_SW06_0.0, PC_SW06_0.5, PC_SW06_1.0	**09-Dec-2024**	**10-Jan-2025**	09-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW01_0.0, MC_SW04_0.0, MC_SW04_0.5, MC_SW04_0.7, PC_SW01_0.0, PC_SW01_0.5, PC_SW01_0.7, DM_SW03_0.0, DM_SW03_0.2	**10-Dec-2024**	**10-Jan-2025**	10-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW06_0.0, MC_SW06_0.2, MC_SW06_1.0, MC_SW05_0.0, MC_SW05_0.5, MC_SW05_0.7, DM_SW02_0.0, DM_SW02_0.5, DM_SW02_1.0	**11-Dec-2024**	**10-Jan-2025**	11-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil (EA033) PC_SW02_0.0, PC_SW02_0.2, PC_SW02_1.0, PC_SW04_0.0, PC_SW04_0.5, PC_SW04_0.7, PC_SW05_0.0, PC_SW05_0.2, PC_SW05_0.7, MC_SW02_0.0, PC_SW06_0.0, PC_SW06_0.5, PC_SW06_1.0	**09-Dec-2024**	**10-Jan-2025**	09-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW01_0.0, MC_SW04_0.0, MC_SW04_0.5, MC_SW04_0.7, PC_SW01_0.0, PC_SW01_0.5, PC_SW01_0.7, DM_SW03_0.0, DM_SW03_0.2	**10-Dec-2024**	**10-Jan-2025**	10-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW06_0.0, MC_SW06_0.2, MC_SW06_1.0, MC_SW05_0.0, MC_SW05_0.5, MC_SW05_0.7, DM_SW02_0.0, DM_SW02_0.5, DM_SW02_1.0	**11-Dec-2024**	**10-Jan-2025**	11-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓

Matrix: **SOIL**

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
EA033-D: Retained Acidity							
80* dried soil (EA033) PC_SW02_0.0, PC_SW02_0.2, PC_SW02_1.0, PC_SW04_0.0, PC_SW04_0.5, PC_SW04_0.7, PC_SW05_0.0, PC_SW05_0.2, PC_SW05_0.7, MC_SW02_0.0, PC_SW06_0.0, PC_SW06_0.5, PC_SW06_1.0	**09-Dec-2024**	**10-Jan-2025**	09-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW01_0.0, MC_SW04_0.0, MC_SW04_0.5, MC_SW04_0.7, PC_SW01_0.0, PC_SW01_0.5, PC_SW01_0.7, DM_SW03_0.0, DM_SW03_0.2	**10-Dec-2024**	**10-Jan-2025**	10-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW06_0.0, MC_SW06_0.2, MC_SW06_1.0, MC_SW05_0.0, MC_SW05_0.5, MC_SW05_0.7, DM_SW02_0.0, DM_SW02_0.5, DM_SW02_1.0	**11-Dec-2024**	**10-Jan-2025**	11-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
EA033-E: Acid Base Accounting							
80* dried soil (EA033) PC_SW02_0.0, PC_SW02_0.2, PC_SW02_1.0, PC_SW04_0.0, PC_SW04_0.5, PC_SW04_0.7, PC_SW05_0.0, PC_SW05_0.2, PC_SW05_0.7, MC_SW02_0.0, PC_SW06_0.0, PC_SW06_0.5, PC_SW06_1.0	**09-Dec-2024**	**10-Jan-2025**	09-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW01_0.0, MC_SW04_0.0, MC_SW04_0.5, MC_SW04_0.7, PC_SW01_0.0, PC_SW01_0.5, PC_SW01_0.7, DM_SW03_0.0, DM_SW03_0.2	**10-Dec-2024**	**10-Jan-2025**	10-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓
80* dried soil (EA033) MC_SW06_0.0, MC_SW06_0.2, MC_SW06_1.0, MC_SW05_0.0, MC_SW05_0.5, MC_SW05_0.7, DM_SW02_0.0, DM_SW02_0.5, DM_SW02_1.0	**11-Dec-2024**	**10-Jan-2025**	11-Dec-2025	✓	**10-Jan-2025**	10-Apr-2025	✓

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: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	4	31	**12.90**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	2	31	**6.45**	**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
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

CHAIN OF CUSTODY RECORD

BlueSphere Environmental Pty Ltd
113 Ferrars Street
Southbank VIC 3006
Ph: (03) 9699 5286

Contact Name: Brigette Small	Lab Quote ID: EM23ISGENV0014	Page: 1 of 1	ALS 4 Westall Road, Springvale 3166
Project Manager: Jake Hopkins	Project Number: 31155.03	Purchase Order: 31155.03	M: 0436 924 166 Ph 03 8549 9601
e-mail for results: ESdat_AU+BlueSphereenviro@ESdatLabSync.net	Project Name: Barwon Water ASS assessment		Contact: Josh Alexander

Special Comments/Directions:
Email copy of results to Brigette and Jake

Analytes

Lab ID	Sample ID	Date/Time	Matrix	Container	Hold	Dissolved metals/metalloids (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Al, Mn & Fe	Total metals/metalloids (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Al, Mn & Fe	NT-01 & 02	NT-06
1	PC_SW01	25/11/2024	w	4p		X	X	X	X
2	PC_SW02	25/11/2024	w	4p	X				
3	PC_SW03	25/11/2024	w	4p		X	X	X	X
4	PC_SW05	25/11/2024	w	4p	X				
5	PC_SW06	25/11/2024	w	4p		X	X	X	X
6	MC_SW01	25/11/2024	w	4p	X				
7	MC_SW02	26/11/2024	w	4p		X	X	X	X
8	MC_SW04	26/11/2024	w	4p		X	X	X	X
9	MC_SW05	26/11/2024	w	4p		X	X	X	X
10	DM_SW01	26/11/2024	w	4p		X	X	X	X
11	DM_SW02	26/11/2024	w	4p		X	X	X	X
12	DM_SW03	26/11/2024	w	4p		X	X	X	X
13	QC01	26/11/2024	w	4p		X	X	X	X

Environmental Division
Melbourne
Work Order Reference
EM2420790

Telephone : + 61-3-8549 9600

1. Relinquished By:	LAB Received By: Moorea	Turn around time: 24hr 48hr 5 day Standard
Date & Time:	Date & Time: (Aug)	
Signature:	Signature: 24/11, 15-00	Method of Shipment: Courier Hand Delivered
2. Received By:	Report Number:	
Date & Time:	Laboratory Comments:	
Relinquished By:		
Date & Time:		
Signature:		

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2420790**

Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Melbourne
Contact	: MR JAKE HOPKINS	Contact	: Josh Alexander
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: jhopkins@bluesphere-enviro.com.au	E-mail	: Josh.Alexander@alsglobal.com
Telephone	: ----	Telephone	: +61-3-8549 9600
Facsimile	: ----	Facsimile	: +61-3-8549 9626
Project	: 31155.03	Page	: 1 of 3
Order number	: 31155.03	Quote number	: EM2024ISGENV0014 (EM24ISGENV0014)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 27-Nov-2024 15:00	Issue Date	: 27-Nov-2024
Client Requested Due Date	: 04-Dec-2024	Scheduled Reporting Date	: **04-Dec-2024**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 4.4°C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 13 / 10

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted at ALS Melbourne, NATA accreditation no. 825, site no. 13778.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	(On Hold) WATER No analysis requested	WATER - EG020F Dissolved Metals by ICP/MS	WATER - EG020T Total Metals by ICP/MS (including digestion)	WATER - EG035F Dissolved Mercury	WATER - EG035T Total Mercury	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-06 Total Nitrogen + NO2 + NO3
EM2420790-001	25-Nov-2024 00:00	PC_SW01		✓	✓	✓	✓	✓	✓
EM2420790-002	25-Nov-2024 00:00	PC_SW02	✓						
EM2420790-003	25-Nov-2024 00:00	PC_SW03		✓	✓	✓	✓	✓	✓
EM2420790-004	25-Nov-2024 00:00	PC_SW05	✓						
EM2420790-005	25-Nov-2024 00:00	PC_SW06		✓	✓	✓	✓	✓	✓
EM2420790-006	25-Nov-2024 00:00	MC_SW01	✓						
EM2420790-007	26-Nov-2024 00:00	MC_SW02		✓	✓	✓	✓	✓	✓
EM2420790-008	26-Nov-2024 00:00	MC_SW04		✓	✓	✓	✓	✓	✓
EM2420790-009	26-Nov-2024 00:00	MC_SW05		✓	✓	✓	✓	✓	✓
EM2420790-010	26-Nov-2024 00:00	DM_SW01		✓	✓	✓	✓	✓	✓
EM2420790-011	26-Nov-2024 00:00	DM_SW02		✓	✓	✓	✓	✓	✓
EM2420790-012	26-Nov-2024 00:00	DM_SW03		✓	✓	✓	✓	✓	✓
EM2420790-013	26-Nov-2024 00:00	QC01		✓	✓	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ALL INVOICES

- A4 - AU Tax Invoice (INV)	Email	Accounts@bluesphere-enviro.com.au

BRIGETTE SMALL

- *AU Certificate of Analysis - NATA (COA)	Email	bsmall@bluesphere-enviro.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	bsmall@bluesphere-enviro.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	bsmall@bluesphere-enviro.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	bsmall@bluesphere-enviro.com.au
- Chain of Custody (CoC) (COC)	Email	bsmall@bluesphere-enviro.com.au
- EDI Format - ESDAT (ESDAT)	Email	bsmall@bluesphere-enviro.com.au

ESDAT REPORTS

- EDI Format - ESDAT (ESDAT)	Email	ESdat_AU+BlueSphereenviro@ESdatLabSync.net

JAKE HOPKINS

- *AU Certificate of Analysis - NATA (COA)	Email	jhopkins@bluesphere-enviro.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jhopkins@bluesphere-enviro.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jhopkins@bluesphere-enviro.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jhopkins@bluesphere-enviro.com.au
- Chain of Custody (CoC) (COC)	Email	jhopkins@bluesphere-enviro.com.au
- EDI Format - ESDAT (ESDAT)	Email	jhopkins@bluesphere-enviro.com.au

CERTIFICATE OF ANALYSIS

Work Order	: **EM2420790**	Page	: 1 of 6
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Melbourne
Contact	: MR JAKE HOPKINS	Contact	: Josh Alexander
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 31155.03	Date Samples Received	: 27-Nov-2024 15:00
Order number	: 31155.03	Date Analysis Commenced	: 27-Nov-2024
C-O-C number	: ----	Issue Date	: 04-Dec-2024 19:00
Sampler	: ----		
Site	: ----		
Quote number	: EM24ISGENV0014		
No. of samples received	: 13		
No. of samples analysed	: 10		

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.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Tahlia Freeman	Instrument Operator	Melbourne Inorganics, Springvale, VIC

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 Contract 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.

- ED041G/ED045G: EM2420790 #7 and #13 Result for Sulfate and Chloride have been confirmed by re-preparation and re-analysis.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	PC_SW01	PC_SW03	PC_SW06	MC_SW02	MC_SW04
				Sampling date / time	25-Nov-2024 00:00	25-Nov-2024 00:00	25-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00
Compound	CAS Number	LOR	Unit		EM2420790-001	EM2420790-003	EM2420790-005	EM2420790-007	EM2420790-008
					Result	Result	Result	Result	Result
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		**10**	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**41**	**48**	**53**	**50**	**54**
Total Alkalinity as CaCO3	----	1	mg/L		**51**	**48**	**53**	**50**	**54**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**2**	**2**	<1	**16**	**3**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**51**	**58**	**71**	**311**	**48**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**8**	**8**	**9**	**13**	**10**
Magnesium	7439-95-4	1	mg/L		**7**	**7**	**9**	**17**	**7**
Sodium	7440-23-5	1	mg/L		**32**	**36**	**42**	**147**	**31**
Potassium	7440-09-7	1	mg/L		**2**	**2**	**1**	**2**	**2**
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.05**	**0.04**	**0.02**	**0.07**	**0.02**
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**0.021**	**0.103**	**0.664**	**1.54**	**0.057**
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	**0.006**	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L		**0.87**	**1.02**	**1.01**	**4.10**	**0.24**
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.49**	**0.23**	**0.06**	**0.22**	**0.14**
Arsenic	7440-38-2	0.001	mg/L		<0.001	**0.001**	<0.001	**0.001**	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	PC_SW01	PC_SW03	PC_SW06	MC_SW02	MC_SW04
				Sampling date / time	25-Nov-2024 00:00	25-Nov-2024 00:00	25-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00
Compound	CAS Number	LOR	Unit		EM2420790-001	EM2420790-003	EM2420790-005	EM2420790-007	EM2420790-008
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**0.028**	**0.116**	**0.695**	**1.65**	**0.068**
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	**0.006**	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	**0.007**	<0.005
Iron	7439-89-6	0.05	mg/L		**1.74**	**1.93**	**2.10**	**6.63**	**0.54**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.09**	**0.04**	<0.01	**0.02**	**0.03**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.09**	**0.04**	<0.01	**0.02**	**0.03**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.4**	**0.4**	**0.4**	**3.4**	**0.3**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.5**	**0.4**	**0.4**	**3.4**	**0.3**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**2.50**	**2.64**	**3.06**	**10.1**	**2.50**
ø Total Cations	----	0.01	meq/L		**2.42**	**2.59**	**3.04**	**8.49**	**2.47**
ø Ionic Balance	----	0.01	%		**----**	**----**	**0.32**	**8.67**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MC_SW05	DM_SW01	DM_SW02	DM_SW03	QC01
				Sampling date / time	26-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00
Compound	CAS Number	LOR	Unit		EM2420790-009	EM2420790-010	EM2420790-011	EM2420790-012	EM2420790-013
					Result	Result	Result	Result	Result
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		69	252	114	141	2
Total Alkalinity as CaCO3	----	1	mg/L		69	252	114	141	2
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		3	8	4	4	59
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		144	562	184	316	313
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		15	48	27	30	13
Magnesium	7439-95-4	1	mg/L		14	52	23	31	17
Sodium	7440-23-5	1	mg/L		74	282	89	157	150
Potassium	7440-09-7	1	mg/L		2	5	4	3	2
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.03	<0.01	0.04	<0.01	0.07
Arsenic	7440-38-2	0.001	mg/L		0.001	0.001	0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		1.05	1.58	0.567	0.500	1.57
Nickel	7440-02-0	0.001	mg/L		0.002	<0.001	0.001	0.001	0.006
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L		0.84	0.26	1.25	0.26	4.06
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.58	0.10	0.60	0.16	0.21
Arsenic	7440-38-2	0.001	mg/L		0.001	0.001	0.002	<0.001	0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	MC_SW05	DM_SW01	DM_SW02	DM_SW03	QC01
				Sampling date / time	26-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00	26-Nov-2024 00:00
Compound	CAS Number	LOR	Unit		EM2420790-009	EM2420790-010	EM2420790-011	EM2420790-012	EM2420790-013
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.001**
Copper	7440-50-8	0.001	mg/L		**0.002**	<0.001	**0.002**	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**1.10**	**2.50**	**0.635**	**0.591**	**1.66**
Nickel	7440-02-0	0.001	mg/L		**0.002**	<0.001	**0.002**	**0.002**	**0.006**
Zinc	7440-66-6	0.005	mg/L		**0.013**	<0.005	<0.005	<0.005	**0.007**
Iron	7439-89-6	0.05	mg/L		**2.09**	**1.38**	**2.99**	**0.86**	**7.37**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.04**	**0.02**	**0.09**	<0.01	**6.02**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.04**	**0.02**	**0.09**	<0.01	**6.02**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.6**	**1.0**	**2.7**	**0.8**	**4.3**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.6**	**1.0**	**2.8**	**0.8**	**10.3**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**5.50**	**21.0**	**7.55**	**11.8**	**10.1**
ø Total Cations	----	0.01	meq/L		**5.17**	**19.1**	**7.21**	**11.0**	**8.62**
ø Ionic Balance	----	0.01	%		**3.11**	**4.95**	**2.29**	**3.78**	**7.87**

QUALITY CONTROL REPORT

Work Order	: **EM2420790**	Page	: 1 of 9
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Melbourne
Contact	: MR JAKE HOPKINS	Contact	: Josh Alexander
Address	: 113 FERRARS STREET SOUTHBANK VICTORIA 3006	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 31155.03	Date Samples Received	: 27-Nov-2024
Order number	: 31155.03	Date Analysis Commenced	: 27-Nov-2024
C-O-C number	: ----	Issue Date	: 04-Dec-2024
Sampler	: ----		
Site	: ----		
Quote number	: EM24ISGENV0014		
No. of samples received	: 13		
No. of samples analysed	: 10		

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.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Laboratory Coordinator	Melbourne Inorganics, Springvale, VIC
Jarwis Nheu	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC
Tahlia Freeman	Instrument Operator	Melbourne Inorganics, Springvale, VIC

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 (%)
ED037P: Alkalinity by PC Titrator (QC Lot: 6219406)									
EM2420783-001	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	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	74	74	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	74	74	0.0	0% - 20%
EM2420774-015	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	<1	<1	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.0	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 6219407)									
EM2420790-005	PC_SW06	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	53	52	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	53	52	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6218901)									
EM2420790-005	PC_SW06	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
EM2420649-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6218908)									
EM2420784-008	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	79	79	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 6218904)									
EM2420790-005	PC_SW06	ED045G: Chloride	16887-00-6	1	mg/L	71	72	0.0	0% - 20%
EM2420649-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 6218909)									

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 (%)*
ED045G: Chloride by Discrete Analyser (QC Lot: 6218909) - continued									
EM2420784-008	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	195	196	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 6227723)									
EM2420790-003	PC_SW03	ED093F: Calcium	7440-70-2	1	mg/L	8	8	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	7	7	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	36	36	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EM2420790-013	QC01	ED093F: Calcium	7440-70-2	1	mg/L	13	14	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	17	17	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	150	148	1.4	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 6227720)									
EM2420654-003	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EM2420778-008	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.008	0.008	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 6227724)									
EM2420790-009	MC_SW05	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit

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 (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 6227724) - continued									
EM2420790-009	MC_SW05	EG020A-F: Manganese	7439-96-5	0.001	mg/L	1.05	1.06	0.7	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.84	0.85	1.5	0% - 50%
EM2420790-013	QC01	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	1.57	1.58	0.6	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.07	0.08	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	4.06	4.12	1.5	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 6223109)									
EM2420378-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0002	0.0003	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.02	0.01	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EM2420790-005	PC_SW06	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.695	0.696	0.2	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.06	0.07	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	2.10	2.10	0.0	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 6227722)									

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 (%)*
EG035F: Dissolved Mercury by FIMS (QC Lot: 6227722) - continued									
EM2420790-012	DM_SW03	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EM2420708-015	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 6228534)									
EM2420619-002	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EM2420790-005	PC_SW06	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6218903)									
EM2420790-005	PC_SW06	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EM2420649-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6218910)									
EM2420784-008	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 6221167)									
EM2420790-001	PC_SW01	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.09	0.09	0.0	No Limit
EM2420790-013	QC01	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	6.02	6.04	0.3	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 6223296)									
EM2420790-009	MC_SW05	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.0	No Limit
EM2420754-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	4.7	4.7	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 Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED037P: Alkalinity by PC Titrator (QCLot: 6219406)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	86.4	85.0	116
ED037P: Alkalinity by PC Titrator (QCLot: 6219407)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	103	85.0	116
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6218901)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	500 mg/L	104	90.0	110
				<1	25 mg/L	105	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6218908)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	500 mg/L	105	90.0	110
				<1	25 mg/L	102	90.0	110
ED045G: Chloride by Discrete Analyser (QCLot: 6218904)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	110	90.0	110
				<1	10 mg/L	108	90.0	110
ED045G: Chloride by Discrete Analyser (QCLot: 6218909)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	110	90.0	110
				<1	10 mg/L	105	90.0	110
ED093F: Dissolved Major Cations (QCLot: 6227723)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	111	80.0	120
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	103	80.0	120
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	102	80.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	101	80.0	120
EG020F: Dissolved Metals by ICP-MS (QCLot: 6227720)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	99.8	90.4	111
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.2	89.0	111
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	88.1	83.5	111
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.5	83.2	109
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.9	83.1	107
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.4	84.6	108
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	96.4	84.8	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	93.0	84.3	110
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	98.6	86.3	112

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 6227720) - continued								
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.0	91.8	112
EG020F: Dissolved Metals by ICP-MS (QCLot: 6227724)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	95.2	90.4	111
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	99.8	89.0	111
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	90.2	83.5	111
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.4	83.2	109
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	96.8	83.1	107
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.7	84.6	108
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	93.8	84.8	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.8	84.3	110
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.4	86.3	112
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	98.7	91.8	112
EG020T: Total Metals by ICP-MS (QCLot: 6223109)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	108	89.6	110
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	106	89.2	110
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	97.6	86.4	115
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	89.0	112
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	102	88.3	111
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	99.4	88.3	112
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	89.9	113
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	98.4	88.8	113
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	106	90.0	115
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	105	85.7	117
EG035F: Dissolved Mercury by FIMS (QCLot: 6227722)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	97.9	71.6	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 6228534)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	97.6	73.4	119
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6218903)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	106	90.0	110
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6218910)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	103	90.0	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6221167)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	90.0	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6223296)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6223296) - continued								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	5 mg/L	85.3	70.0	117

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	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6218901)							
EM2420649-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	84.1	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6218908)							
EM2420790-007	MC_SW02	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	92.7	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 6218904)							
EM2420649-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	116	70.0	142
ED045G: Chloride by Discrete Analyser (QCLot: 6218909)							
EM2420790-007	MC_SW02	ED045G: Chloride	16887-00-6	400 mg/L	107	70.0	142
EG020F: Dissolved Metals by ICP-MS (QCLot: 6227720)							
EM2420654-003	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	96.3	76.6	124
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	90.1	74.6	118
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	98.8	71.0	135
		EG020A-F: Copper	7440-50-8	0.2 mg/L	97.3	76.0	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	99.2	75.0	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	98.1	64.0	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	95.2	73.0	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	113	75.0	131
EG020F: Dissolved Metals by ICP-MS (QCLot: 6227724)							
EM2420790-009	MC_SW05	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	99.4	76.6	124
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	90.0	74.6	118
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	97.8	71.0	135
		EG020A-F: Copper	7440-50-8	0.2 mg/L	98.6	76.0	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	97.4	75.0	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	# Not Determined	64.0	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	96.4	73.0	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	101	75.0	131
EG020T: Total Metals by ICP-MS (QCLot: 6223109)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 6223109) - continued							
EM2420378-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	114	82.0	123
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	103	81.8	123
		EG020A-T: Chromium	7440-47-3	1 mg/L	98.5	78.9	119
		EG020A-T: Copper	7440-50-8	1 mg/L	104	80.4	118
		EG020A-T: Lead	7439-92-1	1 mg/L	100	80.5	121
		EG020A-T: Manganese	7439-96-5	1 mg/L	96.8	73.0	123
		EG020A-T: Nickel	7440-02-0	1 mg/L	102	80.0	118
		EG020A-T: Zinc	7440-66-6	1 mg/L	105	74.0	120
EG035F: Dissolved Mercury by FIMS (QCLot: 6227722)							
EM2420790-001	PC_SW01	EG035F: Mercury	7439-97-6	0.01 mg/L	94.3	70.0	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 6228534)							
EM2420707-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	95.1	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6218903)							
EM2420649-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	107	80.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 6218910)							
EM2420790-007	MC_SW02	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	99.9	80.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6221167)							
EM2420790-003	PC_SW03	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	96.8	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6223296)							
EM2420754-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	87.8	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2420790**	Page	: 1 of 9
Client	: **BLUESPHERE ENVIRONMENTAL**	Laboratory	: Environmental Division Melbourne
Contact	: MR JAKE HOPKINS	Telephone	: +61-3-8549 9600
Project	: 31155.03	Date Samples Received	: 27-Nov-2024
Site	: ----	Issue Date	: 04-Dec-2024
Sampler	: ----	No. of samples received	: 13
Order number	: 31155.03	No. of samples analysed	: 10

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, where applicable to the methodology, 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
Matrix Spike (MS) Recoveries							
EG020F: Dissolved Metals by ICP-MS	EM2420790--009	MC_SW05	**Manganese**	7439-96-5	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
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**29-Nov-2024**	09-Dec-2024	✓
Clear Plastic Bottle - Natural (ED037-P) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**29-Nov-2024**	10-Dec-2024	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**27-Nov-2024**	23-Dec-2024	✓
Clear Plastic Bottle - Natural (ED041G) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**27-Nov-2024**	24-Dec-2024	✓

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
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**27-Nov-2024**	23-Dec-2024	✓
Clear Plastic Bottle - Natural (ED045G) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**27-Nov-2024**	24-Dec-2024	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**03-Dec-2024**	23-Dec-2024	✓
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**03-Dec-2024**	24-Dec-2024	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**03-Dec-2024**	24-May-2025	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**03-Dec-2024**	25-May-2025	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**29-Nov-2024**	24-May-2025	✓	**29-Nov-2024**	24-May-2025	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**29-Nov-2024**	25-May-2025	✓	**29-Nov-2024**	25-May-2025	✓

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
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**03-Dec-2024**	23-Dec-2024	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**03-Dec-2024**	24-Dec-2024	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**03-Dec-2024**	23-Dec-2024	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**03-Dec-2024**	24-Dec-2024	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**27-Nov-2024**	27-Nov-2024	✓
Clear Plastic Bottle - Natural (EK057G) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**27-Nov-2024**	28-Nov-2024	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**----**	----	----	**03-Dec-2024**	23-Dec-2024	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**----**	----	----	**03-Dec-2024**	24-Dec-2024	✓

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
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) PC_SW01, PC_SW03, PC_SW06	**25-Nov-2024**	**03-Dec-2024**	23-Dec-2024	✓	**03-Dec-2024**	23-Dec-2024	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) MC_SW02, MC_SW04, MC_SW05, DM_SW01, DM_SW02, DM_SW03, QC01	**26-Nov-2024**	**03-Dec-2024**	24-Dec-2024	✓	**03-Dec-2024**	24-Dec-2024	✓

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		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by Auto Titrator	ED037-P	3	29	**10.34**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	3	18	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	4	40	**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 (NOx) by Discrete Analyser	EK059G	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	3	18	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	3	18	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by Auto Titrator	ED037-P	2	29	**6.90**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	18	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	40	**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 (NOx) by Discrete Analyser	EK059G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	18	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	2	18	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	40	**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 (NOx) by Discrete Analyser	EK059G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	2	18	**11.11**	**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		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	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 Auto 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 thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm.
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.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. 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)

Analytical Methods	Method	Matrix	Method Descriptions
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 seperately 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)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. 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 1030E. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
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 RECORD

BlueSphere Environmental Pty Ltd
113 Ferrars Street
Southbank VIC 3006
Ph: (03) 9699 5286

Contact Name: Brigette Small	Lab Quote ID:	Page: 1 of 1	Envirolab 1 Dalmore Drive, Scoresby
Project Manager: Jake Hopkins	Project Number: 31155.03	Purchase Order: 31155.03	Ph 03 9763 2500 Fax 03 9763 2633
e-mail for results: ESdat_AU+BlueSphereenviro@ESdatLabSync.net	Project Name: Barwon Water ASS assessment		Contact: Analisa Mathrick

Special Comments/Directions:
Email copy of results to Brigette and Jake

Lab ID	Sample ID	Date/Time	Matrix	Container	Hold	Ca, Mg, Na, K, Cl, SO4, Alkalinity	Total Nitrogen + NO2 + NO3	Dissolved metals/metalloids (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Al, Mn & Fe	Total metals/metalloids (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Al, Mn & Fe
(	QC02	26/11/2024	w	4p		X	X	X	X

Analytes

1. Relinquished By:	LAB Received By: ES	Turn around time: 24hr 48hr 5 day Standard
Date & Time:	Date & Time: 27/11/24 4:15	
Signature:	Signature: ZJ	Method of Shipment: Courier Hand Delivered
2. Received By:	Report Number: MAR0498	
Date & Time:	Laboratory Comments:	
Relinquished By:	Ice, no seal, 6.9°	
Date & Time:		
Signature:		

Envirolab Services Pty Ltd
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melbourne@envirolab.com.au
www.envirolab.com.au

Sample Receipt Advice MFK0498

Client Details

Client	Bluesphere Environmental Pty Ltd (Southbank)
Attention	Jake Hopkins

Sample Login Details

Your Reference	31155.03
Envirolab Reference	MFK0498
Date Sample Received	27/11/2024
Date Instructions Received	27/11/2024
Date Final Results Expected	04/12/2024

Sample Condition

Samples received in appropriate condition for analysis	Yes
Number of Samples	1 Water
Turnaround Time	5 Days
Temperatures / Cooling Methods	6.9°C On Ice

Additional Info

Sample storage - waters are routinely disposed at approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default).

Please direct any queries to:

Pamela Adams

Phone 03 9763 2500
Email padams@envirolab.com.au

Chris De Luca

Phone 03 9763 2500
Email cdeluca@envirolab.com.au

Analysis underway, details on the following page

Sample Receipt Advice MFK0498

Analysis Grid

The • indicates the testing you have requested. ***THIS IS NOT A REPORT OF THE RESULTS.***

	Ion Balance	Nitrogen - Total N (Frozen)	Total Metals (LL)	Total Metals (LL)-Hg	Dissolved Metals (LL)	Dissolved Metals (LL)-Hg	Nitrogen - Nitrate	Nitrogen - Nitrite
MFK0498-01 Water | 26/11/2024 QC02	•	•	•	•	•	•	•	•

Suite Details

Suite Name	Suite Analyses
Ion Balance |Water	Alkalinity Suite, Cations - Dissolved, Chloride, Ion Balance, Sulfate
Dissolved Metals (LL) |Water	Al - Dissolved (LL), As - Dissolved (LL), Cd - Dissolved (LL), Cr - Dissolved (LL), Cu - Dissolved (LL), Fe - Dissolved (LL), Mn - Dissolved (LL), Ni - Dissolved (LL), Pb - Dissolved (LL), Zn - Dissolved (LL)
Dissolved Metals (LL)-Hg |Water	Hg - Dissolved
Nitrogen - Total N (Frozen) |Water	Nitrogen - NOx (Frozen), Nitrogen - TKN, Total Nitrogen - calc (Frozen)
Total Metals (LL) |Water	Al - Total (LL), As - Total (LL), Cd - Total (LL), Cr - Total (LL), Cu - Total (LL), Fe - Total (LL), Mn - Total (LL), Ni - Total (LL), Pb - Total (LL), Zn - Total (LL)
Total Metals (LL)-Hg |Water	Hg - Total

Envirolab Services Pty Ltd
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melbourne@envirolab.com.au
www.envirolab.com.au

Certificate of Analysis MFK0498

Client Details

Client	Bluesphere Environmental Pty Ltd (Southbank)
Contact	Jake Hopkins
Address	113 Ferrars St, Southbank, VIC, 3006

Sample Details

Your Reference	31155.03
Number of Samples	1 Water
Date Samples Received	27/11/2024
Date Instructions Received	27/11/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for soils and on an as received basis for other matrices.

Report Details

Date Results Requested by	04/12/2024
Date of Issue	04/12/2024

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

Authorisation Details

Results Approved By	Chaminda Gunasekara, Inorganics Supervisor Chris De Luca, Lab Manager Tara White, Metals Supervisor
Laboratory Manager	Chris De Luca

Certificate of Analysis MFK0498

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
MFK0498-01	QC02	Water	26/11/2024	27/11/2024

Acid Extractable Low Level Metals (Water)

Envirolab ID	Units	PQL	MFK0498-01
Your Reference			QC02
Date Sampled			26/11/2024
Aluminium	µg/L	10	89
Arsenic	µg/L	1.0	<1.0
Cadmium	µg/L	0.10	<0.10
Chromium	µg/L	1.0	<1.0
Copper	µg/L	1.0	<1.0
Iron	µg/L	10	4900
Mercury	µg/L	0.050	<0.050
Manganese	µg/L	1.0	1600
Nickel	µg/L	1.0	6.1
Lead	µg/L	1.0	<1.0
Zinc	µg/L	1.0	4.4

Dissolved Low Level Metals (Water)

Envirolab ID	Units	PQL	MFK0498-01
Your Reference			QC02
Date Sampled			26/11/2024
Aluminium	µg/L	10	160
Arsenic	µg/L	1.0	1.0
Cadmium	µg/L	0.10	<0.10
Chromium	µg/L	1.0	<1.0
Copper	µg/L	1.0	<1.0
Iron	µg/L	10	8200
Mercury	µg/L	0.050	<0.050
Manganese	µg/L	1.0	1700
Nickel	µg/L	1.0	6.6
Lead	µg/L	1.0	<1.0
Zinc	µg/L	1.0	6.6

Inorganics - Ionic Balance and Indexes (Water)

Envirolab ID	Units	PQL	MFK0498-01
Your Reference			QC02
Date Sampled			26/11/2024
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	52
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	52
Chloride	mg/L	1.0	260
Sulfate	mg/L	1.0	13
Calcium	mg/L	0.50	12
Magnesium	mg/L	0.50	18
Potassium	mg/L	0.50	2.1
Sodium	mg/L	0.50	150
Hardness (calc) equivalent CaCO3	mg/L	3.0	100
Ionic Balance	%		-17
Total Anions	mg/L	7.0	320
Anions as meq	meq/L	0.59	8.5
Total Cations	mg/L	2.0	180
Cations as meq	meq/L	0.10	8.5

Certificate of Analysis MFK0498

Inorganics - Nutrients (Water)

Envirolab ID	Units	PQL	MFK0498-01
Your Reference			QC02
Date Sampled			26/11/2024
Nitrate as N	mg/L	0.0050	46
Nitrate as NO3 by calculation	mg/L	0.020	200
Nitrite as N	mg/L	0.0050	<0.0050
Nitrite as NO2 by calculation	mg/L	0.020	<0.020
NOx as N	mg/L	0.0050	46
TKN as N	mg/L	0.10	3.6
Total Nitrogen as N by calculation	mg/L	0.10	50

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - ION	Calculation
INORG-006	Alkalinity - determined titrimetrically based on APHA latest edition 2320-B. Solids reported from a 1:5 water extract unless otherwise specified. Total Carbon Dioxide - determined by calculation in accordance with APHA latest edition,4500-CO2 D.
INORG-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% i.e. total anions = total cations +/-15%.
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-062	TKN - determined colourimetrically. Alternatively, TKN can be derived from calculation (Total N - NOx).
INORG-081	Anions determined by Ion Chromatography. Waters samples are filtered on receipt prior to analysis. Solids are analysed from a water extract. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS.Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.Salt forms and/or anion/cation forms (e.g. FeO, PbO, ZnO, BO3) are determined stoichiometrically from the base metal concentration.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

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

Surrogate Spike

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

LCS (Laboratory Control Sample)

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

Matrix Spike

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

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

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

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary MFK0498

Client Details

Client	Bluesphere Environmental Pty Ltd (Southbank)
Your Reference	31155.03
Date Issued	04/12/2024

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary MFK0498

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Total Metals (LL) | Water	1	26/11/2024	28/11/2024	29/11/2024	Yes
Total Metals (LL)-Hg | Water	1	26/11/2024	26/11/2024	28/11/2024	Yes
Dissolved Metals (LL) | Water	1	26/11/2024	28/11/2024	29/11/2024	Yes
Dissolved Metals (LL)-Hg | Water	1	26/11/2024	28/11/2024	02/12/2024	Yes
Alkalinity Suite | Water	1	26/11/2024	28/11/2024	28/11/2024	Yes
Chloride | Water	1	26/11/2024	28/11/2024	02/12/2024	Yes
Dissolved Cations | Water	1	26/11/2024	28/11/2024	02/12/2024	Yes
Ion Balance | Water	1	26/11/2024	28/11/2024	02/12/2024	Yes
	1	26/11/2024	28/11/2024	04/12/2024	Yes
Sulfate | Water	1	26/11/2024	28/11/2024	02/12/2024	Yes
Nitrogen - Nitrate | Water	1	26/11/2024	29/11/2024	02/12/2024	Yes
Nitrogen - Nitrite | Water	1	26/11/2024	29/11/2024	02/12/2024	Yes
Nitrogen - NOx (Frozen) | Water	1	26/11/2024	29/11/2024	02/12/2024	Yes
Nitrogen - TKN | Water	1	26/11/2024	29/11/2024	02/12/2024	Yes

Outliers: Matrix Spike

METALS-020|Inorganics - Ionic Balance and Indexes (Water)| Batch BFK5172

Sample ID	Analyte	% Limits	% Recovery
BFK5172-MS1#	Calcium	70 - 130	##[1]
BFK5172-MS1#	Magnesium	70 - 130	##[1]
BFK5172-MS1#	Potassium	70 - 130	##[1]
BFK5172-MS1#	Sodium	70 - 130	##[1]

METALS-022|Acid Extractable Low Level Metals (Water)| Batch BFK5037

Sample ID	Analyte	% Limits	% Recovery
BFK5037-MS1#	Zinc	70 - 130	##[1]

Quality Control MFK0498

METALS-021|Acid Extractable Low Level Metals (Water) | Batch BFK4670

Analyte	Units	PQL	Blank	DUP1 BFK4670-DUP1# Samp | QC | RPD %	DUP2 BFK4670-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK4670-MS1#
Mercury	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	102	107

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022|Acid Extractable Low Level Metals (Water) | Batch BFK5037

Analyte	Units	PQL	Blank	DUP1 BFK5037-DUP1# Samp | QC | RPD %	DUP2 BFK5037-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK5037-MS1#
Aluminium	µg/L	10	<10	21.5 | 23.5 | [NA]	<10 | <10 | [NA]	98.5	113
Arsenic	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	101	102
Cadmium	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	101
Chromium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	101	100
Copper	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	102	94.7
Iron	µg/L	10	<10	20.8 | 19.3 | [NA]	<10 | <10 | [NA]	103	103
Lead	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	101	94.7
Manganese	µg/L	1.0	<1.0	1.95 | 1.88 | [NA]	<1.0 | <1.0 | [NA]	101	101
Nickel	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	101	97.3
Zinc	µg/L	1.0	<1.0	11.4 | 9.21 | 20.9	<1.0 | <1.0 | [NA]	102	##[1]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-021|Dissolved Low Level Metals (Water) | Batch BFK5168

Analyte	Units	PQL	Blank	DUP1 BFK5168-DUP1# Samp | QC | RPD %	DUP2 BFK5168-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK5168-MS1#
Mercury	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	107	99.6

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022|Dissolved Low Level Metals (Water) | Batch BFK5170

Analyte	Units	PQL	Blank	DUP1 BFK5170-DUP1# Samp | QC | RPD %	DUP2 BFK5170-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK5170-MS1#
Aluminium	µg/L	10	<10	16.7 | 16.2 | [NA]	<50 | <50 | [NA]	99.1	98.0
Arsenic	µg/L	1.0	<1.0	39.6 | 39.1 | 1.17	<5.0 | <5.0 | [NA]	99.8	111
Cadmium	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.50 | <0.50 | [NA]	100	106
Chromium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<5.0 | <5.0 | [NA]	100	107
Copper	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<5.0 | <5.0 | [NA]	98.2	99.0
Iron	µg/L	10	<10	238 | 241 | 0.981	11100 | 11900 | 7.68	100	101
Lead	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<5.0 | <5.0 | [NA]	97.3	92.2
Manganese	µg/L	1.0	<1.0	1.86 | 1.75 | [NA]	4680 | 4610 | 1.34	101	110
Nickel	µg/L	1.0	<1.0	1.06 | 1.05 | [NA]	<5.0 | <5.0 | [NA]	99.9	100
Zinc	µg/L	1.0	<1.0	4.00 | 1.30 | [NA]	11.7 | 14.2 | [NA]	99.3	102

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-081|Inorganics - Ionic Balance and Indexes (Water) | Batch BFK5064

Analyte	Units	PQL	Blank	DUP1 BFK5064-DUP1# Samp | QC | RPD %	DUP2 BFK5064-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK5064-MS1#
Chloride	mg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	564 | 558 | 1.07	110	104
Sulfate	mg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	3340 | 3320 | 0.661	110	104

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control MFK0498

METALS-020|Inorganics - Ionic Balance and Indexes (Water) | Batch BFK5172

Analyte	Units	PQL	Blank	DUP1 BFK5172-DUP1# Samp | QC | RPD %	DUP2 BFK5172-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK5172-MS1#
Calcium	mg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	715 | 718 | 0.440	102	##[1]
Magnesium	mg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	1130 | 1140 | [NA]	105	##[1]
Potassium	mg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	162 | 170 | 4.92	104	##[1]
Sodium	mg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	7260 | 7220 | 0.594	87.5	##[1]
Hardness (calc) equivalent CaCO3	mg/L	3		<3.0 | <3.0 | [NA]	6430 | 6470 | 0.569	[NA]	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-006|Inorganics - Ionic Balance and Indexes (Water) | Batch BFK5199

Analyte	Units	PQL	Blank	DUP1 BFK5199-DUP1# Samp | QC | RPD %	LCS %
Bicarbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	[NA]
Carbonate Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	[NA]
Hydroxide OH- as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	[NA]
Total Alkalinity as CaCO3	mg/L as CaCO3	5.0	<5.0	<5.0 | <5.0 | [NA]	104

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-055|Inorganics - Nutrients (Water) | Batch BFK5288

Analyte	Units	PQL	Blank	DUP1 BFK5288-DUP1# Samp | QC | RPD %	DUP2 BFK5288-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK5288-MS1#
Nitrate as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	83.3	76.6
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.0050	<0.0050	0.00744 | 0.00704 | [NA]	<0.0050 | <0.0050 | [NA]	107	116
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
NOx as N	mg/L	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	95.1	96.4

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-062|Inorganics - Nutrients (Water) | Batch BFK5456

Analyte	Units	PQL	Blank	DUP1 BFK5456-DUP1# Samp | QC | RPD %	DUP2 BFK5456-DUP2# Samp | QC | RPD %	LCS %	Spike % BFK5456-MS1#
TKN as N	mg/L	0.10	<0.10	0.600 | 0.556 | 7.69	1.01 | 0.829 | 19.8	88.5	88.0

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

QC Comments

Identifier	Description
[1]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.

Appendix C
Laboratory Documents

Calibration Certificate
Water Quality Meter

Date: 22/11/2024
Enqip Contract No.: 23634
Company: Blue Sphere
Contact/Consultant: Brigette Small

Technician: Phuong Tran
PO No.: 31155.03

UNIT IDENTIFICATION	
Unit Type	HI9829
Serial Number	HI9829-07 07420027101

INSPECTION RECORD		
Test	**Passed**	**Comments**
Batteries checked	☒	
Date/time correct	☒	
Electrodes cleaned and checked	☒	
Temperature check	☒	

CALIBRATION			
Sensor	**Cal. Solution**	**Value**	**Reading**
pH	pH: Buffer Solution 4.00	4.00	4.00
	pH: Buffer Solution 7.00	7.00	7.00
Redox	Zobell ORP solution	234.5 @ 20 °C	234.5
O_2	Dissolved Oxygen: 0 % Standard	0%	0.0
	Dissolved Oxygen: 100 % Standard	100 %	100.0
Conductivity	Standard Conductivity Solution	2.76 mS/cm	2.76 mS/cm
Turbidity	Demineralised water	0.0 FNU	N/A
	Turbidity Solution	FNU	N/A

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