



Detailed Site Investigation

Former Bulong Mine Site, Bulong Road, Bulong, WA
Confidential Privileged Communication

Prepared for:
Department of Mines, Industry Regulation and Safety
100 Plain Street
East Perth, WA 6004

18 June 2020





Distribution

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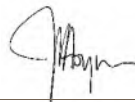

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Executive Summary

Senversa Pty Ltd was commissioned by the Department of Mines, Industry Regulation and Safety (DMIRS) to undertake a detailed site investigation (DSI) to address data gaps in the characterisation of potentially impacted soils, sediment and groundwater relating to the former 'Bulong' mine site located on Bulong Road, Bulong. The Bulong site is located approximately 40 km east of Kalgoorlie, adjacent Lake Yindarlgooda.

The site is one of four pilot sites under the DMIRS Abandoned Mines Program for which the overarching objectives are to identify and characterise hazardous sites, assess the associated safety and/or environmental risks and prioritise works with consideration to potential risk mitigation measures and beneficial end land use. Following completion of an earlier preliminary site investigation (PSI) by other parties, the specific objectives for this DSI were to:

- Assess whether the site (including but not limited to the leach residue storage facility (LRSF) and evaporation ponds) has contributed to an unacceptable risk to the identified receptors.
- Evaluate whether remediation or on-going management measures are required to address impacts identified.

The site has been previously reported to DWER by DMIRSDMIRS as a suspected contaminated site. It is intended that by meeting the above objectives, a more informed assessment can be made by DWER with regard to an appropriate classification for the site under the *Contaminated Sites Act 2003*.

To achieve the stated objectives a sampling and analysis quality plan was prepared and implemented, including:

- Characterising surface impacts via soil sampling and analysis.
- Assessing dust impacts using a combination of dust gauging and occupational exposure monitoring.
- Characterising groundwater quality, via installation of new groundwater wells, and sampling and analysis of groundwater samples.
- Assessment of potential for impacts to Lake Yindarlgooda via sediment sampling.

The investigations undertaken to date have been sufficient to progress the characterisation of soil, air, groundwater and sediment quality at the site enabling some data gaps to be closed out, and refinement of remaining data gaps.

Overall, the investigation has not identified evidence of gross dust emissions or related surficial soil impacts. Identified metals concentrations in surficial soils may be within background ranges for the region, but the relationship between identified metal concentrations and naturally occurring metals has not been established convincingly, and there is some evidence that the identified metal distributions may relate to former mining operations rather than wholly to natural ranges. These could in turn pose a risk to the local ecology and also livestock under future pastoral use.

Assessment of groundwater and Lake Yindarlgooda has identified evidence of impacts emanating from the site and associated potential risks to the Lake Yindarlgooda ecology. It was recognised that, as a salt lake, Lake Yindarlgooda represents an ecology with unique features and attributes (including the concentration of many substances due to high evaporation rates) and the available screening criteria, which don't account for any adaption to this, may not be appropriate.

In light of the DSI outcomes the conceptual site model (CSM) has been revised and updated to reflect that the following source-pathway-receptor (SPR) linkages are potentially complete:

- Direct uptake of contaminants of potential concern (COPCs) through consumption of vegetation by livestock (and ultimately humans).
- Direct uptake and/or contact of COPCs in impacted soil by terrestrial vegetation and fauna.
- Direct contact / direct uptake of COPCs transported in dust (and potentially via surface water flow) by biota in the Lake Yindarlgooda ecological system.
- Direct contact / direct uptake of COPCs via leaching of residue and saturated zone transport in groundwater by biota in the Lake Yindarlgooda ecological system.



The latter two SPR linkages are considered to be the primary risk driver for further assessment of the site.

Given that potential risks to receptors have been identified or cannot otherwise be closed-out due to limitations in Tier 1 screening criteria, further assessment of risk is warranted via completion of a more detailed and site-specific ecological risk assessment (ERA) in accordance with Schedule B5a of the National Environmental Protection Measure (NEPM) Assessment of Site Contamination (ASC) 1999 (as amended 2013). It is considered plausible to perform an ERA based only on the current dataset; however, some additional data collection may assist in further optimising the ERA, such as for example further detail around dust emission seasonality and stability, metal in soil livestock bioavailability and direct assessment of porewater. In this regard any further investigation scoping should be conducted in consultation with an ERA professional.

Active remediation at the site based on the current dataset and contaminated site considerations alone is not considered warranted. Rather, the outcome of the above described ERA should be used as the basis in confirming whether remediation and/or management is or is not required to mitigate risks.

A summary of the conclusions from the investigation is presented below.

Summary of Conclusions and Recommended Actions

Data Gap

Recommended Action

Data Gap 1: Nature and extent of metal impacts in soil and associated risks

Soil sampling undertaken to date does not show a clear spatial distribution of impacts, with increasing concentrations of contaminants with distance from the LRSF being observed in some instances.

Results of soil sampling indicate that concentrations of nickel, chromium and arsenic (in one location only) are present in surface soils at concentrations greater than ecological assessment criteria.

Concentrations of COPCs in surface soils were all less than applicable human health screening criteria.

The remaining data gap relates to the risk to terrestrial ecology and livestock under potential pastoral land uses from potentially impacted surficial soil.

Further assessment of ecological risk (including livestock under pastoral use) is considered warranted. Some intrusive investigation (e.g bioavailability analysis etc) may be useful to further optimise the risk assessment (depending on the design of the risk assessment).

Assessment of any risk to the most significant ecological receptor Lake Yindarigooda should be undertaken using sediment and groundwater quality data (see below).

Data Gap 2: Air Quality and Associated Risks

Dust emissions from the LRSF were observed during the works, with dust deposition sampling indicating that rates of deposition were greater than the adopted assessment criteria in one location at the site boundary.

Rates of dust inhalation were found to be acceptable when compared to occupational exposure criteria.

Remaining data gap relates to dust emission seasonality and LRSF stability, which are not currently defined.

While no immediate health risk has been identified regarding dust deposition, this assessment has not extended to an evaluation of acute impacts to surrounding vegetation from physical dust deposition. Such assessment should further complement the ERA (including whether and to what extent impacts in surficial soil remain dynamic) and future performance monitoring and benchmarking of any environmental management measures.

While not deemed necessary based on the current dataset and beyond the scope of contaminated sites assessment, stabilisation of the LRSF surface consistent with previous advice from Department of Mines and Petroleum (2010) is likely to be required for long term geotechnical stability and nuisance dust suppression.



Data Gap

Recommended Action

Data Gap 3: Nature and Extent of Impacts in Groundwater

Additional investigations have allowed an updated understanding of groundwater flow direction and hence an understanding of background groundwater conditions.

Numerous metals are present at concentrations suggestive of a potential risk to fresh or marine water ecosystems; however, it is noted that these assessment criteria are not directly relevant to inland saline lakes of Western Australia and concentrations of these COPCs are also greater than the assessment criteria in background (i.e. up-gradient) groundwater wells.

An evaluation of up-gradient groundwater quality to water quality immediately down-gradient of the LSRF indicates that there are elevated concentrations of metals and nutrients located immediately down-gradient of the LRSF, suggesting that some leaching and infiltration of contaminants is likely to be occurring.

Elevated nickel concentrations (relative to background) appear to extend approximately 500 m down-gradient, while ammonia-N may extend further.

The remaining data gap includes the lateral down-gradient extent and vertical extent of impacted groundwater; however, more comprehensive characterisation of these aspects through installation of additional wells may not be necessary to adequately assess ecological risk to Lake Yindarlgooda.

Further ecological risk assessment for Lake Yindarlgooda, including, where appropriate, derivation of site-specific sediment and water guidelines values in accordance with prevailing guidelines.

Data Gap 4: Lake Yindarlgooda

Total metals concentrations in sediment from Lake Yindarlgooda did not show a large spatial variation, suggesting that seasonal wetting and drying may play a role in redistributing any surficial impacts.

While total concentrations of metals were indicative of potential toxicity risks, further assessment of metal concentrations suggests that the risk may only be realised for nickel in three of six locations, noting that in general, maximum metal concentrations were observed in samples immediately east and south-east of the LRSF.

While evaluation of sediment data has used multiple lines of evidence, the absence of porewater data (including analysis of nutrients in porewater) has constrained the assessment of risk.

Further ecological risk assessment for Lake Yindarlgooda, including, where appropriate, derivation of site-specific sediment and water guidelines values in accordance with prevailing guidelines.



Recommendations for Site Classification

Senversa understands that a larger land parcel incorporating the site as defined in this DSI has previously been reported via submission of a Form 1 as being potentially contaminated under the CS Act, based on the findings of the PSI (SLR, 2018). This land parcel was defined as follows:

Parcel 34759 = Former Bulong Nickel Mine on dead Mining Tenement M25/97, within Lot 223 on Deposited Plan 238210 as shown on certificate of title LR316/121.

It is understood that DWER have not yet formally classified Parcel 34759 under the CS Act.

The findings of the site investigation undertaken indicate that while contaminants of concern were detected in soil, sediment and groundwater at concentrations that exceed Tier 1 assessment criteria; further consideration of the risks to the identified receptors is required to appropriately evaluate these potential risks. As such, and now that a DSI has been completed, Senversa consider recommend that the classification for the site could proceed and that most appropriate classification would be "*possibly contaminated – investigation required*" (PCIR).

Noting that the original Form 1 nominated Parcel 34759 whilst this investigation has identified soil and groundwater impacts largely confined the northern portion of Dead Mining Tenement M25/97 (being the former Bulong Mine Site) it is considered reasonable to refine the site definition for the purposes of classification under the CS Act. In this regard, it is recommended DMIRS further engage with DWER (and other stakeholders as applicable) in assigning an appropriate site boundary.



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List of Acronyms

Acronym	Definition
ABC	Ambient background concentration
ACL	Added contaminant limit
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ASC	Assessment of Site Contamination
AVS	Acid volatile sulphides
BoM	Bureau of Meteorology
BG	Background
COPC	Contaminant of potential concern
CSM	Conceptual site model
CS Act	Contaminated Sites Act 2003
DG	Default guideline
DGV	Default Guideline Value
DMIRS	Department of Mines, Industry Regulation and Safety
DMP	Department of Mines and Petroleum
DSI	Detailed site investigation
DWER	Department of Water and Environment Regulation
EC	Electrical conductivity
EIL	Ecological investigation level
FWG	Fresh Water Guideline
GME	Groundwater monitoring event
GPS	Global positioning system
GV-high	Guideline Value - high
ICP-MS	Inductively coupled mass spectrometry
LOR	Limit of reporting
LRSF	Leach Residue Storage Facility
m	Metre
m³	Cubic metres
m AHD	Metres Australian Height Datum
m bgl	Metres below ground level



Acronym	Definition
mg/kg	Milligrams per kilogram
MW	Monitoring well
MWG	Marine Water Guideline
NATA	National Association of Testing Authority
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
PEM	Personal exposure monitor
QA	Quality assurance
QC	Quality control
RPD	Relative percentage difference
SEM	Simultaneously extracted metals
SWL	Standing water level
TDS	Total dissolved solids
TEOM	Tapered Element Oscillating Microbalance
TWA	Time-weighted average
µg/kg	Micrograms per kilogram
µg/L	Micrograms per litre
URPOS	Urban Residential Public Open Space
WHO	World Health Organisation
XRF	X-Ray Fluorescence



1.0 Introduction and Objectives

Senversa Pty Ltd was commissioned by the Department of Mines, Industry Regulation and Safety (DMIRS) to undertake a detailed site investigation (DSI) to address data gaps in the characterisation of potentially impacted soils, sediment and groundwater relating to the former 'Bulong' mine site located on Bulong Road, Bulong. The Bulong site is located approximately 40 km east of Kalgoorlie, adjacent Lake Yindarigooda (**Figure 1**).

For the purposes of this investigation, the site boundary is considered to be the dead mining tenement M25/97, which includes the leach residue storage facility (LRSF), evaporation ponds and ancillary infrastructure including but not limited to the underdrainage sump and access roads.

1.1 Background

It is understood that mining operations at Bulong were conducted in several open pits to access the nickel/cobalt resource. The associated processing plant comprised facilities for high pressure acid leaching, solvent extraction and electrowinning. Hypersaline leach residue was pumped to the LRSF, with underdrainage discharged to the evaporation ponds (**Figure 2**).

The tenement holders became insolvent and mining ceased in 2005. Receivers were appointed in 2010, the tenement expired in 2013 and the bond was called in during 2014. The site was selected as one of four pilot programs to be run by the former Department of Mines (DMP) under the Abandoned Mines Program.

The former DMP undertook several field inspections and a site assessment between 2015 and 2017 to assess the stability of the LRSF. The DMP commissioned a site assessment by Soil Water Consultants (SWC) in June 2017 to identify the environmental risks and contributing factors associated with the LRSF. SWC identified that the tailings were 'moderately to slightly acidic with a low potential for acid mine drainage, and indicated that there did not appear to be a discharge of tailings from the facility, noting that 'the LRSF remains intact and the tailings are securely contained in the facility'. Recommendations were made by SWC to conduct soil sampling and sample decant and underdrainage solution ponds.

A preliminary site investigation (PSI) for Bulong was completed in January 2019 (SLR, 2018). As part of the PSI, SLR Consulting (SLR) undertook a limited soil and groundwater sampling program targeting areas with the highest potential for contamination as identified through a desktop assessment of available information. The PSI indicated that areas with elevated soil concentrations of chromium and nickel were located to the east, south and south-west of the LRSF, and around the boundary of the evaporation ponds. In addition, concentrations of metals, ammonia and cyanide were greater than the adopted assessment criteria in several groundwater samples, indicating that numerous migration pathways were potentially active at the site. Based on the findings of the PSI, a detailed site investigation (DSI) was recommended to further investigate potential impacts to the surrounding environment resulting from dust deposition, sedimentation and groundwater migration.

Senversa understand that based on the outcomes of the above investigations (specifically the PSI) DMIRS reported the site (as defined in **Section 2.2** of this report) to the Department of Water and Environmental Regulation (DWER) under the *Contaminated Sites Act 2003* as a 'known or suspected contaminated site'. It is understood that formal classification of the site by DWER is pending and subject to the outcomes of further investigation, to be underpinned by this DSI.



1.2 Objectives

The overarching objectives of the DMIRS Abandoned Mines Program is to identify and characterise hazardous sites, assess the associated safety and/or environmental risks and prioritise works with consideration to potential risk mitigation measures and beneficial end land use. The objectives for this DSI were to:

- Assess whether the site (including but not limited to the LRSF and evaporation ponds) has contributed to an unacceptable risk to the identified receptors.
- Evaluate whether remediation or on-going management measures are required to address impacts identified.

It is intended that by meeting the above objectives, a more informed assessment can be made by DWER with regard to an appropriate classification for the site under the *Contaminated Sites Act 2003* (and any associated further actions, as applicable).

1.3 Scope of Work

In accordance with identified data gaps and corresponding scope proposed within the sampling and analysis quality plan (SAQP) previously prepared by Senversa (Senversa, 2019), the following scope of work was undertaken:

- Soil sampling and analysis, including:
 - Measurement of metals concentrations in surficial soil via X-ray fluorescence (XRF) along 13 transects.
 - Sampling and analysis of 30 primary soil samples for a selection of metals, cyanide, nutrients and physical parameters.
- Dust and air quality monitoring, including:
 - Sampling of air quality at six locations using dust deposition gauges.
 - Monitoring of inhalable particles via personal exposure monitors (PEMs).
- Groundwater sampling and analysis, including:
 - Installation of five additional monitoring wells.
 - Gauging and sampling of eight existing and five new groundwater monitoring wells for a selection of analytes including metals, nutrients and physical parameters.¹
- Sediment and pore water sampling, including:
 - Collection of sediment samples at six locations.
 - Analysis for total moisture, acid volatile sulphides (AVS), simultaneously extracted metals (SEM) and metals.

¹ Within the bounds of the allotted field program eight of 13 existing monitoring wells were sampled with well selection based on the spatial coverage and overall expected usefulness in progressing the defined data gaps.



2.0 Site Information

2.1 Site Location

The site is located on the western shoreline of Lake Yindarlgooda, approximately 5 km east of the decommissioned Bulong Nickel processing plant, and approximately 40 km northeast of Kalgoorlie.

2.2 Site Description

A summary of property information is presented in **Table 2.1**.

Table 2.1: Summary of Property Information

ID	Location/Rationale
Site Address	Bulong Road, Bulong, WA 6431.
Lot Plan Number	Parcel 34759 (part of Lot 223 on Deposited Plan 238210; Certificate of Title LR3136/121). The site boundary is considered to be Dead Mining Tenement M25/97, as shown in Figure 1 , which is a smaller portion of Parcel 34759.
Site Area	Approximately 840 ha.
Current Land Use	Abandoned mine. Pastoral Lease NO49710. Various prospecting tenements, including P25/2313 over the LSRF and P252309 over the Evaporation Ponds.
Current Zoning	Rural.
Local Government	City of Kalgoorlie-Boulder.

2.3 Contaminated Sites Classification

Senversa understand that based on the outcomes of the above investigations (specifically the PSI) DMIRS reported the site (dead mining tenement M25/97) to the Department of Water and Environmental Regulation (DWER) under the *Contaminated Sites Act 2003* as a 'known or suspected contaminated site'. It is understood that formal classification of the site by DWER is pending and subject to the outcomes of further investigation, to be underpinned by this DSI.

2.4 Future Land Use

The site is designated as rural under the City of Kalgoorlie Boulder Planning Scheme No. 1 (DPLH, 2019). Under this scheme, rural use is defined as to:

- Provide for the development of rural activity as appropriate.
- Provide for the development of mining activity as appropriate.
- Protect land from urban uses that may jeopardise the future use of that land for priority mining and rural uses.
- Accommodate the development of isolated communities including aboriginal and railway settlements.



Discussions with DMIRS staff indicate that the proposed future use of the site has not been decided. It is understood that future land use will be evaluated following results of additional site investigations, site management or remedial works (where deemed necessary), in consultation with key stakeholders.

2.5 Site Infrastructure and Site Processes

Infrastructure currently present on-site is summarised in **Table 2.2**, as per descriptions from Soilwater Consultants (2017) and as shown on **Figure 2**.

Table 2.2: Summary of Site Infrastructure

Infrastructure	Location	Description
Leachate Residue Storage Facility	Tenement M25/97. East of Bulong Processing Plant.	Single cell storage facility. Construction of LRSF walls involved multiple lifts using stony scree and lake sediments. The embankment wall varies in height; <1 m along the north western section and up to approximately 8 m along the south eastern section. Total LRSF area of approximately 48 ha, while the tailings surface was approximately 42 ha. The LRSF floor follows local topography sloping from the northwest to the southeast.
Tailing spigot discharge system	Pipework along the internal banks of the LRSF.	Approximately 300 mm diameter poly pipe. Leach residue was discharged from the pipes into the LRSF. The pipes were regularly cycled around the storage facility to develop even beaches that slope towards the centre of the LRSF.
Decant structure	Approximately 50 m along the LRSF pontoon, extending from the west wall of the LRSF.	Raised cement structure, approximately 2 m in diameter and 1 m from ground level. Water from LRSF flowed into the decant tower/internal riser and through an outfall pipe to the external settling pond. From there the water was pumped to the evaporation pond.
Underdrainage solution pond	Along the southern embankment of LRSF.	Underground solution pond is lined and fenced. The inlet is located on the northern bank of the pond. Approximately total area of 0.02 ha.
Toe Drain	Perimeter of LRSF at base of external embankment walls.	Drainage network around perimeter of LRSF.
Access track	Southwest to northeast orientation of main track.	Unsealed access tracks. Access is also possible along the embankment of the LRSF and evaporation ponds.

The associated processing plant comprised facilities for high pressure sulphuric acid leaching, solvent extraction and electrowinning. Hypersaline leach residue was pumped to the LRSF, with underdrainage discharged to the evaporation ponds. Typical composition of the washed and neutralised leach residue was expected to be as follows (Kinchill, 1996):



Table 2.5 Quantity and characteristics of leach residue liquor

Hydrochemical characteristic	Leach residue liquor to dam
Volume (kL/d)	6,750
pH	7.4
Sodium	36,900
Magnesium	13,110
Calcium	3,880
Chloride	81,430
Sulphate	48,360
Iron	<1
Manganese	35
Nickel	11.8
Chromium	<1
Cobalt	<1
Copper	<0.1
Cadmium	<0.01
Lead	<0.02
Arsenic	<0.1
Aluminium	<1
Zinc	<0.1
Ammonium sulphate	11,380
Kerosene	-

Note: Unit of measurement is in mg/L, except pH (dimensionless) and volume.

Principal chemicals associated with the LRSF liquor are therefore considered to be magnesium, calcium, chloride, manganese, nickel, sulphate and ammonium / nitrate species. Which chemicals are considered to be contaminants of potential concern (CoPCs) based on previous phases of work are described in **Section 4.1**.

2.6 Surrounding Land Use

The site is surrounded by pastoral lease and several mining tenements exist over and surrounding the site, as shown in **Appendix A**. General surrounding land use is summarised in **Table 2.3**.

Table 2.3: Summary of Surrounding Land Use

Direction	Description
North	North: Pastoral lease and prospecting tenements P25/2311 and P25/2452.
East	East: Lake Yindarlgooda, exploration license E25/553.
South	South: Lake Yindarlgooda, and Pastoral lease P25/2312.
West	West: Pastoral lease P2504, mining tenements M25/151, P25/2306, P25/232.



2.7 Summary of Site History

A detailed history for the site is presented in SLR (2018). A brief summary of significant events in the history of the site is presented in **Table 2.4**.

Table 2.4: Summary of Site History

Date	Description
Pre-1992	The site is utilised for pastoral land. The site comprises uncleared vegetation, with several access tracks.
1992	Mining lease is approved under the <i>Mining Act 1978</i> .
Feb 1996	Environmental assessments are completed for the proposed development (Kinhill Engineers, 1996).
July 1996	Approval for mining of nickel / cobalt was issued. Mining operations were undertaken over several open pits, with ore processed by high pressure acid leaching.
March 1997	The feasibility study for the LRSF was completed.
1999	Bulong Nickel Operations Pty. Ltd and Bulong Nickel Pty. Ltd acquire the project and commence mining. The LRSF and evaporation ponds were constructed on the shoreline of Lake Yindarlgooda.
March 2000	Numerous issues were identified with the LRSF and evaporation ponds, including: <ul style="list-style-type: none"> • A large volume of water was present in the evaporation pond • Repair works to the external toe of the south-western embankment of the evaporation pond were completed, with minor seepage identified • Seepage was observed through a section of the north-eastern embankment of the evaporation pond.
October 2000	A notice of intent was lodged with DMP regarding the proposed installation of a new evaporation pond.
2001	The northwest corner of the LRSF was extended, and an additional cell was added to the evaporation ponds. Brown surface colouration was observed to spread from the south-east corner of the LRSF and appeared to be surface run-off into Lake Yindarlgooda.
October 2001	A notice of intent regarding a proposal to use the Criterion Pit for leach residue storage to supplement the existing LRSF was lodged with DMP.
August 2003	The Annual Environmental Review report indicated that hydrocarbon and process chemical management and domestic / industrial waste disposal were generally unsatisfactory. Wetting / discolouration was observed midway up the north and east embankments of the LRSF, Tailings were observed in Evaporation Pond 2 (DIR, 2003).
November 2003	A temporary closure plan was prepared, detailing environmental impact assessment and approvals, license details, and the environmental management approach to closure and residue management
2005	Mining ceased.
2013	Mining tenement expired.
2014	Bond was called to cover costs of site remediation



Date	Description
June 2017	<p>Soilwater Consultants undertook a preliminary assessment at the abandoned facility. Key findings of the report were as follows:</p> <ul style="list-style-type: none"> • The facility was structurally stable. • Sediment observed in Lake Yindarlgooda was inferred to be due to surface erosion of the outer southern embankment of the LRSF (rather than transport of the tailings themselves). • Rehabilitation works recommended included a decrease in embankment slope by building the southern embankment out with rocky scree.
December 2018	<p>SLR complete a PSI at the site, with the objective of assessing whether potential sources of contamination were present at the site with the potential for unacceptable impacts to identified receptors. The scope of work included a review of publicly available records, a site walkover and limited judgemental soil and groundwater sampling and analysis. Key findings of the report were as follows:</p> <ul style="list-style-type: none"> • Areas of interest included the LRSF and the Evaporation Ponds. • Nickel, chromium and (and, to a lesser extent, arsenic) were identified in soil at concentrations greater than the assessment criteria in an area to the east, south and south-west of the LRSF, and surrounding the Evaporation Ponds. The concentrations observed were comparable to concentrations observed within the LRSF and the Evaporation Ponds. • Analysis of pre-existing groundwater bores indicated that metals (cadmium, chromium, cobalt, copper, lead, nickel and zinc), ammonia and cyanide were all detected at concentrations greater than the adopted assessment criteria. • Numerous potentially complete exposure pathways were identified, relating to transport of contaminants from the LRSF by wind, surface water, or dissolution by groundwater. <p>The following recommendations were made:</p> <ul style="list-style-type: none"> • Secure the site to limit access to inducted personnel. • Undertake additional groundwater monitoring events (GME), including an assessment of the integrity of existing groundwater bores. • Undertake an airborne dust deposition assessment to evaluate the impact of dust arising from the LRSF and Evaporation Ponds.
April 2019	<p>The site is reported as a known or suspected contaminated site to the DWER via a Form 1. The report is made on the basis of the results of the PSI (SLR, 2018), in addition to consultation with DWER by DMIRS.</p>
April 2019	<p>The DWER inform DMIRS that the decision has been made to extend the time to classify the site. It is understood that the assessment work already undertaken, in combination with the current detailed site investigation will be submitted to the DWER and used as the basis for site classification.</p>

2.8 Current Site Conditions

A site visit was undertaken on 24 June 2019 in order to assess site conditions and prepare for the detailed site investigations. The site inspection was undertaken by Blaire Coleman and Georgia Hefron (Senversa), and Ian Mitchell and Kate Hryczyszyn (DMIRS).

The site was found to be in wet condition, with several tracks deemed inaccessible due to boggy conditions. A review of the Bureau of Meteorology (BOM) website (2019) indicated that 5.2 mm of rainfall was received at Kalgoorlie-Boulder in the preceding 24 hours. Due to the wet conditions, several of the proposed sampling sites were unable to be reached; however, in general infrastructure at the site was observed to be consistent with reports from SWC (2017) and SLR (2018) and additional information supplied by DMIRS. Several access tracks relevant to proposed XRF transects and background groundwater monitoring wells were also observed.



3.0 Environmental Setting

The environmental setting of the site has previously been described by SLR (2018). **Table 3.1** presents a summary of the environmental setting. In summarising this data, Senversa has consulted the primary publicly available databases to assess for factual correctness, in addition to reviewing relevant historical information supplied by DMIRS. A review of climate data (i.e. rainfall and windspeed) was also sourced from BOM.

Table 3.1: Summary of Environmental Setting

Item	Detail																																																																																																
Climate	<p>Kalgoorlie has a semi-arid climate with hot summers and mild winters. The average annual rainfall is 267 mm on an average of 68 days (at Kalgoorlie-Boulder airport; BOM, 2019). While the average rainfall is fairly evenly distributed throughout the year, there is considerable variation from year to year, with yearly maxima ranging from 74 to 308 mm. A summary of long-term averages for temperature and rainfall is presented below (BOM, 2019).</p> <table> <tr> <th></th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th><th>Ann</th></tr> <tr> <td>Mean Max (°C)</td><td>33.7</td><td>32.1</td><td>29.4</td><td>25.2</td><td>20.7</td><td>17.5</td><td>16.8</td><td>18.7</td><td>22.3</td><td>25.9</td><td>29.1</td><td>32</td><td>25.2</td></tr> <tr> <td>Mean Min (°C)</td><td>18.3</td><td>17.9</td><td>16.1</td><td>12.7</td><td>8.7</td><td>6.2</td><td>5</td><td>5.7</td><td>8</td><td>11.2</td><td>14.2</td><td>16.6</td><td>11.7</td></tr> <tr> <td>Mean Rain (mm)</td><td>27.5</td><td>31.2</td><td>25.2</td><td>20.5</td><td>24.9</td><td>27.3</td><td>25.3</td><td>21.3</td><td>13.9</td><td>16.0</td><td>18.9</td><td>16.5</td><td>267</td></tr> <tr> <td>Median Rain (mm)</td><td>8.4</td><td>13.2</td><td>9.8</td><td>13.3</td><td>20.1</td><td>20.4</td><td>24.4</td><td>15.8</td><td>10.4</td><td>9.3</td><td>13.2</td><td>11.8</td><td>244.3</td></tr> <tr> <td>Mean Rain Days</td><td>3.8</td><td>4.4</td><td>4.5</td><td>5.3</td><td>7.1</td><td>9.2</td><td>9.5</td><td>7.5</td><td>5.5</td><td>4.3</td><td>4</td><td>3.8</td><td>68.1</td></tr> </table> <p>Average annual evaporation is 2,641 mm (BOM, 2019), indicating that soil loses moisture rapidly. Annual wind direction verses speed data indicates that the prevailing wind at 9am is to the west (with a strong north, northwest and southwest component). Annual average wind speed at 3pm has a strong east and north-easterly component, as well as to the west and south-west. Wind-rose data is shown in Appendix B.</p>														Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann	Mean Max (°C)	33.7	32.1	29.4	25.2	20.7	17.5	16.8	18.7	22.3	25.9	29.1	32	25.2	Mean Min (°C)	18.3	17.9	16.1	12.7	8.7	6.2	5	5.7	8	11.2	14.2	16.6	11.7	Mean Rain (mm)	27.5	31.2	25.2	20.5	24.9	27.3	25.3	21.3	13.9	16.0	18.9	16.5	267	Median Rain (mm)	8.4	13.2	9.8	13.3	20.1	20.4	24.4	15.8	10.4	9.3	13.2	11.8	244.3	Mean Rain Days	3.8	4.4	4.5	5.3	7.1	9.2	9.5	7.5	5.5	4.3	4	3.8	68.1
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann																																																																																				
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Topography	<p>The Bulong site is situated on low stony rises on the western shoreline of Lake Yindarlgooda, which is a large island-studded salt lake, which forms a compensating basin for drainage from the surrounding area. Site topography ranges from 300 to 350 metres Australian Height Datum (AHD) (Kern, 1996).</p> <p>The LRSF was located on a section of land which sloped between 1 to 5 degrees towards the shoreline of Lake Yindarlgooda (Kinhill Engineers, 1996b). The LRSF embankment varies from <1m along the north western margin to around 8 m along the south eastern section, with the embankment level being approximately 331 mAHD.</p>																																																																																																



Item	Detail
Geology	<p>Geological mapping for the site and surrounds is presented in Figure 4.</p> <p>Geological strata underlying the site can be described as follows:</p> <ul style="list-style-type: none"> Northern Site: underlain by metamorphosed felsic igneous rocks (Mesoarchean era). The formation is metamorphosed feldspar porphyry and undifferentiated felsic volcanic rocks, including quartz-feldspar schist and quartz-muscovite schist. Southern site: Quaternary-period lake and swamp deposits, comprising mud, silt, evaporites, limestone, minor sand and peat. <p>The Bulong nickel and cobalt resource is concentrated within subsurface laterite deposits, derived from the weathering of ultramafic bedrock of the region (Kinhill Resources, 1996).</p> <p>Surface soils within the area are noted to comprise red-brown shallow calcareous loams (and calcareous loamy earths).</p> <p>Particle size distribution (PSD) tests undertaken as part of geotechnical investigations at the site in 2001 indicated that soils generally comprised medium plasticity sandy clays and clayey sands (Soil & Rock Engineering, 2001).</p> <p>Field investigations undertaken by SWC (2017) indicated that the LRSF embankment comprised well graded, coarse to fine sandy clay; while the tailings material comprised poorly graded silt and clay.</p> <p>Recent field investigations undertaken by SLR (2018) described the surface soils to mostly comprise clay / clay loam. Surface soils to the south of the LRSF embankment were described as clay, with a green clay hardpan.</p>
Hydrogeology	<p>The site and its surrounds are part of the Kurnalpi region, which comprises weathered and fractured Archaean bedrock overlain by palaeochannel deposits and widespread alluvium and like deposits (Kern, 1996).</p> <p><u>Groundwater Elevations</u></p> <p>Groundwater in the region ranges between 1 to 50 m below ground level (BGL), with a tendency to flow towards locations characterised by shallow groundwater tables, such as palaeo-drainage channels and modern playa lakes. Shallow groundwater was therefore inferred to be present at the site by SLR, with an easterly flow direction, towards Lake Yindarlgooda. Kern (1996) states that the regional watertable is close to the surface in playa-lake environments.</p> <p>Site-specific investigations by SLR indicated that groundwater levels ranged from 1.03 to 9.64 mBTC (shallow monitoring wells) and 1.13 to 12.38 mBTC (deep monitoring wells). Depth to groundwater was not contoured, and although groundwater wells were designated as “shallow” or “deep”, no further information on the bore construction or distinction between aquifers was supplied.</p> <p><u>Groundwater Quality</u></p> <p>Site specific investigations reported that pH of groundwater ranged from 5.74 to 7.36, and total dissolved solids ranged from 62,010 to 135,655 mg/L, indicating that groundwater was of brackish to saline quality. This is consistent with the ranges reported in Kern (1996).</p> <p><u>Registered Bores</u></p> <p>A review of the DWER’s Water Information Reporting (WIR) database (accessed July 2019) indicates that there are no registered groundwater bores within a 5 km radius of the site.</p> <p><u>Groundwater / Surface Water Interaction</u></p> <p>Shallow groundwater is inferred to discharge at Lake Yindarlgooda.</p> <p><u>Beneficial Use of Groundwater</u></p> <p>Given that groundwater at the site is not extracted and used, the highest beneficial use of groundwater has been determined to be for maintenance of the ecosystem of Lake Yindarlgooda.</p>
Hydrology, Wetlands and Sensitive Ecosystems	<p>The Bulong region is within the Raeside-Ponton Catchment of the Salt Lake Basin and Western Plateau Division (DPIRD, 2018).</p> <p>The surface hydrology at the site is characterised by Lake Yindarlgooda, isolated creek lines and diffuse ephemeral drainage lines (Soil and Rock Engineering, 2002). Lake Yindarlgooda extends west of the site and is approximately 338 km². Four apparent drainage lines have been identified within the vicinity of the site.</p>
Acid Sulfate Soil (ASS)	<p>A review of the Natural Resources Information Interactive Map (DMIRS, 2018) indicates that the site and its immediate surrounds were not at risk of being impacted by ASS.</p> <p>Site-specific information obtained by SLR was consistent with the above, with the no ASS being detected (SLR, 2018).</p>



Item	Detail
Vegetation	Vegetation at and surrounding the site comprises eucalypt woodland and shrub and grass thickets.
Environmental Value	<p>The site is considered to support valuable biodiversity due to its location within the Great Western Woodlands (GWW), which is currently under consideration for listing for conservation status under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> (EPBC). The Department of Biodiversity Conservation and Attractions (DBCA) released a Biodiversity and Cultural Conservation Strategy for the GWW in 2010, which delineates the GWW area and includes a portion of the site.</p> <p>Matters of National Environmental Significance (MNES) relevant to the site and surrounds were summarised in SLR (2018).</p> <p>According to the DBCA, two conservation significant species were located within a 5 km radius of the site:</p> <ul style="list-style-type: none"> • One Priority 1 flora (<i>Tecticornia flabelliformis</i>), 4 km south of the site. • One Priority 4 fauna (Hooded Plover, Hooded Dotterel) adjacent the site. <p>No recognised Threatened or Priority Ecological Communities are located within 15 km of the site.</p>
Aboriginal Heritage	<p>A review of the Aboriginal Heritage Inquiry System (DPLH, 2019) indicated that 14 registered Aboriginal Sites were located within 15 km of the site. Heritage sites are shown on Figure 2.</p> <p>It is noted that the Maduwongga people registered a native title claim over the site in 2017.</p>
European Heritage	A search of the Heritage Council of Western Australia State Heritage Register undertaken on 25 January 2019, indicated that no registered sites are located within the site.

3.1 Background Nickel and Chromium Concentrations

The Bulong nickel and cobalt resource is concentrated within subsurface laterite deposits, derived from the weathering of ultramafic bedrock of the region (Kinhill Resources, 1996). On this basis, any consideration of contamination resulting from the storage of processed leachate will need to consider ambient background nickel concentrations specific to the mineralised area. Nickel has previously been reported at concentrations greater than adopted assessment criteria (SLR, 2018). While chromium was not considered to be a COPC at the site based on the mineral deposit and previous characterisation of the leach residue (Section 2.5), it has also been previously been reported at concentrations greater than the EIL (SLR, 2015). This section summarises the available data regarding ambient nickel and chromium concentrations within the vicinity of the site, and is based on review of the following data sources:

- Heron Resources (2006) Bulong Manor Project, Annual Report, 01 January 2005 to 31 December 2006.

This document provides background information on the types of nickel-cobalt mineralisation in the area and documents several surface metal assay results for an area near the site. It is understood that the samples were collected from 25 to 200 mm depth after removing the top 20 mm.

In addition to the above information Senversa was also supplied with a database from DMIRS "Company Surface Data" containing surface metal data from Heron Resources, along with additional data sourced from:

- Acacia Resources Ltd (87 samples)
- Inco Australia Ltd (3 samples)
- Southern Gold Ltd (2,052 samples).

The data provided was extracted from the Company Surface Sample Geochemistry database publically accessible via GeoVIEW. WA and the Western Australian Mineral Exploration Reports (WAMEX) database.



3.1.1 Nickel Concentrations

A review of Heron Resources (2006) indicates that concentrations of nickel range from 40 mg/kg to 1,380 mg/kg within the vicinity of the site (with the closest samples being approximately 1 km southwest of the evaporation ponds). A comparison of total magnetic intensity (TMI) provided indicates that higher nickel concentrations (e.g. 320 to 1,380 mg/kg) correlate to the zone of higher TMI identified to extend close to the area mapped as Archaean ultramafic rocks (**Figure 4**).

A review of additional data supplied by DMIRSDMIRS for assay transects undertaken immediately west of the site (shown on **Figure 5a**) indicates that concentrations of nickel range up to 10,000 mg/kg in the areas of higher topography (Archaean bedrock). Concentrations within the low-lying area (Cainozoic colluvium and Quaternary alluvium) may be as high as 400 mg/kg (**Figure 5a**) but are more likely to be up to 180 mg/kg.

3.1.2 Chromium Concentrations

Data compiled by Heron Resources (2006) indicates that concentrations of chromium in surface soil within the area to the southwest of the site ranged from 351 to 12,100 mg/kg, with an average of 1,443 mg/kg. The additional dataset supplied by DMIRS (**Figure 5b**) indicates that concentrations of chromium immediately east of the site range from 24 to 12,100 mg/kg, with maximum concentrations observed in the higher topography to the west of the site (i.e. where bedrock is close to the surface). Concentrations within the low-lying sediments west of the site area may be up to 1,300 mg/kg, but area likely to be below 790 mg/kg.



4.0 Preliminary Conceptual Site Model

4.1 Potential Sources of Contamination

The two known areas of potential environmental concern (APEC) identified at the site are as summarised in **Table 3.1** and shown on **Figure 2**. A review of the SWC (2017) and SLR (2018) in conjunction with the historical information provided by DMIRS indicates that it is unlikely that additional AEPs are located within the site boundary (i.e. mining tenement M25/97).

Table 4.1: Potential Sources of Contamination

APEC	Source	Contaminants ¹
LRSF	Residual tailings	Metals [specifically arsenic, chromium and nickel which were previously detected in LRSF sediment and site soils at concentrations greater than the adopted assessment criteria (SLR, 2018)]
Evaporation Pond	Residual soils	Cyanide Nutrients (total nitrogen, ammonia, nitrate, nitrite, and sulphate were previously detected at concentrations greater than the assessment criteria)

¹ As defined from previous investigations (SLR, 2018), the results of which are summarised in Table 2.4. Aside from nitrate, major anions and cations are not considered COPCs for the purpose of this DSI).

Groundwater at the site is impacted with metals (cadmium, chromium, cobalt, copper, lead, nickel and zinc), ammonia and cyanide all detected at concentrations greater than the adopted assessment criteria.

The preliminary CSM for the site is presented in **Figure 6**.

4.2 Potential Migration and Exposure Pathways

Migration pathways identified include the following:

- Migration of impacted soil or leachable contaminants by surface water flow.
- Wind-blown migration of particulates (i.e. dust).
- Leaching of soluble contaminants and migration within groundwater.
- Uptake by vegetation and consumption by livestock.

It is noted that the decant, toe drain and underdrainage solution pond are all possible preferential pathways of contamination to groundwater.

Exposure routes include the following:

- Direct contact with impacted soil or surface water.
- Inhalation of impacted particulates.
- Incidental ingestion of impacted soil or surface water.
- Direct uptake by livestock.
- Direct uptake (including possible bioaccumulation) by ecosystems.



4.3 Potential Receptors

- On- and off-site users (pastoral / recreational / exploration / prospecting).
- Livestock
- On- and off-site terrestrial ecology (including transient fauna).
- On- and off-site ecosystems of Lake Yindarlgooda.



5.0 Data Gap Analysis and Data Quality Objectives

5.1 Data Gap Analysis

A review of the PSI undertaken by SLR (2018) indicates that the investigation was generally complete and in accordance with current guidance namely DWER (2014) *Assessment and Management of Contaminated Sites* and NEPC (2013) *National Environment Protection Measure (Assessment of Site Contamination)*. The review identified numerous gaps in the characterisation of contamination at the site, as shown in **Table 5.1**.

Table 5.1: Summary of Data Gaps, Preliminary Site Investigation (SLR, 2018)

Data Gap	Details
Data Gap 1: Nature and extent of metal impacts in soil and associated risks	<ul style="list-style-type: none"> Ambient background concentrations (ABCs) of metals in soil are unknown (i.e. background sample REF01 is considered too close to the site and too small a dataset upon which to base an ABC). Nominated EILs (ABC + added contaminant level (ACL)) by SLR (2018) in the PSI don't appear to account for ABCs and therefore are potentially conservative. SLR sampling may have 'composited' surficial soil contamination from dust with deeper underlying soils. Prevailing winds (as a key contaminant migration pathway) have not been defined. Only soils within (relative) close vicinity of the LRSF and Evaporation Pond have been assessed and hence the full extent of any identified impact is unknown. The geochemistry (and associated mobility/solubility properties) and environmental fate of metals is not understood. While a potential risk to terrestrial ecology and human was identified, the risk was not assessed and is currently unknown.
Data Gap 2: Air quality and associated risks	<ul style="list-style-type: none"> It is unknown whether dusting events at the LRSF and Evaporation Pond are ongoing and to what degree (this is also relevant to the above data gap). Contaminant concentrations in dust (including background quality) and associated risks are unknown.
Data Gap 3: Nature and extent of impacts in groundwater	<ul style="list-style-type: none"> Groundwater flow direction has not been determined using gauging data. Hydrogeology is not described at the local scale. It is noted that paired deep and shallow groundwater bores exist; however, the different aquifers and relationship are not described. There is no representative background groundwater monitoring bore. Whilst the background groundwater quality unknown, it is unlikely that the existing network (understood to be for license monitoring purposes) will adequately characterise groundwater quality. Hypersaline water from Lake Yindarlgooda may be confounding groundwater results. Accurate measurement of trace metals in high saline environments is inherently unreliable. Collision cell inductively coupled plasma mass spectrometry (ICP-MS) is recommended for analysis of water samples.
Data Gap 4: Risk to Lake Yindarlgooda	<ul style="list-style-type: none"> Hydraulic relationship between groundwater and Lake Yindarlgooda is not understood. Sediment and pore water quality is not known (acknowledging benthic organisms are likely to be a key ecological receptor).



5.2 Data Quality Objectives

The Data Quality Objectives (DQOs) for this DSI were developed based on the seven-step process presented in *National Environment Protection (Assessment of Site Contamination) Measure (as amended and in force 16 May 2013)* (ASC NEPM) (NEPC, 2013).

The DQO process has been tailored to suit the specific nature of the project and has been designed to be both consistent with the principles of DQO development and be fit for purpose (i.e. represent a logical rationale to inform and organise the data collection and implementation aspects of the project).

The NEPM ASC endorsed 'seven step DQO process' as follows:

1. Step 1: State the problem.
2. Step 2: Identify the decision/goal of the study.
3. Step 3: Identify the information inputs.
4. Step 4: Define the boundaries of the study.
5. Step 5: Develop the analytical approach/decision rules.
6. Step 6: Specify performance or acceptance criteria.
7. Step 7: Develop the plan for obtaining data.

DQO's for the current investigation are presented in **Table 5.2**.

**Table 5.2: Data Gaps and Corresponding Data Quality Objectives**

Data Gap	Data Gap 1: Nature and extent of metal impacts in soil and associated risks	Data Gap 2: Air quality and associated risks	Data Gap 3: Nature and extent of impacts in groundwater	Data Gap 4: Risk to Lake Yindarlgooda
1. Problem	<ul style="list-style-type: none"> Site derived soil impacts have been identified; however, the nature and extent are unknown. Adequate delineation, both vertical and lateral, is fundamental to understanding the nature and magnitude of 'the source' and providing an appropriate basis for detailed risk assessment. Metal concentrations in surface soil may be under-estimated. 	<ul style="list-style-type: none"> Dusting from the evaporation pond and LRSF is considered a primary contaminant pathway for surficial soil impacts identified on-site. The extent to which dusting is above ambient background conditions and remains an ongoing active contaminant pathway (and associated risk to human health and the environment) is unknown. 	<ul style="list-style-type: none"> Elevated contaminant concentrations have been detected in groundwater; however, the nature (including whether such concentrations are representative of background concentrations) and extent is unknown. As with soil impacts, adequate delineation is fundamental to understanding the potential for existing or future complete exposure pathways. 	<ul style="list-style-type: none"> In the context of this site, Lake Yindarlgooda is considered the key ecological receptor. Given the Lake is immediately adjacent to the Evaporation Pond and LRSF and that both dusting, surface runoff and groundwater discharge are all plausible contaminant pathways (to be further investigated) there is a reasonable likelihood that at least localised impact within the lake is identified by the DSI. The opportunity to augment the DSI in anticipation of this outcome should allow for more detailed assessment of actual risk (and an additional line of evidence).
2. Decision/ Goal of the Study	<ul style="list-style-type: none"> ABC determined and robust site-specific EILs calculated. Extent of site derived impacts above EILs have been determined. Metal geochemistry (and how this influences mobility and availability) understood. 	<ul style="list-style-type: none"> Dust deposition rates and associated contaminant concentrations versus background conditions and associated risks are understood. 	<ul style="list-style-type: none"> Background groundwater quality determined. Groundwater flow direction determined. Nature and extent of site derived groundwater impact above adopted screening criteria determined. Lateral extent of groundwater contamination characterised supporting an accurate assessment of pollutant linkage between source Lake Yindarlgooda. 	<ul style="list-style-type: none"> Relationship between groundwater levels and Lake Yindarlgooda better understood, particularly in the context of whether there is a complete source-pathway-receptor (SPR) linkage between groundwater and the lakebed ecosystem. Quality of surface water (if present) sediment and porewater characterised and compared against background Lake Yindarlgooda quality and assessment criteria.



Data Gap	Data Gap 1: Nature and extent of metal impacts in soil and associated risks	Data Gap 2: Air quality and associated risks	Data Gap 3: Nature and extent of impacts in groundwater	Data Gap 4: Risk to Lake Yindarlgooda
3. Inputs	<ul style="list-style-type: none"> Field observation and XRF screening (supported by a percentage of traditional sample collection and analysis) Where applicable, exploration survey and historical geochemical mining approvals soil data may be utilised (particularly in assessment of ambient background conditions). Laboratory analysis (contaminants, contaminant species, and geochemical indicators pH and redox) and comparison to EILs. 	<ul style="list-style-type: none"> Initial assessment of dust deposition rates both up and down-wind at varying distances. Personal exposure monitors (PEM) during fieldwork. BOM regional wind rose data. Sampling and analysis of collected dust from gauges for COPCs. 	<ul style="list-style-type: none"> Installation of additional groundwater monitoring wells. Comparison of groundwater levels within pre-existing deep and shallow bores. GME of existing and newly installed groundwater monitoring bores. Laboratory analysis (contaminants, contaminant species, toxicity modifying factors, geochemical indicators and comparison to adopted criteria (modified as appropriate). 	<ul style="list-style-type: none"> Outcomes of Data Gaps 1-3. Sediment sampling and analysis (including toxicity modifying factors), including representative background locations. Surface water sampling and analysis, including representative background locations. Porewater sampling and analysis, including representative background locations, ionic comparison with groundwater (to further the understanding of hydraulic relationship between groundwater and the lake).
4. Study Boundaries	<p>For the purposes of this DSI and consistent with notification to DWER the site boundary is defined by dead mining tenement M25/97 (Figure 1).</p> <p>The vertical extent of the study boundary will extend to the depth of groundwater (anticipated to be up to 12 mBGL).</p> <p>Temporal boundaries will be limited to a study event ranging at least five weeks from site mobilisation.</p> <p>Specific study constraints included:</p> <ul style="list-style-type: none"> The time of year and Senversa-DMIRS agreed investigation timeframes (and in particular acknowledging how soil moisture and wind patterns will vary seasonally). Indigenous heritage sites and how such sites may limit access (or the type of activity permitted). Vehicle access, noting potential areas may be inaccessible based on the outcomes of the site visit. XRF survey allowance limit of three days (subject to additional approval by DMIRSDMIRS if required). 			



Data Gap	Data Gap 1: Nature and extent of metal impacts in soil and associated risks	Data Gap 2: Air quality and associated risks	Data Gap 3: Nature and extent of impacts in groundwater	Data Gap 4: Risk to Lake Yindarlgooda
5. Decision Rules	<p>Has the extent of soil impact has been adequately characterised (i.e. is soil impact delineated using multiple lines of evidence an appropriate level of certainty)?</p> <p>If impacted soil is not considered to present a risk to the identified receptors (in accordance with assessment criteria outlined in Section 5), no further assessment will be required</p> <p>If the extent of soil impact has been adequately characterised and is considered to present a potential risk to the identified receptors, further detailed risk assessment will be required, along with an evaluation of possible management measures, where required.</p> <p>If the extent of soil impact has not been adequately characterised by the investigation, further intrusive investigations may be necessary.</p>	<p>If the magnitude of dusting is considered to be adequately characterised (i.e. allowing for potential seasonal variability) and is not considered to present a source of on-going contamination to the identified receptors (Section 5), no further investigation will be required.</p> <p>If the magnitude of dusting is appropriately characterised and it is considered to represent a source of on-going contamination to the identified receptors, further risk assessment and an evaluation of management measures may be required.</p> <p>If the extent of dusting is not adequately characterised (i.e. data cannot be extrapolated to represent average annual conditions) further investigations into dust deposition rates will be required.</p>	<p>Are ambient concentrations of COPCs in groundwater adequately characterised using multiple lines of evidence?</p> <p>If so, is the extent of groundwater with impacts greater than ambient concentrations adequately characterised (i.e. delineated with respect to the identified receptors and site boundaries?)</p> <p>If yes to the above, if the concentrations of COPCs identified in groundwater indicate a potential risk to the identified receptors (refer to assessment criteria in Section 5), then further risk assessment and an evaluation of management measures may be required.</p> <p>If groundwater is not considered to have been adequately characterised by the investigation, further groundwater investigations will be required.</p>	<p>Have sufficient lines of evidence (i.e. a combination of sediment / porewater / surface water data) been collected to evaluate potential risk to the lakebed ecosystem?</p> <p>If yes to the above, if measured concentrations of COPCs in sediments / porewater / surface water do not indicate a potential risk to the lakebed ecosystem, no further evaluation will be required.</p> <p>If yes to the above, if measured concentrations of COPCs in sediments / porewater / surface water indicate a potential risk to the lakebed ecosystem (refer to assessment criteria in Section 5)? Further risk assessment and an evaluation of management measures may be required.</p> <p>If the sediment and porewater results are not considered to provide an accurate representation of the quality of lakebed sediments, then further investigation may be required.</p>



Data Gap	Data Gap 1: Nature and extent of metal impacts in soil and associated risks	Data Gap 2: Air quality and associated risks	Data Gap 3: Nature and extent of impacts in groundwater	Data Gap 4: Risk to Lake Yindarlgooda
6. Specify Limits on Decision Errors	<p>Decision errors related to the two key study questions are possible:</p> <ul style="list-style-type: none"> Sampling errors that occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the site (i.e. the samples collected are not representative of the site conditions). Measurement errors that occur during sample collection, handling preparation, analysis and data reduction. <p>To minimise the potential for decision errors, the following data quality indicators (DQIs) will be adhered to: precision, accuracy, representativeness, comparability and completeness. DQIs will be assessed at the completion of the investigation to assess for the presence of decision errors. A description of the DQIs are as follows:</p> <ol style="list-style-type: none"> Precision – measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples. Precision is also assessed by sampling methodologies being appropriate and complied with. Accuracy – measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this project is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards. Accuracy is also assessed by sampling methodologies being appropriate and complied with. Representativeness – expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the Site, and by using an adequate number of sample locations to characterise the Site to the required accuracy. Comparability – expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods. Completeness – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study, including all critical locations sampled. Sensitivity – expresses the appropriateness of the chosen laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted criteria. <p>Further details on how the above DQIs will be assessed is presented in the quality assurance / quality control QA/QC procedures documented in Section 6.4 of this report. If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.</p>			
7. Optimise the Design	<p>The sampling and analysis program is presented in Section 7.0 and has been prepared with reference to relevant guidelines and regulations. The plan has been optimised based on the evaluation of historical data and the identified data gaps in site characterisation.</p> <p>Further optimisation will occur during the field program including:</p> <ul style="list-style-type: none"> Via 'real-time' data generated by the XRF analysis along the pre-defined transects allowing for delineation of contamination (e.g. the final lengths and locations of the transects as well as finalisation of soil, dust and groundwater background locations). Duration of dust gauging deployment was assessed by interim inspection of dust gauges between the first and second mobilisation). 			



6.0 Guideline Framework for Contamination Assessment

6.1 Assessment Guidelines

The approach to investigation of the site will be consistent with relevant guidelines including:

- 1) DWER *Contaminated sites guidelines*, including *Assessment and management of contaminated sites* (DER 2014).
- 2) ASC NEPM (NEPC, 2013).

The nominated soil, sediment, porewater, groundwater and dust/air quality assessment criteria to be used in the investigation are summarised in the following sections.

6.2 Soil Assessment Criteria

Soil assessment criteria are presented in **Table 6.1**.

Table 6.1: Soil Assessment Criteria

Assessment Criteria	Relevant Receptor	Source	Comments
Human Health Screening Criteria			
Health Investigation Level – Recreational (HIL-C)	Pastoral / recreational / prospecting site users	NEPC (2013)	Assesses exposures in scenarios such as for public open space, playing fields and footpaths. Is likely conservative, for the assumed exposure scenarios so will be applied as an initial screening tool in recognition of this. The opportunity to apply values derived using commercial/industrial exposure inputs (as per HIL-D) potentially more closely resembling anticipated exposure scenarios will be considered as appropriate. Note that the HIL-C allow for exposure paths including outdoor inhalation of dust, dermal contact with shallow soil and dust, and incidental ingestion of shallow soil and dust.
Ecological Screening Criteria			
Ecological Investigation Level for national parks and areas of high conservation status	Terrestrial ecology	NEPC (2013)	<p>EILs assess impacts to terrestrial vegetation from direct uptake of contaminants in soil.</p> <p>While the site is known to be utilised by pastoralists, it is noted that EIL criteria are not applicable to assess agricultural soils for the purposes of grazing, which require evaluation of plant contaminant uptake and consideration of soil type.</p> <p>Where possible, site-specific EILs will be calculated using soil physical-chemical parameters to define ACLs, and measured background concentrations to define ABCs.</p> <p>The methodology to derive site-specific EILs to be used in the field screening program via XRF is discussed in Section 6.2.1.</p>
Ecological Investigation Level for urban residential and public open space	Terrestrial ecology	NEP (2013)	Assessment of results against these less conservative EILs will be used to give further understanding of risks at the site, if it is not considered to reflect an area of high conservation status.



6.2.1 XRF Screening Criteria

To allow an adaptive approach to delineation of soil impacts in the field, XRF was used to screen samples against field assessment criteria as follows:

- Soil physical-chemical properties as defined by SLR (2018) were utilised to calculate added ACLs.
- Ambient background concentrations were conservatively assumed to be 0, given that the data gap analysis indicated that background soil samples may not have been appropriately located outside the inferred area of impact (**Section 2.9**). Appropriate ABCs will be calculated based on the analytical dataset obtained during the investigation and used in the final assessment of soil analytical results.

XRF screening criteria for metals are summarised in **Table 6.2**. It is noted that the XRF was used to delineate metal impacts in soil only, and not other COPCs such as nutrients or cyanide.

Table 6.2: Field Screening Criteria for Metals in Soil via XRF.

Analyte	EIL for Field Screening (mg/kg)	XRF Detection Limit (ppm) ¹
Arsenic	40	<5
Chromium	140	<10
Copper	95	<10
Lead	470	<5
Nickel	120	<5
Zinc	440	<5

¹ Olympus Vanta L Series

6.3 Sediment Assessment Criteria

Sediment samples were compared to Default Guideline Values (DGV) from ANZG (2018). DVGs represent the concentrations of COPCs below which there is a low risk of unacceptable effects occurring. Upper guideline values (GV-high) provide an indication of concentrations at which toxicity-related adverse effects may already be observed and are used as an indicator of potential high-level toxicity problems. It is noted that these guidelines are not directly applicable to saline inland wetlands of WA, and do not allow inclusion of an assessment of ambient background concentrations. DGV and GV-high values to be utilised in the investigation are presented in **Table 6.3**.

Table 6.3: Sediment Assessment Criteria (dry weight)

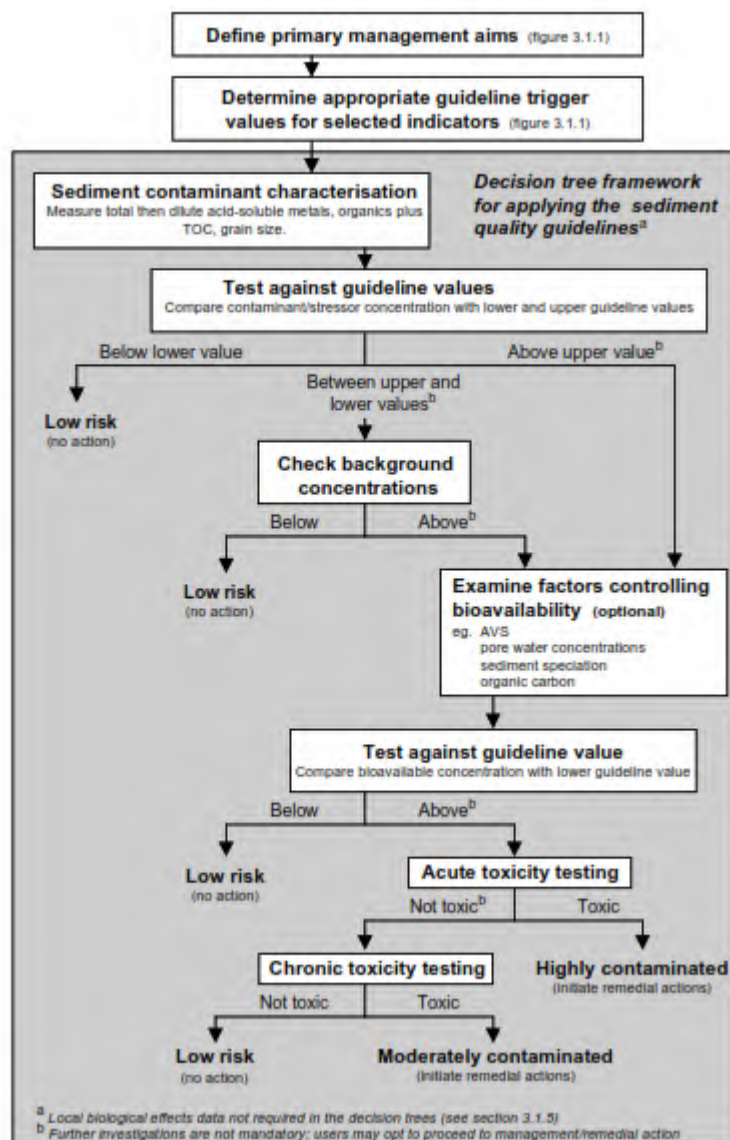
Analyte	DGV (mg/kg)	GV-high (mg/kg)
Arsenic	20	70
Chromium	80	370
Copper	65	270
Lead	50	220
Nickel	21	52
Zinc	200	410



Analyte	DGW (mg/kg)	GV-high (mg/kg)
Cyanide	n/a	n/a

6.3.1 Toxicity Modifying Factors

Exceedances of the GV-high values shown in **Table 6.3** were further evaluated in accordance with the decision tree for assessment of contaminated sediments ANZG (2018).



Additional lines of evidence included an assessment of factors controlling bioavailability using SEM and AVS. Bioavailable metals are indicated where $[SEM] - [AVS]$ is a positive value (i.e. there is more SEM than AVS). Metals are not considered bioavailable if $[SEM] - [AVS]$ is less than zero (i.e. there is excess AVS to bind metals). Nasr et al. 2014 further categorises the USEPA (2004) classification of SEMAVS as follows.

- Tier 1: $[SEM] - [AVS]$ is greater than 5 = Associated adverse effects on aquatic life are probable.
- Tier 2: $[SEM] - [AVS]$ is between zero and 5 = Associated adverse effects on aquatic life are possible.
- Tier 3: $[SEM] - [AVS]$ less than zero = No indication of associated adverse effects.



6.4 Groundwater, Leachate and Pore Water Assessment Criteria

Assessment criteria for groundwater are presented in **Table 6.4**.

Table 6.4: Groundwater, Leachate and Pore Water Assessment Criteria

Assessment Criteria	Receptor	Source	Comments
Ecological Screening Criteria			
Fresh Water Guidelines	Lake Yindarlgooda Ecology	ANZG (2018)	<ul style="list-style-type: none"> A 95 % species protection level will be applied. Where appropriate, screening values will be modified for the hardness of the water observed in Lake Yindarlgooda in accordance with ANZG (2018). Adoption of the 95% species protection level slightly–moderately disturbed ecosystems reflects the expectation that aquatic biodiversity may have been adversely affected by small but measurable degree by human activity such as via pastoralism and mining (beyond any site-specific contribution being investigated). Depending on measured salinity in the various media it may be more appropriate to assess risks to ecological via comparison with marine and not freshwater guideline values. In any case it is acknowledged that either the fresh water or marine water guideline values do not strictly apply to inland salt lakes and hence the assessment of risk will also take into account background concentrations.

Note that extraction of groundwater for non-potable use or stock watering is not considered a viable beneficial use of groundwater at the site (as described in **Table 3.1**), given the saline water quality and lack of abstraction within the area. As such, assessment criteria protective for human health in the use of groundwater have not been applied.

The adoption of the guidelines above is consistent with Section 5.2 of DWER (2014) in that the environmental value of groundwater is assigned by evaluating it by use or potential use [in this instance, maintenance of ecosystems (assumed to be at the point of possible discharge to Lake Yindarlgooda)].

6.5 Dust and Air Quality Assessment Criteria

6.5.1 Dust Deposition Gauge Data

Data obtained from fixed dust gauges was assessed as follows:

- Volume of dust in fixed dust gauges was evaluated for spatial trends (i.e. is there evidence of greater dusting in down-wind gauges?).
- Where possible, analytical results were used to calculate a mass per mass volume of dust, which will allow a comparison to HIL / EIL criteria.
- Senversa are not aware of any Western Australia or national legislation / policy stating specific deposition limits to be adhered to; hence in the absence of local or national guidelines Senversa has referred to New South Wales guidance which nominate a dust deposition value for impacts to amenity uses of 4g/m²/month (EPO New South Wales, 2010). This value broadly equates to a visible layer of dust on outdoor furniture or on a clean car as a means of contextualising the quantum of dust deposition.

It is noted that the above assessment provides a qualitative assessment as to whether dusting is occurring and to what degree. If results of the analysis indicate that dusting is likely to be a significant pathway for mobilisation of contaminants, then further quantitative assessment will be considered as a recommendation.



6.5.2 Personal Exposure Monitor Data

Data obtained from PEMs was compared to time-weighted averages (TWA) relevant to occupational exposure, as presented in NOHSC (1995) and summarised in **Table 6.5**.

Table 6.5: Time-Weighted Averages for Personal Exposure Monitor Data

Analyte	DGV (mg/m ³)
Arsenic	0.05
Chromium	0.5
Copper	1
Lead	0.15
Nickel	1
Zinc	n/a
Cyanide	5



7.0 Sampling and Analysis Procedures

Senversa prepared an initial (SAQP) to guide the investigative approach to be undertaken on-site (Senversa, 2019). This section outlines the sampling and analysis procedures undertaken during the investigation and includes comparison to what was outlined in the SAQP (Senversa, 2019) to highlight where deviations were required due to field conditions.

Fieldworks were initially proposed to be undertaken in three stages; however, were ultimately undertaken in two stages as shown in **Table 7.1**:

Table 7.1: Program of Works

Proposed Program		Program Undertaken	
Stage	Scope of Works	Stage	Scope of Works
Stage 1	<ul style="list-style-type: none"> • XRF survey. • Deployment of dust deposition gauges. • Installation of groundwater monitoring wells. • Sampling of Lake Yindarlgooda. 	Stage 1	<ul style="list-style-type: none"> • XRF survey. • Deployment of dust deposition gauges. • Installation of groundwater monitoring wells. • Sampling of Lake Yindarlgooda. • Groundwater Monitoring.
Stage 2	<ul style="list-style-type: none"> • Groundwater monitoring, contingency soil or lake monitoring (if required from Stage 1). 	Stage 2	<ul style="list-style-type: none"> • Collection of dust deposition gauges. • Supervision of groundwater well survey. • Collection of additional background samples.
Stage 3	<ul style="list-style-type: none"> • Sampling of dust deposition gauges, contingency groundwater or Lake Yindarlgooda monitoring (if required from Stage 2). 	---	

7.1 Soil Assessment

7.1.1 XRF Survey Methodology

As the principal contaminants of concern are metals/metalloids, *in-situ* testing via XRF was undertaken to augment intrusive investigation and analysis. The in-situ testing for metals was used as a diagnostic screening tool to assess the extents of contamination prior to scheduling laboratory analysis.

The XRF survey involved measuring the metal content in surface samples at regular intervals along several transects extending outwards from the LRSF. As discussed in **Table 3.1**, prevailing wind directions are dominated by a northerly to south-easterly direction; however, a strong east to north-easterly component is also noted. Hence transects shown in **Figure 7** are oriented in these directions. Final transect locations on-site were subject to accessibility and heritage considerations. Further details on the XRF scope and methodology are presented below.

**Table 7.2: XRF Survey Methodology**

Proposed Scope of Works	Deviation from Proposed Scope of Works
Two XRF units (Olympus Vanta L series) will be utilised in the field program and will be operated by appropriately trained personnel. XRF units will be selected to allow determination of metal concentrations at concentrations below the adopted assessment criteria.	None. XRF training certificates are presented in Appendix C .
Each morning prior to commencement of fieldwork each of the two XRF units were checked against calibrated sources.	None. Calibration certificates are presented in Appendix D .
A GPS-enabled field tablet operating with GIS and preloaded with proposed XRF sampling locations (and other sampling locations) will be used by the field team throughout the fieldwork.	Due to remote working conditions, the ability for Senversa staff to utilise the ArcGIS collector software for XRF sampling locations was inefficient. As such, data was split between Avenza Offline and ArcGIS collector software.
Three readings of the soil surface will be undertaken at each site, with each reading being approximately 30 seconds in length. The mean XRF reading was screened against the adopted criteria. Where this was exceeded the underlying soil (e.g. 20 mm depth) was also measured by XRF.	None.
XRF readings will be collected along transects at approximate 50 m intervals.	While a 50 m spacing was used initially, the spacing was increased to up to 200 to 500 m due to the overall length of transects that was required to delineate contamination.
Transects are intended to extend until three consecutive samples have contaminant concentrations below the adopted assessment criteria. Due to the fact that a conservative EIL will be applied (Section 5.2.1), this may not be achievable in the field, and in this instance, ABCs may be determined by XRF in the field, or further review of the currently available dataset.	It was not possible to obtain three consecutive readings where contaminant concentrations were below the adopted assessment criteria for some transects. Further review of the dataset was undertaken with respect to adoption of representative background concentrations.
The final scope of the XRF survey (e.g. how many transects and at what length, what sampling interval and depth) will be refined as real time data is collected and with regard to the stated data gap outcomes.	13 transects were completed, as presented in Figure 7 .
Confirmatory soil sampling will be undertaken to confirm the XRF soil results. Soil sampling will be taken at an approximate frequency of 10% of XRF survey results, biased towards any XRF results of particular decision-making significance.	None. 184 transect locations were measured via XRF with confirmatory laboratory analysis being undertaken for 40 samples (i.e. greater than 10 % of XRF locations).
Transects will be labelled sequentially starting at T1. Samples collected will be labelled as T1-1 T1-2 and so on.	None.

Further information regarding XRF sampling technique was as follows:

XRF field sampling broadly followed the following steps.

1. Turn on equipment and allow to warm up for at least 30 minutes.
2. Ensure soil is not saturated (no standing water).
3. Remove any large, non-representative debris and homogenise sample.
4. Create a smooth, flat surface.
5. Select target analytes and appropriate excitation sources.



6. Select instrument parameters based on DQOs.
7. Perform energy calibration.
8. Analyse instrument blank at the start and end of each sampling day and following every 20 samples analysed.
9. Perform calibration verification at the start and end of each sampling day and at least once during analysis.
10. Analyse samples (clean analyser window between each sample).
11. Analyse method blanks, calibration verification samples and energy calibration checks (standardisation) at the start and end of each sampling day.
12. Perform precision measurement at minimum of one sample per day, with the sample analysed at least seven consecutive times in an analytical run.
13. Report concentrations consistent with precision.
14. Submit at least 5% of samples for confirmatory analysis.

7.1.2 Soil Sampling Methodology

As described in **Section 7.2**, confirmatory soil sampling was undertaken at 30 locations, including four locations to further assess background contaminant concentrations. Soil sampling methodology is summarised in **Table 7.3**.

Table 7.3: Soil Sampling Methodology

Proposed Soil Sampling Procedure	Deviation from SAQP
Soil samples will be collected from the surface and will be directly transferred to the glass jar by gloved hand (where possible), or hand trowel.	None. Soil samples were collected into glass jars using a combination of hand trowel and gloved hand.
Deeper soil samples will be collected from 0.3 m depth by hand trowel or hand auger.	None. Soil samples were collected into glass jars using a combination of hand trowel and gloved hand.
Geological and environmental conditions encountered at each location will be logged and recorded in accordance with the Unified Soil Classification System (USCS) and AS1726:2017.	Soil texture was not logged at each location due to time restrictions in completing XRF transects.
Sediment samples will be placed directly into clean sample containers provided by the primary laboratory using disposable nitrile gloves for each sampling location. Where used, the hand trowel / hand auger will be decontaminated after use at each sampling location using a wash and rinse with potable water and a scrubbing brush followed by a dual rinse with deionised water to reduce the potential for cross-contamination.	None. Soil samples were collected into glass jars using a combination of hand trowel and gloved hand.

7.2 Air Quality Sampling

7.2.1 Dust Deposition Gauges

Five dust deposition gauges were deployed around the LRSF and evaporation ponds. Wind-rose data (**Appendix B**) indicates that dusting may be possible in all directions from the LRSF and hence dust gauges DG01 to 04 and DG06 were intended to assess possible dust deposition along the boundaries of the LRSF, while DG05 was intended to provide an indication of background levels of dust (not likely to be derived from the LRSF).



Dust gauge installation and sampling methodology was undertaken in consultation with Australian Standard: Methods for sampling and analysis of ambient air: Method 10.1: *Determination of particulate matter – deposited matter – gravimetric method* (AS/NZS 3580.10.1:2003) as follows:

- At each sampling location, dust gauges were attached to a metal stake, at approximately human height (i.e. approximately 1.7 m above ground level).
- Dust gauges were deployed for at least four weeks.
- Dust gauges will allow an assessment of dust deposition rates ($\text{g/m}^2/\text{month}$).

In addition, metal concentrations in dust were also calculated based on converting the total sample metal mass and total sample solid mass (both in mg) to mg/kg. The use of dust deposition gauges to measure airborne metal concentration is not an approved dust sampling method according to Australian Standards hence this aspect of the dust monitoring was to provide some preliminary insight into relative dust composition between locations together with any total solid comparisons.

Table 7.4 summarises the dust gauge sample locations used during the field program, with locations shown in **Figure 9**.

Table 7.4: Dust Gauge Sampling Locations

ID	Location/Rationale	Deployment Date	Collection Date / Total Days	Deviations from SAQP
DG-01	North-western boundary of site; to assess possible dust deposition from LRSF.	3 December 2019	Not collected.	DG01 had been removed from site when visited on 24 February 2020 and was unable to be located.
DG-02	Eastern boundary of site; to assess possible dust deposition from LRSF.	4 December 2019	24 February 2020	None.
DG-03	Western boundary of site, west of evaporation ponds; to assess possible dust deposition from LRSF.	3 December 2019	24 February 2020	None.
DG-04	Eastern boundary of site; east of evaporation ponds and on Lake Yindarlgooda boundary; to assess possible dust deposition from LRSF / evaporation ponds.	4 December 2019	24 February 2020	Sample broken during courier transit.
DG-05	West of site boundary; to assess background dust conditions.	3 December 2019	24 February 2020	None.
DG-06	South of evaporation pond; to assess possible dust deposition from LRSF / evaporation ponds.	3 December 2019	24 February 2020	None.



7.2.2 Personal Exposure Monitors

PEMs were worn by field staff during both Stage 1 activities, which included soil sampling, monitoring well installation and groundwater gauging and sampling. PEM monitoring was undertaken in consultation with *Australian Standard: Workplace atmospheres – Method for sampling and gravimetric determination of inhalation dust* (AS 3640-2009), and involved the following steps.

1. Place the pump into the carry case and attach to waistline.
2. Run the rubber tubing inside shirt and attach the tubing to the collar of shirt using the clip. Record the time that the pump is switched on.
3. Attach the IOM cassette to the collar clip near the breathing zone (below chin) with the opening to the cassette facing from face.
4. Record the time that pump is switched off.
5. Place the IOM cassette in a zip lock bag for subsequent analysis.

It is noted that consideration was given to the dust investigation methodology, specifically dust deposition gauges and PEMs in comparison to more sophisticated continuous ambient air quality monitoring program using high volume air samplers, Tapered Element Oscillating Microbalance (TEOM) units or similar. In this regard, Senversa consider that the first step is to establish whether dusting is occurring above background and whether the dust is contaminated. PEM results will also allow for a 'snapshot' of ambient air quality and associated occupational risks. Depending on the results of the data obtained, a more specific ambient air quality monitoring program may be required.

7.3 Groundwater Monitoring Well Installation

Groundwater monitoring wells will be installed at five locations surrounding the LRSF and evaporation ponds, as shown in **Figure 8** and **Table 7.5**. New monitoring wells were positioned strategically along site boundaries to assist with decision-making including potential classification requirements under the *Contaminated Sites Act 2003*.

Table 7.5: Locations of Newly Installed Groundwater Monitoring Wells

ID	Proposed Location/Rationale	Deviation from SAQP
MW-01	East of LRSF, at eastern boundary of the site. Anticipated to indicate cross-gradient water quality.	None.
MW-02	North of LRSF, along access track. Anticipated to represent up-gradient water quality.	None.
MW-03	South-western corner of site. Anticipated to represent up-gradient water quality.	None.
MW-04	South-western corner of site. Anticipated to represent up-gradient water quality.	None.
MW-05	Approximately 1 km northeast of LRSF. Anticipated to represent up-gradient (background water quality).	Moved approximately 150 east of original location MW05a (original location deemed unsuitable due to being located on top of a ridge) MW05a was dry at 19.5 mBG and no well was installed MW05b (450 m east of original location. Dry at 19.5 mBGL and no well was installed. MW05c installed (Figure 8). Herein referred to as MW05.

The procedure for installation of groundwater monitoring wells and groundwater sampling was as shown in **Table 7.6**.

**Table 7.6: Groundwater Well Installation and Sampling Procedures**

Item	Proposed Groundwater Sampling Procedure	Deviation from SAQP
Groundwater Well Installation	<ul style="list-style-type: none"> Drilling will be performed using hollow flight auger (if required) to proposed target depth for groundwater monitoring well installation (nominally two metres below the static water level). No drilling fluids will be used during well installation. Drill cuttings will be used to backfill the void around the monitoring well, with soils being placed at the approximate depth of origin. Geological and environmental conditions encountered at each location will be logged in consultation with Australian Standard: AS 1726:2017 Geotechnical Site Investigations. Groundwater monitoring wells will be constructed using 50 mm, Class 18 uPVC threaded screen and casing, with a bentonite seal and gravel pack installed in consultation with the relevant specification in Minimum Construction Requirements for Water Bores in Australia (as updated). A steel riser will be installed for each well as applicable. All wells will be developed by removing water and gently surging the standing water column using a bailer or 12-volt pump. Development will continue until multiple lines of evidence indicate that appropriate well development has been achieved (i.e. for at least 15 minutes at each well or until water appears to be visually free from sediment). Purged water will be temporarily stored and disposed of to the settlement pond to minimise potential impacts to vegetation. All existing and newly installed monitoring wells will be professionally surveyed to allow water levels to be reduced to relative levels. 	<p>None.</p> <p>Drill logs and survey records are presented in Appendix G.</p>
Groundwater Gauging and Sampling	<ul style="list-style-type: none"> Groundwater samples will be collected at least one week following installation and development of the monitoring wells to allow groundwater quality to stabilise with surrounding groundwater. Existing and newly installed monitoring wells will be sampled at each site. Prior to sampling, the standing water levels (SWL) will be gauged using an interface probe from the top of well casing. In addition, the total depth of the groundwater monitoring well (where less than 50 m) and its condition will be recorded. If free product is identified at any location that location will not be sampled. Groundwater samples will be collected from each monitoring well using low flow sampling methods using HDPE tubing and bladders. The groundwater pump will be inserted to approximately 1 m below the SWL. Purging of groundwater will be continue until field measurements of water quality parameters have stabilised across three readings (pH (+/- 0.05), electrical conductivity (+/- 3%), temperature (+/-10%), dissolved oxygen (+/- 10%) and redox potential (+/- 10mV)). Purged water will be temporarily stored and disposed of to the settlement pond to minimise potential impacts to vegetation. Groundwater samples analysed for dissolved metals (where required) will be field filtered with a dedicated 0.45-micron disposable filter. Samples will be placed into laboratory prepared containers, preserved for the relevant analyses. 	<p>None.</p> <p>Groundwater sampling forms are included in Appendix E.</p>

7.3.1 Sediment and Pore Water Sampling

Evaluation of sediment quality was undertaken using the decision tree framework for applying sediment quality guidelines (ANZG, 2018), and involved consideration of multiple lines of evidence to determine possibility of impacts.

Evaluating lakebed conditions was proposed to include assessment of both sediment and pore water (where available). Pore water (also known as interstitial water), is the moisture that is contained within the pore spaces between soil or sediment particles. Some COPCs may become entrapped in sediments and will not always dissolve into the overlying surface water, however, can be expected to be present in the pore water within the sediment. Where sediments and surface water are not in equilibrium, analysis of pore water contained within sediments will provide the most accurate representation of the COPCs that sediment dwelling organisms are exposed to, as pore water is the expected route of exposure.



The analysis of pore water is matrix dependent as grain size influences pore water recovery and the ability of the laboratory to perform analysis on pore water extraction is dependent upon sufficient volume obtained through the pore water extraction process. The extraction of pore water from sediment is undertaken using a centrifuge which typically yields 10% water from the sediment sample. Where a sufficient volume of pore water cannot be extracted from the sample, analysis of the sediment itself will provide an indication of the concentrations of COPCs that may impact upon the benthic fauna, albeit possibly more conservative.

Sediment samples (inclusive of any pore water) were collected from five locations, as shown in **Figure 7** and **Table 7.7**.

Table 7.7: Proposed Locations of Sediment and Pore Water Samples

ID	Location/Rationale
PW-01	Southern boundary of site, close to Evaporation Pond.
PW-02	Approximately 250 m south of Evaporation Pond. Assess impacts to lakebed sediments.
PW-03	Approximately 350 m south of Evaporation Pond. Assess impacts to lakebed sediments.
PW-04	East boundary of site, southeast of Evaporation Pond.
PW-05	East boundary of site, northern corner of Evaporation Pond.
PW-06	Western edge of lake, approximately 1 km southwest of the Evaporation Pond

The methodology for lakebed sediment sampling is summarised in **Table 7.8**.

Table 7.8: Sediment Sampling Methodology

Proposed Sediment Sampling Procedure	Deviation from SAQP
<ul style="list-style-type: none"> Sample locations will be recorded on a tablet with GPS capability to ensure accuracy. In the absence of standing water, sediment sampling will be undertaken via the use of a hand-trowel or hand auger. Where standing water is present, samples will be collected by piston sampler. A piston sampler works by creating a partial vacuum which holds the sample in place and helps prevent washout, the sampler will also be fitted with a disposable liner and core catcher. Samples will be collected at the surface through to a target depth of 1.0 mBGL or refusal. It is noted that poor sample recovery and blockages caused by detrital matter and very soft silts may reduce the effective sampling depth at some locations to around 0.5 mBGL. Soil logging of the sediment encountered at each sampling location will be undertaken in accordance with the Unified Soil Classification System (USCS) and AS1726:2017. Sediment samples will be placed directly into clean sample containers provided by the primary laboratory using disposable nitrile gloves for each sampling location. Where used, the hand trowel / hand auger or piston sampler will be decontaminated after use at each sampling location using a wash and rinse with potable water and a scrubbing brush followed by a dual rinse with deionised water to reduce the potential for cross-contamination. 	<p>None. Samples were collected directly into glass jars / plastic bags using a hand trowel / gloved hand.</p> <p>No surface water was present.</p>



7.4 Laboratory Analysis

Primary soil and groundwater samples were subject to the analytical suites presented in **Table 7.9**. Primary and secondary laboratories that were utilised are presented in **Table 7.10**.

Table 7.9: Analytical Suites

Media	Proposed Analytical Suite	Deviations from the SAQP
Soil	<i>All samples:</i> metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, selenium, cobalt, manganese, iron). <i>Selected samples:</i> hexavalent chromium, pH, redox, cation exchange capacity (CEC), cyanide, Australian Standards Leachate Procedure (ASLP) with deionised water, particle size distribution.	None.
Sediment	<i>All samples:</i> metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, selenium, cobalt, manganese, iron). <i>Selected samples:</i> hexavalent chromium, total v weak acid digest, elutriate testing, acid volatile sulphates, total organic content, sediment size.	Elutriate sampling was not undertaken as a sufficient volume of pore water could not be extracted. Concentrations of leachable metals (ASLP under DI) was also undertaken (in lieu of the ability to perform pore water analysis).
Pore Water	<i>All samples:</i> pH, ferrous iron, hardness, major cation and anions (calcium, magnesium, sodium, potassium, chloride, sulphate), metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, selenium, cobalt, manganese, iron) ¹ , nutrients (total nitrogen, nitrate, nitrite and ammonia).	Pore water analysis was not undertaken due to an insufficient volume of water being obtained during sample processing.
Groundwater	<i>All samples:</i> metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, selenium, cobalt, manganese, iron) ¹ , cyanide, hexavalent chromium, nutrients (total nitrogen, nitrate, nitrite and ammonia), sulphate, ferrous iron, pH, hardness, major cation and anions (calcium, magnesium, sodium, potassium, chloride, sulphate).	None.
Surface Water	<i>All samples:</i> metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, selenium, cobalt, manganese, iron) ¹ , cyanide, hexavalent chromium, nutrients (total nitrogen, nitrate, nitrite and ammonia), sulphate, ferrous iron, pH, hardness, major cation and anions.	Since no surface water was present no surface water sampling and analysis was undertaken.
Dust	<i>All samples:</i> volume metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, selenium, cobalt, manganese, iron).	None.

¹ metals analysis was undertaken by collision cell ICP-MS to eliminate matrix interferences associated with saline waters and allow a lower limit of reporting.

Table 7.10: Primary and Secondary Laboratories

Media	Primary Laboratory	Secondary Laboratory
Soil	ALS Global	Eurofins
Sediment	ALS Global	Eurofins
Groundwater	National Measurement Institute	ALS Global
Dust	ALS Global	Not undertaken.



8.0 Quality Assurance / Quality Control

The objective of conducting Quality Assurance/Quality Control (QA/QC) is to provide an assessment of the accuracy, precision, reliability, and completeness of the data presented for interpretation for the project. QA involves all of the actions, procedures, checks and decisions, undertaken to ensure the representativeness and integrity of samples and accuracy and reliability of analytical results. QC involves protocols to monitor and measure the effectiveness of QA procedures. **Appendix F** provides a detailed assessment of QA / QC elements adopted during the investigation, with the results summarised in **Table 8.1**.

Table 8.1: QA/ QC Program

Element	Description
Field Personnel	Field work was undertaken by suitably trained personnel with experience in contaminated site investigations, field sampling techniques and health and safety issues.
Laboratories	Laboratory analysis was completed by National Association of Testing Authority (NATA) accredited laboratories.
Limits of Reporting	Appropriate limits of reporting (LoRs) were requested from the laboratory to ensure that the assessment criteria could be met. All LORs were less than the adopted assessment criteria, with the exception of leachable concentrations of chromium and mercury, where comparison against assessment criteria was of lesser importance than the comparison between leachable and total concentrations.
Record Keeping	Full records of field activities, including daily activity logs and chains of custody were maintained. Non-compliance includes the loss of data from the sheets for groundwater wells MW1, MW3 and MW4. Field forms are included in Appendix E .
Sample Collection	Samples were collected directly into laboratory supplied sample containers. Sample preservation was in accordance with standard laboratory protocols. Samples were collected and stored on ice prior to and during transit to the laboratory to minimise sample degradation.
Sample Labelling	A unique sample number was used for each sample location to clearly differentiate each sample and assist in the assessment.
Chain of Custody	Sample details were entered on to a chain of custody form that will accompany the samples to the laboratory. All samples will be transported and handled following chain of custody procedures. A chain of custody form was used for every batch of samples submitted to the laboratory. Chain of custody sheets recorded details of project name/ number, sample numbers, date of collection, sampler, analysis required and required limits of reporting. It is noted that dust gauge samples were misplaced by the courier during transit, and sample DG04 was broken; however, as noted in laboratory certificates in Appendix H, holding times for analysis were met.
Equipment Calibration	Equipment requiring calibration for environmental assessment purposes was calibrated by the supplier or by Senversa staff prior to use. Relevant calibration certificates are provided as Appendix D .
QC Sampling	Intra-laboratory duplicates were collected and analysed at a rate of 1 in every 20 primary samples. Inter-laboratory duplicates were collected and analysed at a rate of 1 in every 20 primary samples. The duplicate samples were obtained from locations suspected of being contaminated and analysed for the same analytes as collected primary samples. Duplicated samples were labelled in a way that concealed their relationship to the primary sample from the laboratory. RPDs were to be less than 30 % for inorganic and organic analyses where the results of one or both values are greater than 10 times the limit of reporting. Where both values are less than 10 times the LoR RPDs of less than 100% were considered acceptable. Some non-conformances were identified and are discussed in more detail in Appendix F .



A QA/ QC assessment was undertaken for the soil and groundwater investigations undertaken for this DSI. A detailed summary of the QA/ QC assessment is provided in **Appendix F**.

A small number of QA/ QC non-conformances were identified; however, these were not considered to materially impact on the quality or representativeness of the data, and the majority of results indicated that the precision and accuracy of the data was within acceptable limits. The results of the soil and groundwater investigations are therefore considered to be representative of chemical concentrations in the environmental media sampled at the time of sampling, and to be suitable to be used for their intended purpose in forming conclusions relating to the contamination status of soil and groundwater at the site.



9.0 Investigation Results

9.1 Soil Results

9.1.1 Soil Profile

Drill logs showing the soil profile are presented in **Appendix G**. In summary, the soil profile encountered during drilling at the site comprised red brown silt, overlying green to grey, high plasticity silty clay, overlying weathered quartzite and schist (likely corresponding the ultramafic sequences shown in **Figure 4**, collectively known a 'greenstone' formations).

9.1.2 Background Metal Concentrations

Inferred background concentrations of metals were measured at four locations outside of the site boundary, as shown on **Figure 10**.

- XRF_BG (located to the north of the site, near MW02). XRF and laboratory analysis was undertaken.
- DG05 (located east of the site, near Dust Gauge 05). XRF analysis was undertaken and was corrected as per **Section 9.1.6**.
- BG02 located along the main access track.
- BG3 Located north of the main access track.

A summary of the background analytical results is provided in **Table 9.1**, and the full dataset is provided in the **Summary Table 1 (attached)**. The laboratory documentation is provided in **Appendix H**.

Table 9.1: Summary of Metal Concentrations in Background Samples

Sample	Measurement Type	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
XRF-BG	Laboratory (mg/kg)	7	822	16	<5	682	19
DG05	XRF (mg/kg)	33	5,419	19	<LOD	1,562	44
DG05	Corrected Value (mg.kg) ¹	14	834 ²	18	<5	465	27
BG02	Lab (mg/kg)	<5	210	26	<5	77	43
BG03	Lab (mg/kg)	<5	152	28	<5	70	61

¹ Correction of XRF field values discussed in **Section 9.1.6**.

² Correction considered to be of low reliability (**Section 9.1.6**)

As noted in Section 3.1, nickel is the predominant COPC at the site, and has previously been reported at concentrations greater than adopted assessment criteria (SLR, 2018). While chromium was not considered to be a COPC at the site based on the mineral deposit and previous characterisation of the leach residue (Section 2.5), it has also been previously been reported at concentrations greater than the EIL (SLR, 2015). The following section presents a discussion on how the observed nickel and chromium concentrations in background samples have been evaluated in the context of the additional datasets to assist in determining an appropriate ambient background concentration (ABC) to calculate a site-specific EIL.



Nickel background concentrations recorded during the DSI have been considered in combination with the background information compiled in **Section 3.1.1**, where typical regional (colluvium and alluvium) concentrations were in the order of 180 mg/kg. Although higher concentrations were observed in XRF-BG and DG05, retrospectively these locations may not be reflective of true background concentrations, hence background nickel concentrations are conservatively assumed to be in the order of 180 mg/kg for the purposes of this investigation.

Chromium concentrations have been compared to regional data as per **Section 3.1.2**. While sample XRF-BG and the corrected value for DG05 may be within the background range reported, values within the alluvium/colluvium are likely to be lower, and the value of 210 mg/kg has been adopted as a conservative measure.

9.1.3 Soil Physio-chemical Properties

Soil physio-chemical properties were analysed for selected samples and background samples, as shown in Table 1 (**Summary Tables - attached**). Analytical results can be summarised as follows:

- Soil pH ranged from 6.5 to 8.2 (the larger dataset from SLR (2018) indicated an average of 7.5)
- Cation exchange capacity (measured at background samples XRF_BG, BG2 and BG3) ranged from 13.3 to 21.5 meq/100g.
- While total organic carbon content was not measured as part of this scope of work, historical results (SLR, 2018) indicate that values ranged from 0.2 to 1.2 % (average of 0.3%).
- PSD analysis indicated clay content ranged from 3 % to 16 %, with an average of 7.5 %, consistent with data provided by SLR (2018) which indicated that clay content ranged from 2.5 to 28 %, with an average of 9 %.

9.1.4 Calculation of EILs

Based on the background concentrations and soil physio-chemical properties presented in Sections **9.1.2** and **9.1.3**, EILs were calculated as shown in **Table 9.2**. EIL calculation worksheets are presented in **Appendix I**.

Table 9.2: Calculated Site-Specific EILs

Arsenic	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
EIL – Ecological Significant	40	330	65	470	210	170
EIL- URPOS	100	570	80	1100	380	560

9.1.5 XRF Survey Results

Raw XRF survey results are presented in **Appendix J**. Trends in concentrations of nickel and chromium are shown in **Figures 11** and **12** can be summarised as follows.

- XRF transect results indicate that concentrations of nickel ranged from 44 to 3,000 mg/kg.
- The highest nickel concentrations were generally observed in Transects 8, 9 and 10 to the north of the LRSF and in Transect T6 (within drainage to the northwest) and Transect 23.
- Transects within the lakebed generally showed the lowest concentrations of nickel.
- Transects generally showed decreasing trends in nickel concentrations with distance from the LRSF, with the exceptions of transects to the west of the site, particularly when within drainage channels.
- The decreasing trends in metal concentrations were not as obvious for transects within the lakebed.



- An evaluation of Table 1 – attached indicates that where surface sample and an immediately deeper sample (i.e. 0.3 to 0.4 mBGL) were both analysed, concentrations of metals are generally lower in the deeper sample, suggesting there may be a slight trend of decreasing concentrations with depth.
- **Appendix J** includes a selection of graphs showing metal concentrations with distance from the LRSF/Evaporation ponds. These graphs indicate that trends in nickel concentrations with distance are broadly similar to those for other metals.
- To some extent, concentrations of chromium mirrored those of nickel, with the lowest concentrations being observed in the lakebed.
- Highest concentrations of chromium were generally observed to the southwest of the Evaporation Pond, and decreased to the west.
- Decreasing trends in chromium concentrations with distance from the LRSF were observed in Transects 13, 16, 21, 23, 24.

9.1.6 Laboratory Analytical Results and XRF Data

Laboratory analytical results are summarised in **Table 1 (Summary Tables - attached)**. Analytical results indicate that concentrations of nickel ranged from <2 mg/kg to 786 mg/kg, with the highest concentrations typically being observed in 'background' sample 'XRF_BG' (to the north of the site), Transect 23 (west of the Evaporation Ponds) and Transect 6, to the northwest of the site boundary.

Comparison to Laboratory Analytical Data

A comparison of XRF transect results to analytical results is presented in **Appendix J**. The comparison can be summarised as follows:

- XRF results measured in the field differed from those analysed in the laboratory. Results from the laboratory are considered to represent the most accurate result.
- Generally, results were most comparable at lower concentrations, and less reliable at higher concentrations.
- Linear regression was most reliable for nickel and copper, and least reliable for lead and chromium.

9.1.7 Comparison of Analytical Results to Assessment Criteria

A comparison of analytical results to the adopted assessment criteria indicates the following exceedances with respect to human health criteria:

- Concentrations of all COPCs were less than the HIL-C in all samples analysed.
- While all samples were analysed for total chromium, a selection were analysed for the more toxic hexavalent form. No hexavalent chromium was detected in any sample, suggesting that chromium is likely to be present in the less toxic trivalent form. It is noted that the adopted HIL criteria are for the hexavalent form, and not the trivalent form (Table 1 – attached).
- Total cyanide concentrations remained below the laboratory LOR in all samples analysed.

A comparison of analytical results to the calculated site-specific EILs can be summarised as follows:

- Concentrations of arsenic marginally exceeded the EIL at one location (41 mg/kg compared to 40 mg/kg at location T6-8).
- Concentrations of chromium exceeded the EIL for high conservation areas in 18 of 40 samples (including background sample XRF_BG). The EIL-URPOS was only exceeded in 15 of 40 samples.
- Concentrations of nickel exceeded the EIL for high conservation areas in 26 of 40 samples (including background sample XRF_BG). The EIL-URPOS was only exceeded in 6 of 40 samples.

Exceedances of the EIL for nickel are shown in **Figure 13**.



9.1.8 Comparison of XRF Survey Results to Assessment Criteria

As described in Section 9.1.6, XRF field data was generally higher than laboratory analytical results. The linear regressions shown in **Appendix J** have therefore been applied to calibrate the XRF transect data for metals that exceeded the assessment criteria (i.e. nickel and chromium), to allow for a more accurate delineation of impacts.

Corrected XRF data is presented in **Appendix J**. A comparison of the data to the adopted assessment criteria can be summarised as follows:

- There were no additional exceedances of the assessment criteria for arsenic.
- Concentrations of chromium exceeded the EIL in the majority of XRF measurements (and as such, have not been plotted).
- Concentrations of nickel exceeded the ecological assessment criteria at numerous transect locations, as shown in **Figure 13**.
- The spatial distribution of impacts is not consistent across transects.

9.1.9 Soil Leachate Data

Leachable metal concentrations were analysed for 11 of 40 samples. Leachate analysis was selected based on XRF metal results in the field, to give results for a range of total metal concentrations yet was biased towards samples with elevated metals concentrations as a conservative measure.

An examination of leachable metal concentrations presented in **Table 2 (Summary Tables)** indicates the following.

- With the exception of T23-3 and T24-4, leachable concentrations of metals were detected in every sample analysed.
- Excluding iron, chromium and nickel were detected in leachate at the highest concentrations (with this pattern being similar to that observed with total metal concentrations)
- A comparison of leachable concentrations to total concentrations indicates that leachable concentrations of nickel and copper are low relative to total concentrations, ranging from 0.0005 % to 0.07 %
- A comparison of the leachable concentrations to the adopted assessment criteria for groundwater (both FWG and MWG) indicates that arsenic, cadmium, chromium cobalt, copper, manganese and nickel exceeded the criteria, indicating the potential for impact to the identified receptor if undiluted leachate from the sediment were to directly interact with the receptor.

The above information indicates that the metals contained in the surface sample are leachable, indicating the potential to migrate to groundwater at concentrations that may pose a risk to the identified receptors.

9.2 Lakebed Sediment Results

As shown in **Section 7.3** and **Figure 7**, five lakebed samples were collected. Assessment of lakebed sediment was undertaken using several lines of assessment, as discussed in **Sections 8.2.1 to 8.2.4**. The sediment analytical results are provided in Table 4 and Table 5 (**Summary Tables - attached**) and the associated laboratory documentation is provided in **Appendix H**.

9.2.1 Physical Parameters

Particle size distribution analysis indicates that the sediment was dominated by the silt fraction (2-60 µm), and can be classified as a silty sand. Total organic carbon ranged from 1,000 mg/kg at PW1 to 10,200 at PW3.



9.2.2 Total Metal Concentrations

Total concentrations of key metals in sediment samples can be summarised as follows:

- Concentrations of nickel ranged from 82.6 mg/kg (at PW1) to 863 mg/kg (at PW5).
- Concentrations of chromium ranged from 222 mg/kg (at PW1) to 628 mg/kg (at PW2)
- Concentrations of arsenic ranged from 2.63 mg/kg (at PW6) to 9.35 mg/kg (a PW4).

In general, overall minimum concentrations of metals corresponded with location PW6 (the intended background sample) and PW1, while higher concentrations were observed at sample locations east and southeast of the LRSF.

A comparison of total concentrations against the adopted sediment assessment criteria (**Summary Table 5**) are summarised as follows:

- Concentrations of nickel were greater than both the DGV and GV-high in all sediment samples analysed.
- Concentrations of chromium were greater than the DGV in all sediment samples analysed).
- Concentrations of chromium were greater than the GV-high at all locations except for PW1 and PW2.
- Concentrations of all other metals analysed were less than the adopted screening criteria.

As concentrations of nickel exceeded the GV-high, additional factors controlling bioavailability of COPCs were evaluated in accordance with the decision tree framework for applying sediment quality guidelines (ANZG, 2018). Additional lines of evidence included pore water analysis, leachable concentration analysis and acid volatile soluble metals, as described in the following sections.

9.2.3 Pore Water Analysis

While samples comprised between 17 to 28 % moisture content (**Table 4 – attached**), sample processing did not result in collection of a sufficient volume of pore water for analysis to be undertaken.

9.2.4 Leachable Metal Concentrations

Results of leachate (ASLP) testing for metals in sediment are presented in **Table 5 - attached** and can be summarised as follows:

- Maximum leachable metals concentrations were observed at PW3.
- Minimum leachable concentrations were observed at PW1 and PW6 (background).
- A comparison of leachable metals concentrations to total concentrations indicates that leachable concentrations are relatively low, ranging from 0.0002 % (chromium) to 0.05 % (arsenic). This range is similar to that seen for metals in soil (**Section 8.1.9**).

Two key limitations are associated with the leachate results as follows:

1. As there was no surface water present (sediment elutriate test typically uses a dilution of 1:4, wet sediment: added host water) the laboratory used deionised water. Hence the leachate method performed is effectively a soil leachate method rather than a sediment method (as described in ANZG, 2018).
2. The adopted criteria (FWG and MWG) (and underlying derivation methods) are not directly relevant to the assessment of ecological risk within a salt lake environment.

Noting the methodology limitations, leachate analysis has provided the following context and relative comparisons:

- Leachable concentrations of arsenic, copper and nickel exceeded the adopted MWG and FWG at PW2, PW3 and PW5.



9.2.5 Acid Volatile Sulphides

Results of analysis for AVS and SEM can be summarised as follows:

- Maximum AVS concentrations were observed at PW3, PW4 and PW5 (AVS was not detected at PW1 and PW2).
- Concentrations of SEM were less than total metals, indicating that approximately up to 30 % of total metals concentrations comprise AVS-SEM.
- Concentrations of SEM metals were below GV-high for all metals, except for nickel.
- SEM-AVS was less than 0 for samples PW1, PW2 and PW6, and ranged between 0 to 5 for samples PW3, PW4 and PW5.
- Ratios of SEM to AVS were less than 1 for most samples, indicating that there is sufficient sulfur available to bind with metals from solution, and thus they are not bioavailable. The exception to this was nickel in samples PW3, PW4 and PW5, where the SEM:AVS was greater than 1, indicating that nickel is likely to be present in solution in pore water. These sample locations are classified as 'Tier 2' risk sites i.e. associated adverse effects on aquatic life are possible.

9.3 Groundwater Results

9.3.1 Groundwater Levels

Groundwater was encountered during drilling at depths that ranged between 4 mBGL (MW4) to 16 mBGL (MW3). Field observations indicated that the upper profile was slightly moist; however, the major water bearing unit was within the silts and clays immediately above the fractured greenstone lithology.

The groundwater field sampling forms, including water level gauging and stabilised field chemistry information, are provided in **Appendix E**. Groundwater field results and laboratory analytical data are provided in **Table 7** and **Table 8 (attached)**, respectively, and all associated laboratory documentation is provided in **Appendix H**.

Groundwater gauging indicated that groundwater ranged from 1.3 mBGL to 16.0 mBGL, which corresponds to 317.8 to 320.6 mAHD. Groundwater showed an overall south-easterly flow direction, which indicated groundwater flows from topographic highs northwest of the site, towards Lake Yindarlgooda. An evaluation of the groundwater profile in combination with previous groundwater gauging data for the site suggests that groundwater is unconfined and is likely to be in hydraulic connectivity with moisture within the shallower sediments.

Groundwater levels in bores BMH11 and BMH12 (located on the edge of the Lake Yindarlgooda lakebed) were approximately 2.0 mBGL and it is hence inferred that the groundwater may be in direct connectivity with the lakebed when the watertable is at its maximum following rainfall (this is consistent with the regional hydrogeology review which indicated that the regional water table is close to the surface in playa-lake environments (Kern, 1996)).

9.3.2 Groundwater Field Chemistry

Groundwater physical parameters are available for nine of the 13 monitoring wells sampled. Results are not available for wells MW1, MW3 and MW4 (all sampled on 9 December 2019) as the electronic record was corrupted.

Physical parameters can be summarised as follows:

- Physical parameters for groundwater are summarised in Table 5. Parameters indicate that groundwater salinity ranged from 67 (MW5; up-gradient) to 227 mS/cm (BMH06; down-gradient of Evaporation Pond 2). Groundwater salinity indicates that groundwater is hypersaline and is consistent with ranges reported by Kern (1996) for the regional aquifer.
- pH ranged between 5.88 (at BMH01) and 7.22 (BMH09). pH did not show a clear trend across the site.
- Dissolved oxygen ranged from 0.07 (BMH12A) to 4.74 at MW5 (up-gradient), indicating oxygenated conditions.



- Redox conditions ranged from -164 (BMH09) to 61.8 (BMH01). Redox conditions recorded did not correlate well with DO readings, and hence results for both measurements should be interpreted with caution.

9.3.3 Groundwater Analytical Results

Groundwater analytical results are presented in **Table 8 – attached**, and summarised below.

Major Ions / Cations

An evaluation of the proportions of major cations and anions via preparation of a Piper Plot (**Figure 9.1**, below) indicates that groundwater is sodium chloride dominated, consistent with the site's position in a playa lakebed system and the influence of evaporation.

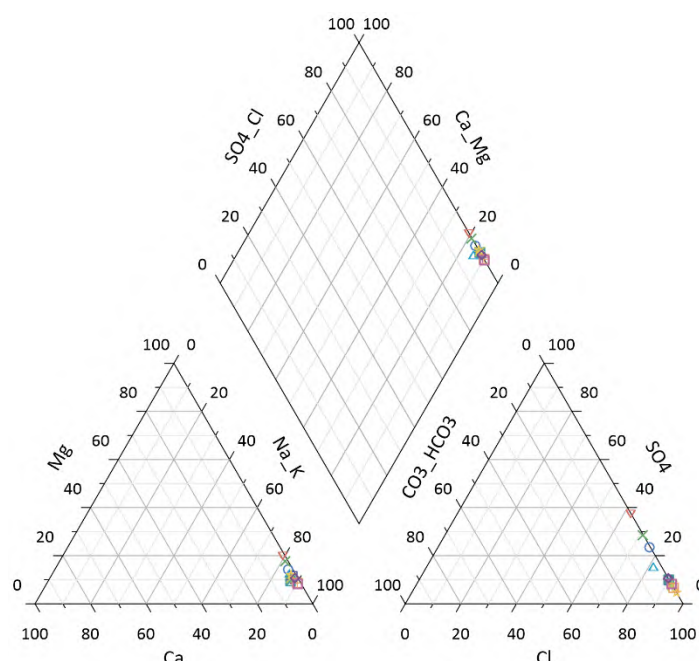


Figure 9.1: Piper Diagram showing major ions.

Metals and Inorganics

- Concentrations of arsenic, cadmium, chromium, cobalt, iron and lead show similar concentrations across all wells (i.e. no spatial trend was observed).
- Concentrations of manganese, nickel and zinc show a high degree of spatial variation, with maximum concentrations of nickel (4,090 ug/L) and manganese (69,700 ug/L) observed at BMH09 to the southeast of the LRSF. Concentrations of nickel in groundwater are shown in Figure 16.
- Maximum concentrations of zinc (290 mg/L) were observed at BMH04, at the southwest corner of the LRSF.
- Total cyanide concentrations remained below the laboratory LOR in all samples analysed.

A comparison of the observed concentrations to the adopted screening criteria (**Table 8 - attached**) indicates the following:

- Chromium, cobalt, copper, lead, manganese, nickel, selenium and zinc are all present at concentrations greater than the adopted freshwater criteria.
- Concentrations of cobalt, copper, lead, manganese, nickel, selenium and zinc are all present at concentrations greater than the adopted marine water criteria.



Nutrients

Analytical results for nutrients (ammonia (as-N) and nitrate (as-N)) can be summarised as follows:

- Concentrations of total nitrogen showed were similarly low at wells BMH01, BMH04, BMH08, and MW1, MW2, MW3, MW4 and MW5. At these eight wells, nitrogen was dominated by nitrate species.
- Markedly higher concentrations of total nitrogen were observed in wells BMH02, BMH09, BMH11, BMH12 and MW4. At these wells, ammonia was the dominant nitrogen species.
- Maximum concentrations of ammonia-N were observed at BMH09, located immediately down-gradient of the LRSF, while minimum concentrations were observed at MW5 (up-gradient/background). Concentrations of ammonia-N are shown in **Figure 16**.
- Concentrations of nitrate exceeded the FWG / MWG at all wells except for BMH01, MW1 and MW5.
- Concentrations of ammonia-N exceeded the adopted criteria at six of the 13 wells analysed, and concentrations of nitrate exceeded the assessment criteria at 10 wells.

9.4 Air Quality

9.4.1 Visual Observations

Several dust events were observed at the LRSFLSRF, dust was observed being generated leaving the LRSF at the following times

- 2 December at 12.53 pm.
- 4 December at 9 am (Photograph 1)
- 4 December at 3.25 pm (Photograph 2).



Photograph 1. Dust generation from LRSF, 4 December, 9am.



Photograph 2: Dust generation from LRSF, 4 December 2019, 3.25 pm.

9.4.2 Occupational Sampling

Analytical results for PEMs worn by field personnel Matthew Hunt and Brandon Henry are presented in **Table 9.3** and **Table 10 (attached)**. Formal wind speed and direction were not recorded during the period of PEM data collection however the conditions were described as being windy by the field personnel (hence likely to be conservative).

Table 9.3: Summary of Personal Exposure Monitor Data

Date	Sample ID	Flow Rate (L/sec)	Time (min)	Worn By	Nickel (ug/m ³)	Iron (ug/m ³)
Assessment Criteria					1,000	---
5 Dec	PVC2515042	2.0	479	MH	<5	11
8 Dec	PVC2515046	2.0	517	BH	<5	<10
9 Dec	PVC2515043	2.0	552	MH	<5	<10
10 Dec	PVC2515045	2.0	620	BH	<5	<10
11 Dec	PVC2515044	2.0	544	MH	<5	<10

Analytical results for dust monitoring can be summarised as follows:

- Except for iron, no metals were detected in any sample analysed.
- It is noted that iron was detected in sample PVC2515042 (from 5 December) at 11 ug/m³. As shown in **Table 6.5**, no assessment criterion is available for iron.



9.4.3 Dust Deposition Gauges

Results of dust deposition gauge analysis are presented in **Table 9.4**, and **Table 11 (attached)**, and shown in **Figure 17**.

Table 9.4: Dust Deposition Gauge Results

ID	Location	Volume (mL)	Total Solids (mg)	Total Solids (g/m ² /month)	Ni (mg/L)	Ni (mg/kg) ¹
Assessment Criteria				4.0	---	
DG2	Eastern boundary	1,100	129	2.7	0.015	128
DG3	Western boundary	1,190	80	1.6	0.004	60
DG5	West - background	1,380	105	2.1	0.004	53
DG6	South of Evaporation Pond	790	310	6.3	0.058	148

¹ Estimate calculated from total volume, solid mass and measured concentration in solution.

Dust deposition gauge results indicate that dusting is occurring at rates greater than the rate recommended by EPO NSW (2010), within the vicinity of DG06 (to the south of the evaporation ponds). Deposition rates elsewhere did not appear to indicate an issue. DG6 aside, there was no noteworthy variation in the volume of dust between the background sample and other samples.

In addition to measurement of total solids, sufficient volume of rainfall was collected within the dust gauges to enable analysis of metal concentrations within the respective samples. The total mass of solids and mass of metals (both as mg) were used to calculate an estimated concentration of metals in dust in mg/kg (**Table 9.4**).

A limitation of this method is the volume/weight of solid collected is small (up to 310 mg) hence the calculated result is not of the same precision as with laboratory soil analysis results reported elsewhere in this report (for which the laboratories are NATA accredited to report the results in mg/kg) or Australian Standard endorsed methodologies for measuring airborne metal particulate concentrations. Notwithstanding these limitations, the calculated metal results in dust do appear of a similar magnitude in soil and as with the total solids result suggest dust emissions in DG6 differ to background. For the purposes of providing further context, comparison of calculated metal concentrations against the adopted HIL-C and EIL did not identify an exceedance in any sample however greater weight should be given to the soil results presented elsewhere in assessing risk.



10.0 Discussion of Data Gaps and Revised CSM

Sections 10.1 to 10.4 presents a discussion of the investigation results in the context of risk to the identified receptors, along with an evaluation of the data gaps identified in **Section 5.1** and associated Data Quality Objectives. **Section 10.5** presents a revised CSM for the site based on the updated dataset resulting from this investigation.

10.1 Data Gap 1: Nature and extent of metal impacts in soil and associated risks

Analytical results indicate that concentrations of all COPC were less than the adopted human health screening criteria in surface soil samples. It is noted that while SLR (2018) previously identified numerous exceedances of the HIL-C for chromium, the data gained from this investigation has shown that chromium is present in the trivalent form, and hence does not present a human health risk.

Nickel and chromium were identified in soil at concentrations that exceed the adopted ecological screening criteria (and arsenic in one instance); however, this does not necessarily mean that there is an unacceptable risk to the identified ecological receptors given the applicability of the EILs to terrestrial vegetation and the variable nature of background concentrations for these metals. In the case of the latter, due to the size and geological setting of the site, it is reasonable that several different ABCs may be applied to account for soil type (e.g. colluvium & alluvium versus ultramafic bedrock). For the purposes of the DSI lower bound estimates of the background concentrations were used as a conservative measure, and hence it is possible that the exceedances may not be indicative of an actual risk to the ecological receptors.

Metal concentrations in soil do not show a consistent pattern in distribution (in some instances, concentrations *increase* with distance from the LRSF and Evaporation Ponds), suggesting that the measured concentrations may not reflect site-derived impacts in all cases (this is particularly likely to be the case towards the north west where Transect 6 approached areas mapped as Archaean ultramafic rocks). Additionally, a decreasing trend in concentration with distance from the LRSF / Evaporation Ponds were not as obvious in transects on the lakebed, potentially suggesting that seasonal wetting and drying of the lakebed could be responsible for redistribution of surficial impacts. Higher metal concentrations within a salt lake generally compared to nearby land would not be unexpected given natural evapo-concentration processes (noting that the annual evaporation rate is some order of magnitude higher than rainfall within the region).

Based on the site-specific EILs used, and notwithstanding ABC limitations, site-derived impacts are likely to extend beyond the site boundary to the west and north. It is worth noting that while the impacts exceed the EILs, they are within regional ranges.

It is noted that the EIL criteria are adopted to be protective of terrestrial vegetation via soil toxicity. Impacts to vegetation within dust impacted areas are unlikely to result in an unacceptable risk to the vegetation population as a whole given the relatively small area of inferred impact and considering the wide-ranging background concentrations in the region of the site. It should be noted that the EILs and assessment scope under the *Contaminated Sites Act 2003* do not allow evaluation of acute effects on vegetation that may exist due to dusting (which has been previously documented by several sources). In addition, the adopted screening criteria do not directly allow for an assessment of risk to livestock associated with pastoral land use.



Analysis of leachable metals from soil samples suggests that the identified metals in soil may leach from the soil under rainfall conditions, and hence be transported to groundwater. Overall, as a proportion of total concentrations for nickel and chromium (both identified as being in excess of the EIL in multiple locations) metal mobility is low. This is consistent with speciation and geochemistry indicator results which indicate:

- Chromium is present as trivalent chromium. Trivalent chromium is relatively immobile in soil, being strongly sorbed by soils and readily forming insoluble precipitates.
- Neutral to mildly alkaline soil conditions were recorded, under which most metals are less mobile than acidic conditions.
- The presence of clay particles and associated adsorption which is a key retention mechanism.

A summary of the DQO decision rules and an evaluation of the data gap for soil impacts is presented in **Table 10.1**.

Table 10.1: Evaluation of Data Gap 1 using Data Quality Objectives

DQO Step		Evaluation
Problem	<ul style="list-style-type: none"> • Site derived soil impacts have been identified; however, the nature and extent are unknown. • Adequate delineation, both vertical and lateral, is fundamental to understanding the nature and magnitude of 'the source' and providing an appropriate basis for detailed risk assessment. • Metal concentrations in surface soil may be underestimated. 	---
Decision Rules	<ul style="list-style-type: none"> • Has the extent of soil impact been adequately characterised (i.e. is soil impact delineated using multiple lines of evidence an appropriate level of certainty)? 	Based on the site-specific EILs used, site-derived impacts are likely to extend beyond the site boundary to the west and north. In the context of known regional ranges of metal impacts (likely evident in the outer margins of some transects) the extent of soil impact is considered adequately characterised such as to underpin a broader ecological risk assessment and to manage associated risks (if applicable).
	<ul style="list-style-type: none"> • If impacted soil is not considered to present a risk to the identified receptors (in accordance with assessment criteria outlined in Section 5), no further assessment will be required 	COPCs in soil are less than HIL criteria and hence are not considered to pose a risk to the identified human health receptors. Further assessment of ecological risk (including livestock under pastoral use) is considered warranted.
	<ul style="list-style-type: none"> • If the extent of soil impact has been adequately characterised and is considered to present a potential risk to the identified receptors, further detailed risk assessment will be required, along with an evaluation of possible management measures, where required. 	<p>Nickel and chromium (and arsenic in one location only) are present at concentrations that may indicate a potential risk to the identified ecological receptors on- and off-site. Further assessment of ecological risk (including livestock under pastoral use) is considered warranted.</p> <p>The risk to the most significant ecological receptor Lake Yindarlgooda is further evaluated via assessment of sediment data and groundwater data.</p>
	<ul style="list-style-type: none"> • If the extent of soil impact has not been adequately characterised by the investigation, further intrusive investigations may be necessary. 	Further assessment of ecological risk (including livestock under pastoral use) is considered warranted. Some intrusive investigation (e.g bioavailability analysis etc) may be necessary to further inform the risk assessment (depending on the design of the risk assessment).



10.2 Data Gap 2: Air Quality and Associated Risks

Dust was observed leaving the LRSF on several occasions during the field investigation. An evaluation of dust deposition gauge data suggests that dusting is occurring at rates greater than those recommended by EPO NSW (2010) within the vicinity of DG06 (to the south of the Evaporation Ponds). No noteworthy variation was observed in the volume of dust between background samples and other samples, indicating that: (a) the LRSF and Evaporation Ponds were not the source of the dust; or (b) wind patterns are such that dust was not blown in a consistent direction from the site.

Calculated concentrations of metal in the dust during the sampling period (within the constraints of the analytical method) indicated that concentrations of nickel were less than the adopted human health and ecological screening criteria and hence did not pose an unacceptable risk to human health or the environment.

Results of occupational dust monitoring undertaken during the field program indicates that concentrations of inhalable particles were less than the limit of reporting during the measurement period and hence did not present an occupational risk to site users. It is noted that the assessment criteria for dust are relevant to human health receptors only, and do not allow an evaluation of the possible acute effect on terrestrial vegetation via being covered with dust. Additionally, the total duration of dust monitoring was limited and influenced by rainfall events (as reflected by the presence of rainwater within the dust gauges) meaning the results as representations of longer-term trends should be treated with caution.

It is noted that the above assessment of dust for ecological receptors is for direct toxicity of contaminants, and do not consider the effects of vegetation being smothered by dust (noting that Soilwater (2017) includes some examples of vegetation on the LRSF embankment with thick dust / sediment coatings). A summary of the DQO decision rules and an evaluation of the data gap for soil impacts is presented in **Table 10.2**.

Table 10.2 Evaluation of Data Gap 2 (Air Quality) using DQOs

DQO Step	DQO Step	Evaluation
Problem	<ul style="list-style-type: none"> Dusting from the evaporation pond and LRSF is considered a primary contaminant pathway for surficial soil impacts identified on-site. The extent to which dusting is above ambient background conditions and remains an ongoing active contaminant pathway (and associated risk to human health and the environment) is unknown. 	---
Decision Rules	<ul style="list-style-type: none"> If the magnitude of dusting is considered to be adequately characterised (i.e. allowing for potential seasonal variability) and is not considered to present a source of on-going contamination to the identified receptors (Section 5), no further investigation will be required. 	<p>The highest level of dust (as inferred by total solid weights) recorded immediately south of the Evaporation Pond may indicate an ongoing dust emission is occurring. This is consistent with visual observations of dust emissions during past studies and also assessment of surficial soil impacts in this DSI. Hence, and acknowledging potential dust emission seasonality, further assessment of dust is considered warranted. Such assessment should further complement any ecological risk assessment (including whether and to what extent impacts in surficial soil remain dynamic) and performance monitoring of any environmental management measures.</p> <p>The data obtained to date do not indicate an acute risk to receptors via dust emissions that requires immediate management via remediation; however, stabilisation of the LRSF surface consistent with previous advice from Department of Mines and Petroleum (2010) is likely to be required for long term geotechnical stability and nuisance dust suppression, and will ensure that any data gaps associated with the characterisation of dust impacts are appropriately managed.</p>



DQO Step	DQO Step	Evaluation
	<ul style="list-style-type: none"> If the magnitude of dusting is appropriately characterised and it is considered to represent a source of on-going contamination to the identified receptors, further risk assessment and an evaluation of management measures may be required. 	Consistent with the above, further risk assessment and, subject to which (or in parallel), management measures to mitigate dust should be undertaken.
	<ul style="list-style-type: none"> If the extent of dusting is not adequately characterised (i.e. data cannot be extrapolated to represent average annual conditions) further investigations into dust deposition rates will be required. 	Rainfall events were recorded during the deployment of the gauges. Hence (and noting evidence of ongoing dust emissions) further assessment of seasonality should be undertaken.

10.3 Data Gap 3: Nature and Extent of Impacts in Groundwater

Results of groundwater sampling and analysis indicate that an unconfined aquifer is hosted in the sediments and underlying fractured rock aquifer. Depth to water corresponds to topography, with greater depths at higher topography, and shallow groundwater on the flats closest to the Lake Yindarlgooda boundary. Groundwater flow direction was determined to be towards the southeast, towards Lake Yindarlgooda (consistent with expectations).

An assessment of groundwater quality against the adopted assessment criteria indicate that numerous metals are present at concentrations suggestive of a risk to fresh or marine water ecosystems; however it is noted that these assessment criteria are not directly relevant to inland saline lakes of Western Australia, and that concentrations of these COPCs are also greater than the assessment criteria in background (i.e. up-gradient) groundwater wells. In this regard, an evaluation of the presence of impacts is best assessed via a comparison of down-gradient water quality to background / up-gradient water quality, which indicates elevated concentrations of metals and nutrients in well BMH04, located immediately down-gradient of the LRSF (**Figure 8**). This suggests that some leaching and infiltration of contaminants is likely to be occurring. It is noted that elevated nickel concentrations (relevant to background) appear to extend approximately 500 m down-gradient of this location, and hence at this point do not appear to present an immediate risk to Lake Yindarlgooda.

In addition to the metals described above the presence of elevated nutrient concentrations were detected in groundwater beneath the site with evidence of a distinct plume emanating from around the LRSF as visible in **Figure 16**. The presence of nutrient contamination is consistent with site history information which estimated leach residue ammonium sulphate (AMSUL) concentrations up to 11,380mg/L (Kinhill, 1996).

Results indicate that ammonia is the dominant form of nitrogen present. The exception is BH06 located between Evaporation Pond 1 and 2 which exhibited higher concentrations of nitrate (potentially due to nitrification). TKN analysis also indicate an organic source of nitrogen at this location. The downgradient extent of ammonia-N has not been delineated and is inferred to be hydraulic connection with Lake Yindarlgooda (risk to Lake Yindarlgooda is further discussed below).

Acknowledging the potential AMSUL source and associated density, it is possible that higher contaminant concentrations may be present at depth within the aquifer than that characterised by this DSI due to density driven migration; however it is considered that the implications of this uncertainty do not impact the findings of the investigation with respect to risks to Lake Yindarlgooda, given that shallow portion of the aquifer where discharge would occur.



A summary of the DQO decision rules and an evaluation of the data gap for soil impacts is presented in **Table 10.3**.

Table 10.3: Evaluation of Data Gap 3 (Groundwater) using DQOs

DQO Step	DQO Step	Evaluation
1.0 Problem	<ul style="list-style-type: none"> Elevated contaminant concentrations have been detected in groundwater; however, the nature (including whether such concentrations are representative of background concentrations) and extent is unknown. Adequate delineation is fundamental to understanding the potential for existing or future complete exposure pathways. 	---
Decision Rules	Are ambient concentrations of COPCs in groundwater adequately characterised using multiple lines of evidence?	<p>Newly installed MW5 is located up hydraulic gradient of the site based on groundwater contours and hence is likely to be representative of ambient groundwater conditions and concentrations of COPCs (and beyond the inferred extent of dust emission derived impacts in overlying surficial soils as evidenced by Transect T6).</p> <p>An understanding of contaminant concentration seasonality and stability has not been established)</p>
	If so, is the extent of groundwater with impacts greater than ambient concentrations adequately characterised (i.e. delineated with respect to the identified receptors and site boundaries?)	<p>The extent of groundwater concentrations greater than background are considered to be delineated based on the current dataset for nickel; however, the elevated ammonia-N in groundwater may extend further towards Lake Yindarlgooda.</p> <p>Additionally, to the densities of some COPCs (namely nutrients associated with historical AMSUL use) higher COPC concentrations may exist at depth within the aquifer.</p>
	If yes to the above, if the concentrations of COPCs identified in groundwater indicate a potential risk to the identified receptors (refer to assessment criteria in Section 5), then further risk assessment and an evaluation of management measures may be required.	<p>Concentrations of COPCs exceed the adopted screening criteria for ecological receptors; however, these are likely screening criteria and are known to not be directly applicable to the saline ecosystem in question. No other beneficial uses of groundwater were determined.</p> <p>Further assessment is recommended; however, it may be that ecological risk assessment using existing data will be adequate. Active management via remedial works is not considered necessary based on the current dataset and tier 1 screening exercise.</p>
	If groundwater is not considered to have been adequately characterised by the investigation, further groundwater investigations will be required.	As above, further assessment is recommended; however, it may be that ecological risk assessment using existing data will be adequate.



10.4 Data Gap 4: Risk to Lake Yindarlgooda

An evaluation of groundwater levels and groundwater flow direction indicate that groundwater at the site flows towards Lake Yindarlgooda and is likely to be in connection with the lakebed for at least some portion of the year.

In general, the lowest concentrations of metals in sediment samples were detected at location PW6, which is located furthest from the Evaporation Ponds, with maximum concentrations being observed at sample locations immediately east and south-east of the LRSF. This may indicate that metal concentrations in sediment have been influenced by transport of tailings/dust from the site and or evapo-concentration of metal-impacted groundwater emanating from the site.

Following the ANZG (2018) decision tree framework, including consideration of total metal concentrations, leachable metal concentrations and finally AVS:SEM evaluation indicates that nickel at total and leachable concentrations in excess of adopted criteria may be sufficiently bioavailable at selected sample locations (PW3, PW4 and PW5) to pose a toxicity risk to benthic fauna within Lake Yindarlgooda. Key limitations in assessing ecological risk to Lake Yindarlgooda included the lack of pore water or surface water available to enable a direct measurement (as opposed to predicted concentrations) against DGVs, and the applicability of available ecological criteria to salt lake ecosystems. These limitations are considered in recommendations for further work presented later in this report.

Noting the above any sediment/sediment leachate criteria exceedances should be viewed in the context that the site is situated in an area of natural nickel mineralisation and that Lake Yindarlgooda, as a salt lake, is subject to evapoconcentration. More broadly the salt lakes of the Goldfields region are highly variable in terms of water quality, displaying a wide range of salinity, pH, nutrient and metal concentrations over the hydrocycle (filling and drying phases) (DoW, 2009). With regard to nickel (being the only metal found to be potentially bioavailable), concentrations up to 3 mg/L have been recorded in the surface water of unimpacted salt lakes within the Goldfields region (DoW, 2009). By comparison (and to the emphasise the unique nature of salt lakes) this concentration compares to the adopted 95% MWG criteria of 0.007 mg/L.

Beyond metal concentrations, further evaluation of evaluate potential impacts to Lake Yindarlgooda from the presence of elevated concentrations of ammonia-N recorded in groundwater is required.

A summary of the DQO decision rules and an evaluation of the data gap for soil impacts is presented in **Table 10.4**.

Table 10.4: Evaluation of Data Gap 4 (Lake Yindarlgooda) using DQOs

DQO Step	DQO Step	Evaluation
Problem	<ul style="list-style-type: none"> Lake Yindarlgooda is considered the key ecological receptor. Given the Lake is immediately adjacent to the Evaporation Pond and LRSF and that both dusting, surface runoff and groundwater discharge are all plausible contaminant pathways (to be further investigated) there is a reasonable likelihood that at least localised impact within the lake will be present. 	---
Decision Rules	Have sufficient lines of evidence (i.e. a combination of sediment / porewater / surface water data) been collected to evaluate potential risk to the lakebed ecosystem?	No. While evaluation of sediment data has used multiple lines of evidence, consistent with ANZG (2018), the absence of porewater (including analysis of nutrients in porewater) has constrained the assessment of risk. In any case, further environmental risk assessment will be required to develop criteria specific to the Lake Yindarlgooda ecosystem, and hence the lack of porewater (and surface water data) do not change the recommendations of this report.



DQO Step	DQO Step	Evaluation
	If yes to the above, if measured concentrations of COPCs in sediments / porewater / surface water do not indicate a potential risk to the lakebed ecosystem, no further evaluation will be required.	---
	If yes to the above, if the concentrations of COPCs identified in groundwater indicate a potential risk to the identified receptors (refer to assessment criteria in Section 5), then further risk assessment and an evaluation of management measures may be required.	Concentrations of nickel exceed the GV-high for sediment in some samples down-gradient from the LRSF; however, the criteria applicability to this type of environment may not be appropriate. Further assessment is considered necessary to evaluate impacts and (where warranted) develop site-specific assessment criteria, particularly for nutrient species where direct toxicity values for sediment are not available.
	If groundwater is not considered to have been adequately characterised by the investigation, further groundwater investigations will be required.	Further assessment is recommended; however, it may be that ecological risk assessment using existing data will be adequate.

10.5 Revised Conceptual Site Model

A CSM describes the possible pathways by which exposure to potential contamination may occur. The preliminary CSM in **Section 4** summarised all possible pathways and receptors that may have been relevant to assessment of the site. For exposure to occur, a complete pathway must exist between the source of contamination and the receptor (i.e. the person or ecosystem components potentially affected by the contamination). Where the exposure pathway is incomplete, exposure cannot occur, leaving no risk via that pathway.

Table 10.5 presents a revised CSM for the site based on the information obtained to date, identifying where source-pathway-receptor (SPR) linkages have been identified.

An evaluation of **Table 10.5** indicates that no complete SPR linkages are likely to exist for human health receptors at the site (with the potential exception of consumption of livestock grazing on impacted soil). Potentially complete SPR linkages identified primarily relate to sediment within the Lake Yindarlooda ecosystem and require further assessment.

**Table 10.5 Revised Conceptual Site Model****Source:** LRSF / Evaporation Ponds**COPCs:** metals¹, nutrients²

Potential Exposure Pathways	Exposure Route	Potential Receptors	SPR Linkage	Discussion	Data Gaps
Wind-blown migration of particulates (i.e. dust)	Inhalation	Human Health: Pastoral / recreational / prospecting	Incomplete	Concentrations of COPCs in wind-blown dust were below occupational exposure criteria, although exceedances of nuisance dust were noted.	Dust emission seasonality and stability (to the extent that this relates to the assessment of soil related risks below).
Migration of tailings material via wind-blown dust or erosion/surface water flow	Direct contact	Human Health: Pastoral / recreational / prospecting	Incomplete	Concentrations of COPCs in surface soils are less than the HIL-C.	None.
	Direct contact / direct uptake	Livestock / human health	Potentially complete	Adopted assessment criteria do not allow for an assessment of toxicity to livestock from impacted surface soils.	Metal and nutrient impacted dust and soil related risk to livestock under potential future pastoral use.
	Direct contact / direct uptake	Terrestrial Ecology	Potentially complete	Concentrations of nickel and chromium in surface soils are greater than site-specific EILs in some locations. While this linkage is considered potentially complete, it is not considered to be the primary risk driver for the site.	Metal impacted dust and soil related risk to terrestrial ecology (application of the EILs allows for an assessment of direct toxicity to vegetation via uptake from soil and hence does not allow an assessment of acute physical impacts from dust). No tier 1 criteria are available for nutrients in soil / dust.
	Direct contact / direct uptake	Lake Yindarlgoooda Ecology	Potentially complete	Concentrations of nickel in sediment exceed the DGV, and further evaluations indicate that it may be bioavailable.	Metal impacted dust and sediment risks to Lake Yindarlgoooda ecology. No tier 1 criteria are available for nutrients in sediment.
Leaching of COPC, saturated zone transport and discharge to water bodies	Direct contact / direct uptake	Lake Yindarlgoooda ecology	Potentially complete	Spatial variation in concentrations of COPC indicate that the LRSF is contributing to elevated metals and nutrients in groundwater immediately down-gradient of the LRSF.	Lateral down-gradient extent and vertical extent of impacted groundwater (specific determination of these aspects may not be necessary to assess ecological risk to Lake Yindarlgoooda ecology). Metal and nutrient impacted groundwater and porewater risks to Lake Yindarlgoooda ecology.

¹ Metals (arsenic, chromium and nickel in soil, and chromium, cobalt, copper, lead, manganese, nickel, selenium, zinc in groundwater)² Nutrients (total nitrogen, ammonia, nitrate, nitrite, and sulphate were previously detected at concentrations greater than the assessment criteria)



11.0 Community Consultation

11.1 Key Stakeholders and Engagement to Date

Stakeholders for the site comprise Traditional Owners, mining tenement holders and pastoral lessees, in addition to the City of Kalgoorlie-Boulder. DMIRS has been responsible for all stakeholder consultation to date, including obtaining consent regarding accessing Aboriginal Heritage sites. Key stakeholders are presented in **Table 7.1**, (with lease boundaries and claim areas shown in **Appendix A**).

Table 11.1: Summary of Relevant Stakeholders

Stakeholder	Description
<u>Traditional Owners</u>	
Maduwongga	Native title claimants. Marjorie Strickland is currently the key contact.
Daniel Sinclair	Site informant/knowledge holder to Lake Yindarlgooda registered site.
DPLH Heritage	Provide guidance on requirements under the Aboriginal Heritage Act 1972.
<u>Tenement / Lease Holders</u>	
Andrew O'Shea	Holder of P25/2313 and P25/2309 over the LRSF and evaporation ponds. Transferred from Kevin King in January 2019.
Bradley Woollett, Nardyn Tion	Holder of P25/2452 north of LRSF. Granted in October 2018.
Kevin King	Previous holder of P25/2313 and P25/2309. Holder of P25/2311 to the north and west of the LRSF.
Kalgoorlie Nickel Pty Ltd	Holder of M 25/151 to the west of the LRSF, transferred from Heron Resources in June 2018
Chris Potts	Holder of P25/2304 to the west of the evaporation ponds
Aruma Exploration	Holder of E25/553 to the east of the LRSF and evaporation ponds
Wingstar Investments	Current holder of Bulong nickel tenements (plant, pits etc). Access through tenement is required
Burchell and Margaret Jones	Pastoral lease holders. LPL N049710 covers project area.
City of Kalgoorlie-Boulder	Responsible for management of the Bulong Road reserve.
DPLH Land	Manage Crown land.

To date, consultation with the above parties has been limited to discussions around site access and the scope of the investigation. As these initial investigations have not indicated the potential for significant risk to current site users, communication of investigation results is not currently considered necessary.



11.2 Regulator Consultation

As presented in **Section 2.3**, the site was reported to the DWER in 2019 as a suspected contaminated site and the site is currently awaiting classification under the *CS Act*. No additional consultation with DWER has been undertaken since submission of the Form 1 and accompanying PSI.

It is anticipated that the results of this DSI will be communicated to the DWER by DMIRS.



12.0 Conclusions and Recommendations

12.1 Conclusions

The investigations undertaken to date have been sufficient to progress the characterisation of soil, air, groundwater and sediment quality at the site enabling some data gaps to be closed out, and refinement of remaining data gaps.

Overall, the investigation has not identified evidence of gross dust emissions or related surficial soil impacts. Identified metals concentrations in surficial soils may be within background ranges for the region, but the relationship between identified metal concentrations and naturally occurring metals (which vary significantly) has not been established convincingly, and there is some evidence that the identified metal distributions may relate to former mining operations rather than wholly to natural ranges. These could in turn pose a risk to the local ecology and also livestock under future pastoral use.

Assessment of groundwater and Lake Yindarlgooda has identified evidence of impacts emanating from the site and associated potential risks to the Lake Yindarlgooda ecology. It was recognised that, as a salt lake, Lake Yindarlgooda represents an ecology with unique features and attributes (including the concentration of many substances due to high evaporation rates) and the available screening criteria, which don't account for any adaption to this, may not be appropriate.

In light of the DSI outcomes the CSM has been revised and updated to reflect that the following SPR linkages are potentially complete:

- Direct uptake of COPCs through consumption of vegetation by livestock (and ultimately humans).
- Direct uptake and/or contact of COPCs in impacted soil by terrestrial vegetation and fauna.
- Direct contact / direct uptake of COPCs transported in dust (and potentially via surface water flow) by biota in the Lake Yindarlgooda ecological system.
- Direct contact / direct uptake of COPCs via leaching of residue and saturated zone transport in groundwater by biota in the Lake Yindarlgooda ecological system.

The latter two SPR linkages are considered to be the primary risk driver for further assessment of the site.

Given that potential risks to receptors have been identified or cannot otherwise be closed-out due to limitations in Tier 1 screening criteria, further assessment of risk is warranted via completion of a more detailed and site-specific ecological risk assessment (ERA) in accordance with Schedule B5a of the NEPM 1999 (as amended 2013). It is considered plausible to perform an ERA based only on the current dataset; however, some additional data collection may assist in further optimising the ERA, such as for example further detail around dust emission seasonality and stability, metal in soil livestock bioavailability and direct assessment of porewater. In this regard any further investigation scoping should be conducted in consultation with an ERA professional.

Active remediation at the site based on the current dataset and contaminated site considerations alone is not considered warranted. Rather, the outcome of the above described ERA should be used as the basis in confirming whether remediation and/or management is or is not required to mitigate risks.

Summary of the conclusions from the investigation is presented in **Table 12.1**.

**Table 12.1: Summary of Conclusions and Recommended Actions**

Data Gap	Recommended Action
Data Gap 1: Nature and extent of metal impacts in soil and associated risks	
<p>Soil sampling undertaken to date does not show a clear spatial distribution of impacts, with increasing concentrations of contaminants with distance from the LRSF being observed in some instances.</p> <p>Results of soil sampling indicate that concentrations of nickel, chromium and arsenic (in one location only) are present in surface soils at concentrations greater than ecological assessment criteria.</p> <p>Concentrations of COPCs in surface soils were all less than applicable human health screening criteria.</p> <p><i>The remaining data gap relates to the risk to terrestrial ecology and livestock under potential pastoral land uses from potentially impacted surficial soil.</i></p>	<p>Further assessment of ecological risk (including livestock under pastoral use) is considered warranted. Some intrusive investigation (e.g. bioavailability analysis etc) may be useful to further optimise the risk assessment (depending on the design of the risk assessment).</p> <p>Assessment of any risk to the most significant ecological receptor Lake Yindarigooda should be undertaken using sediment and groundwater quality data (see below).</p>
Data Gap 2: Air Quality and Associated Risks	
<p>Dust emissions from the LRSF were observed during the works, with dust deposition sampling indicating that rates of deposition were greater than the adopted assessment criteria in one location at the site boundary.</p> <p>Rates of dust inhalation were found to be acceptable when compared to occupational exposure criteria.</p> <p><i>Remaining data gap relates to dust emission seasonality and LRSF stability, which are not currently defined.</i></p>	<p>While no immediate health risk has been identified regarding dust deposition, this assessment has not extended to an evaluation of acute impacts to surrounding vegetation from physical dust deposition. Such assessment should further complement the ERA (including whether and to what extent impacts in surficial soil remain dynamic) and future performance monitoring and benchmarking of any environmental management measures.</p> <p>While not deemed necessary based on the current dataset and beyond the scope of contaminated sites assessment, stabilisation of the LRSF surface consistent with previous advice from Department of Mines and Petroleum (2010) is likely to be required for long term geotechnical stability and nuisance dust suppression.</p>
Data Gap 3: Nature and Extent of Impacts in Groundwater	
<p>Additional investigations have allowed an updated understanding of groundwater flow direction and hence an understanding of background groundwater conditions.</p> <p>Numerous metals are present at concentrations suggestive of a risk to fresh or marine water ecosystems; however, it is noted that these assessment criteria are not directly relevant to inland saline lakes of Western Australia and concentrations of these COPCs are also greater than the assessment criteria in background (i.e. up-gradient) groundwater wells.</p> <p>An evaluation of up-gradient groundwater quality to water quality immediately down-gradient of the LRSF indicates that there are elevated concentrations of metals and nutrients located immediately down-gradient of the LRSF, suggesting that some leaching and infiltration of contaminants is likely to be occurring.</p> <p>Elevated nickel concentrations (relevant to background) appear to extend approximately 500 m down-gradient, while ammonia-N may extend further.</p> <p><i>The remaining data gap includes the lateral down-gradient extent and vertical extent of impacted groundwater; however, more comprehensive characterisation of these aspects through installation of additional wells may not be necessary to adequately assess ecological risk to Lake Yindarigooda.</i></p>	<p>Further ecological risk assessment for Lake Yindarigooda, including, where appropriate, derivation of site-specific sediment and water guidelines values in accordance with prevailing guidelines.</p>



Data Gap

Recommended Action

Data Gap 4: Lake Yindarlgooda

Total metals concentrations in sediment from Lake Yindarlgooda did not show a large spatial variation, suggesting that seasonal wetting and drying may play a role in redistributing any surficial impacts.

While total concentrations of metals were indicative of potential toxicity risks, further assessment of metal concentrations suggests that the risk may only be realised for nickel in three of six locations, noting that in general, maximum metal concentrations were observed in samples immediately east and south-east of the LRSF.

While evaluation of sediment data has used multiple lines of evidence, the absence of porewater data (including analysis of nutrients in porewater) has constrained the assessment of risk.

Further ecological risk assessment for Lake Yindarlgooda, including, where appropriate, derivation of site-specific sediment and water guidelines values in accordance with prevailing guidelines.

12.2 Recommendations for Site Classification

Senversa understands that a larger land parcel incorporating the site as defined in this DSI has previously been reported via submission of a Form 1 as being potentially contaminated under the CS Act, based on the findings of the PSI (SLR, 2018). This land parcel was defined as follows:

Parcel 34759 = Former Bulong Nickel Mine on dead Mining Tenement M25/97, within Lot 223 on Deposited Plan 238210 as shown on certificate of title LR316/121.

It is understood that DWER have not yet formally classified Parcel 34759 under the CS Act.

The findings of the site investigation undertaken indicate that while contaminants of concern were detected in soil, sediment and groundwater at concentrations that exceed Tier 1 assessment criteria; further consideration of the risks to the identified receptors is required to appropriately evaluate these potential risks. As such, and now that a DSI has been completed, Senversa consider recommend that the classification for the site could proceed and that most appropriate classification would be “*possibly contaminated – investigation required*” (PCIR).

Noting that the original Form 1 nominated Parcel 34759 whilst this investigation has identified soil and groundwater impacts largely confined the northern portion of Dead Mining Tenement M25/97 (being the former Bulong Mine Site) it is considered reasonable to refine the site definition for the purposes of classification under the CS Act. In this regard, it is recommended DMIRS further engage with DWER (and other stakeholders as applicable) in assigning an appropriate site boundary.



13.0 Principles and Limitations of Investigation

The following principles are an integral part of site contamination assessment practices and are intended to be referred to in resolving any ambiguity or exercising such discretion as is accorded the user or site assessor.

Area	Field Observations and Analytical Results
Elimination of Uncertainty	Some uncertainty is inherent in all site investigations. Furthermore, any sample, either surface or subsurface, taken for chemical testing may or may not be representative of a larger population or area. Professional judgment and interpretation are inherent in the process, and even when exercised in accordance with objective scientific principles, uncertainty is inevitable. Additional assessment beyond that which was reasonably undertaken may reduce the uncertainty.
Failure to Detect	Even when site investigation work is executed competently and in accordance with the appropriate Australian guidance, such as the National Environmental Protection (Assessment of Site Contamination) Amendment Measure ('the ASC NEPM'), it must be recognised that certain conditions present especially difficult target analyte detection problems. Such conditions may include, but are not limited to, complex geological settings, unusual or generally poorly understood behaviour and fate characteristics of certain substances, complex, discontinuous, random, or heterogeneous distributions of existing target analytes, physical impediments to investigation imposed by the location of services, structures and other man-made objects, and the inherent limitations of assessment technologies.
Limitations of Information	The effectiveness of any site investigation may be compromised by limitations or defects in the information used to define the objectives and scope of the investigation, including inability to obtain information concerning historic site uses or prior site assessment activities despite the efforts of the user and assessor to obtain such information.
Level of Assessment	The investigation herein should not be considered to be an exhaustive assessment of environmental conditions on a property. There is a point at which the effort of information obtained and the time required to obtain it outweigh the benefit of the information gained and, in the context of private transactions and contractual responsibilities, may become a material detriment to the orderly conduct of business. If the presence of target analytes is confirmed on a property, the extent of further assessment is a function of the degree of confidence required and the degree of uncertainty acceptable in relation to the objectives of the assessment.
Comparison with Subsequent Inquiry	The justification and adequacy of the investigation findings in light of the findings of a subsequent inquiry should be evaluated based on the reasonableness of judgments made at the time and under the circumstances in which they were made.
Data Useability	Investigation data generally only represent the site conditions at the time the data were generated. Therefore, the usability of data collected as part of this investigation may have a finite lifetime depending on the application and use being made of the data. In all respects, a future reader of this report should evaluate whether previously generated data are appropriate for any subsequent use beyond the original purpose for which they were collected or are otherwise subject to lifetime limits imposed by other laws, regulations or regulatory policies.
Nature of Advice	The investigation works herein are intended to develop and present sound, scientifically valid data concerning actual site conditions. Senversa does not seek or purport to provide legal or business advice.



14.0 References

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Figures

Figure 1: Regional Location

Figure 2: Site Features

Figure 3: Previous Sample Locations

Figure 4: Surface Geology

Figure 5: Background Nickel and Chromium Concentrations

Figure 6: Preliminary Conceptual Site Model

Figure 7: Soil and Sediment Sample Locations

Figure 8: Groundwater Sampling Locations

Figure 9: Air Quality Sample Locations

Figure 10: Measured Background Metal Concentrations

Figure 11: Raw XRF Data – Nickel

Figure 12: Raw XRF Data – Chromium

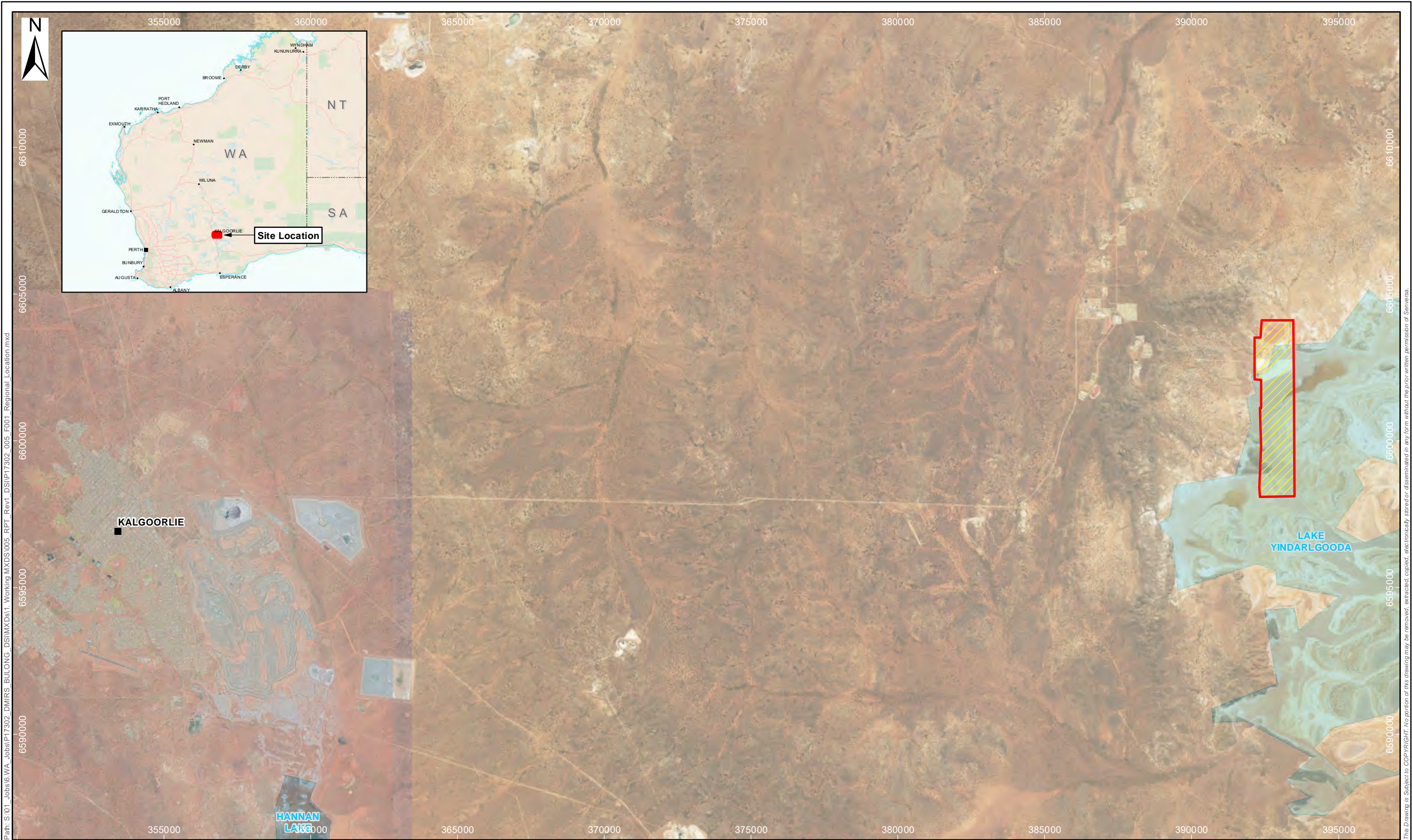
Figure 13: Guideline Exceedances – Nickel in Soil

Figure 14: Analytical Results - Sediment

Figure 15: Groundwater Analytical Results – Nickel

Figure 16: Groundwater Analytical Results – Ammonia-N

Figure 17: Dust Gauge Analytical Results



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Legend

- TOWN
- ▨ M25/97 Expired Mining Tenement
- Site Boundary

Aerial imagery © Landgate
Inset data © Geoscience Australia

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:120,000 (A3)
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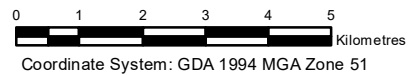
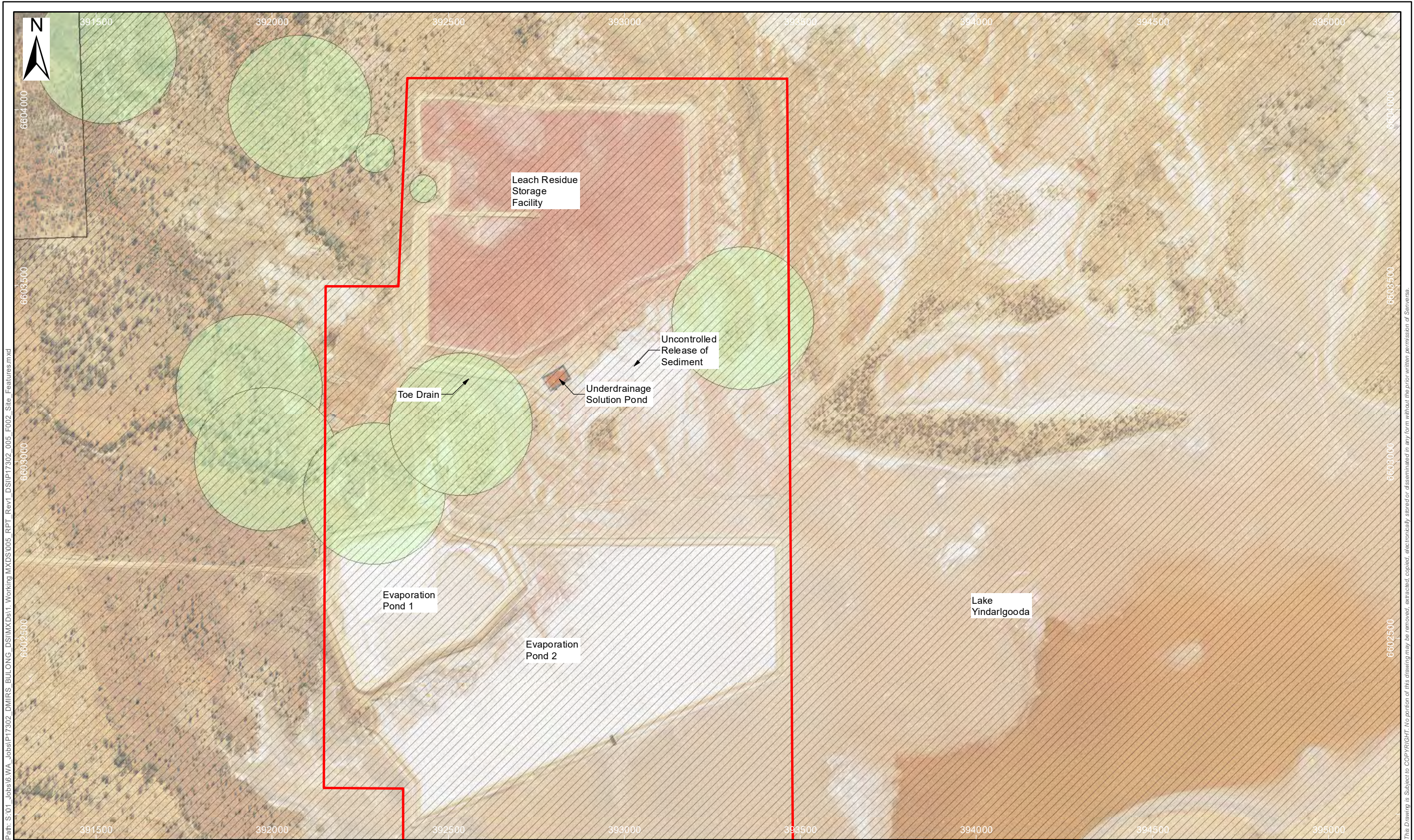


Figure No:	1
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Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS



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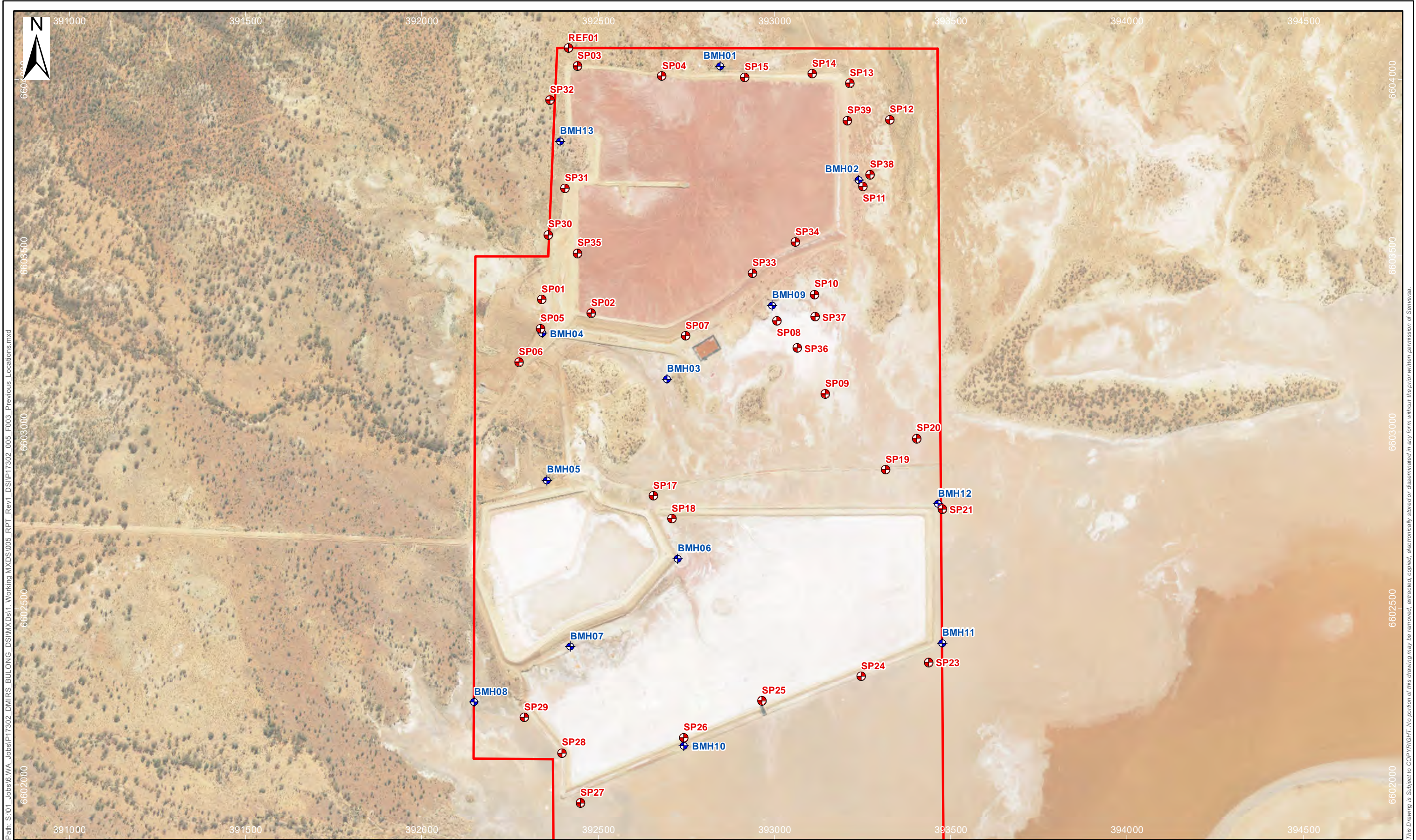
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- Registered Aboriginal Heritage Site
- Site Boundary

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Checked:	B. Coleman	Scale:	1:10,000 (A3)
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Figure No:	2
Title:	Site Features
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS

Aerial imagery © Landgate



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Legend

- Previous Soil Sample Locations (SLR, 2018)
- Existing Groundwater Monitoring Well Location
- Site Boundary

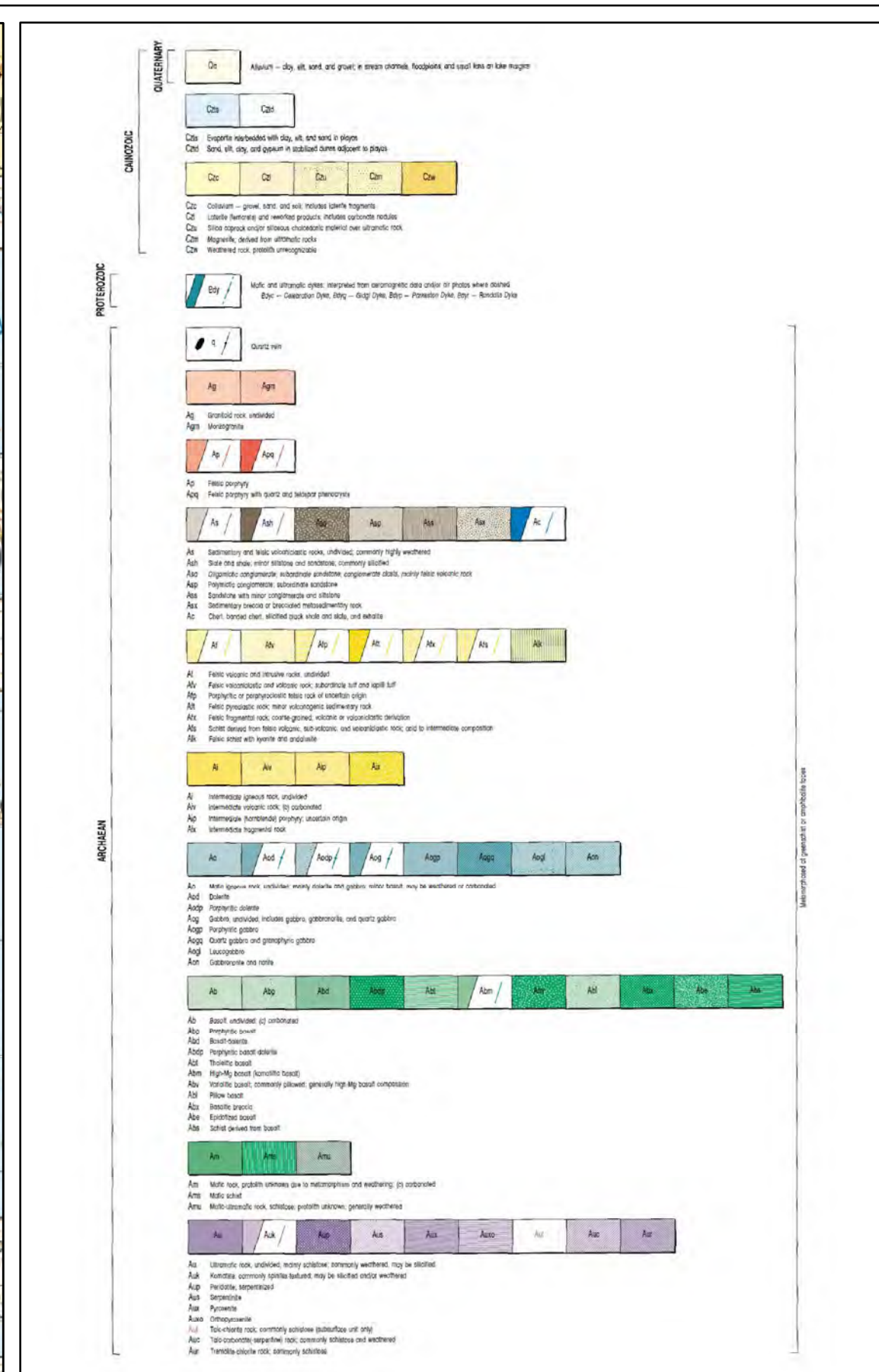
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Aerial imagery © Landgate

Figure No: 3
Title: Previous Sample Locations

Project: Detailed Site Investigation
Location: Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client: DMIRS



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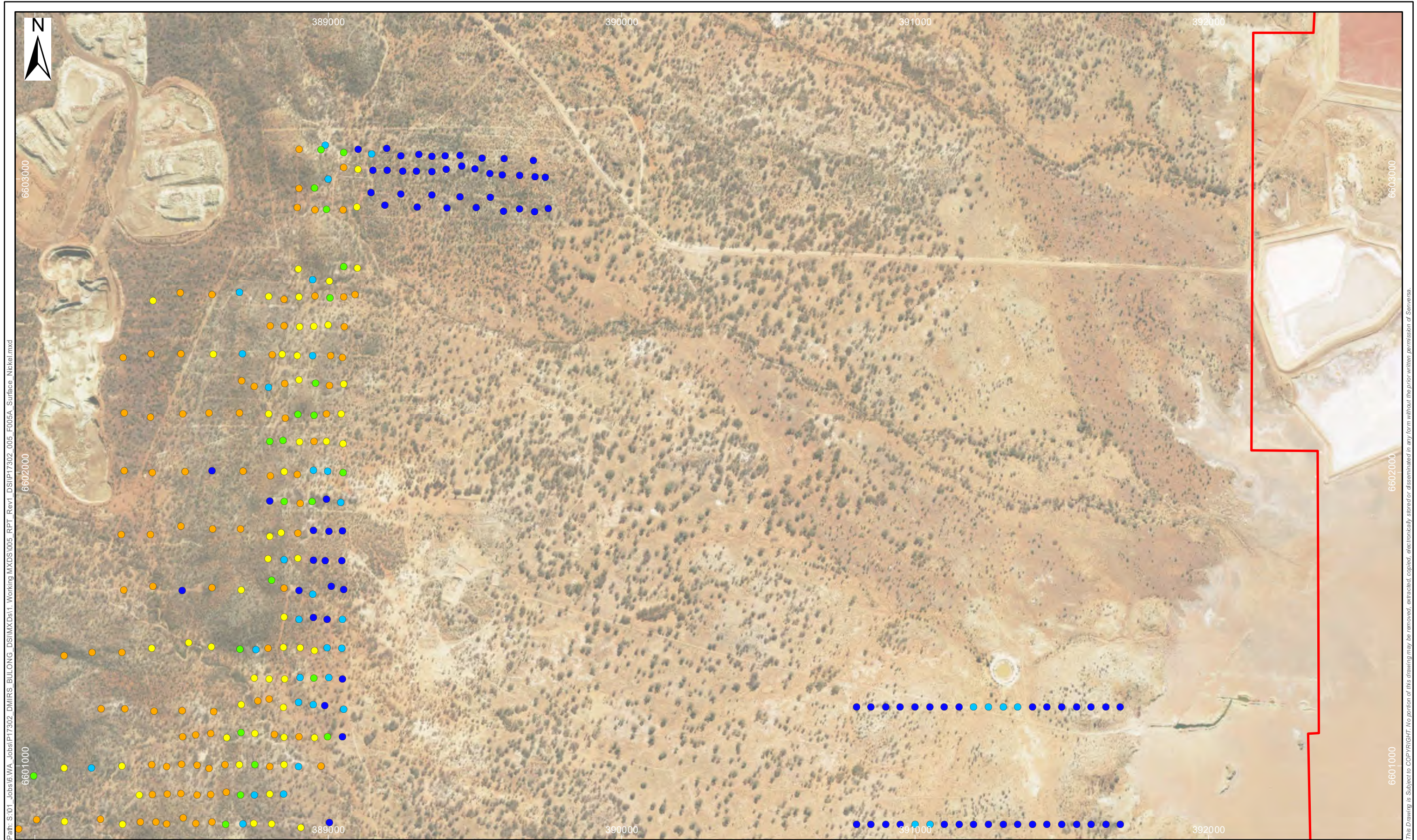
Legend
Site Boundary

Kanowna Geology Map, Sheet 3236, First Edition 1995 © Western Australia 1995

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File:	P17302_005_F004_Surface_Geology		
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Figure No:	4
Title:	Surface Geology
Project:	Detailed Site Investigation
Location:	Former 'Bulung' Mine Site, Bulung Road, Bulung, WA
Client:	DMIRS

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Path: S:\01_Jobs\6.WA_Jobs\P17302_DMIRS_BULONG_DSI\MXDs\1_Working\MXDS\005_RPT_Rev1_DSI\P17302_005_F005A_Surface_Nickel.mxd

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Address: Level 17, 140 St Georges Tce
Perth WA 6000
Phone: (08) 6324 0200
Website: www.senversa.com.au

Legend

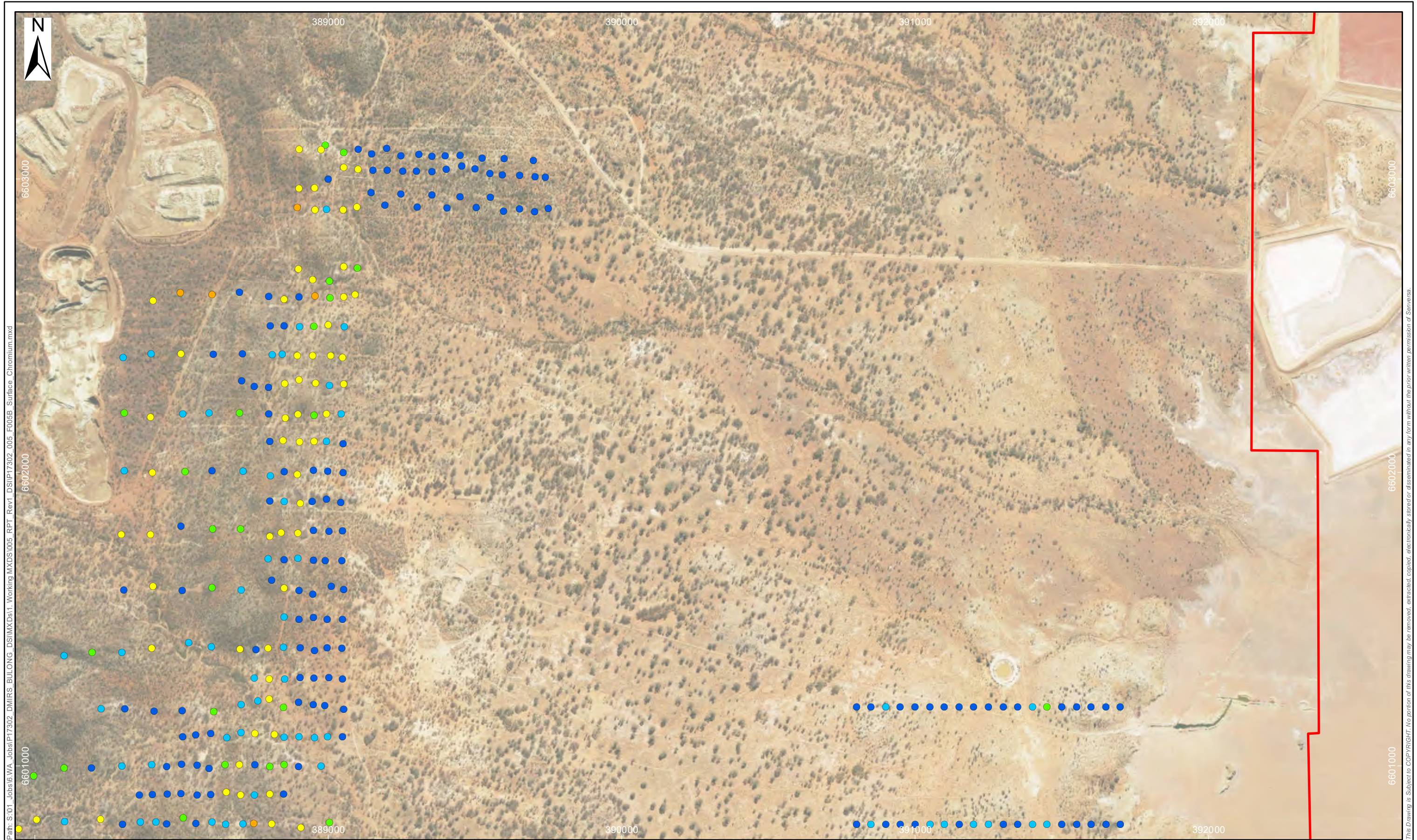
Nickel (ppm)

- 19 - 180
- 180.1 - 400
- 400.1 - 590
- 590.1 - 1000
- 1000.1 - 10000
- 10000.1 - 21590
- Site Boundary

Aerial imagery © Landgate

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:12,000 (A3)
File:	P17302_005_F005A_Surface_Nickel		
<div><div><div>0</div><div>100</div><div>200</div><div>400</div><div>600</div><div>800</div><div>1,000</div></div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></d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Figure No:	5A
Title:	Background Surface Nickel Concentrations
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS



Path: S:\01_Jobs\6.WA_Jobs\P17302_DMIRS_BULONG_DSI\MXDs\1. Working\MXDS\005_RPT_Rev1_DSI\P17302_005_F005B_Surface_Chromium.mxd

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Address: Level 17, 140 St Georges Tce
Perth WA 6000
Phone: (08) 6324 0200
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Legend

Chromium (ppm)

- 24 - 790
- 790.1 - 1100
- 1100.1 - 1300
- 1300.1 - 5000
- 5000.1 - 10000
- 10000.1 - 12100
- Site Boundary

Aerial imagery © Landgate

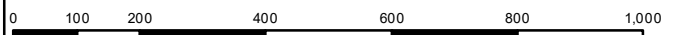
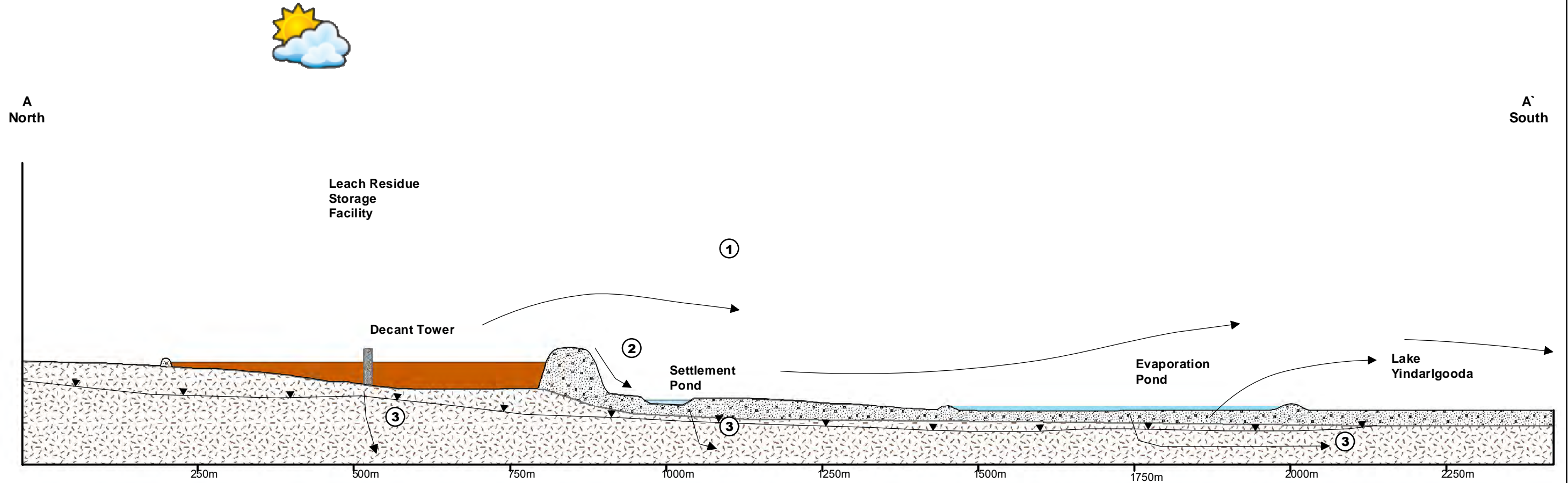
Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:12,000 (A3)
File:	P17302_005_F005B_Surface_Chromium		
			
Coordinate System: GDA 1994 MGA Zone 51			

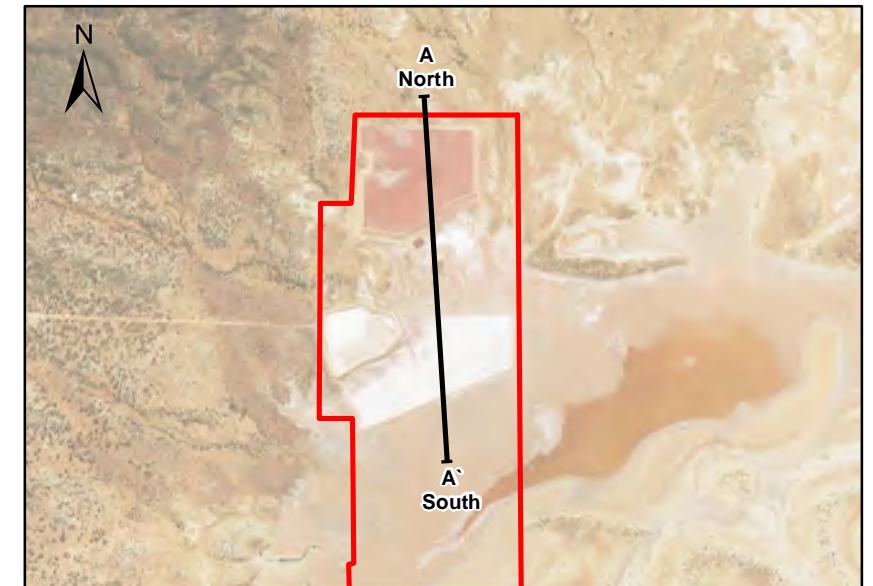
Figure No:	5B
Title:	Background Surface Chromium Concentrations
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS

Path: S:\01_Jobs\6.WA_Jobs\P17302_DMIRS_BULONG_DS\IMXDsl\Working\MXD\005_F006_Preliminary_Site_Model.mxd



Wind-Blown Transport and Deposition of Dust

1. Wind-blown deposition of dust
2. Migration of tailings/embankment material by erosion/surface water flow
3. Leaching of soluble contaminants and migration within groundwater



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Legend

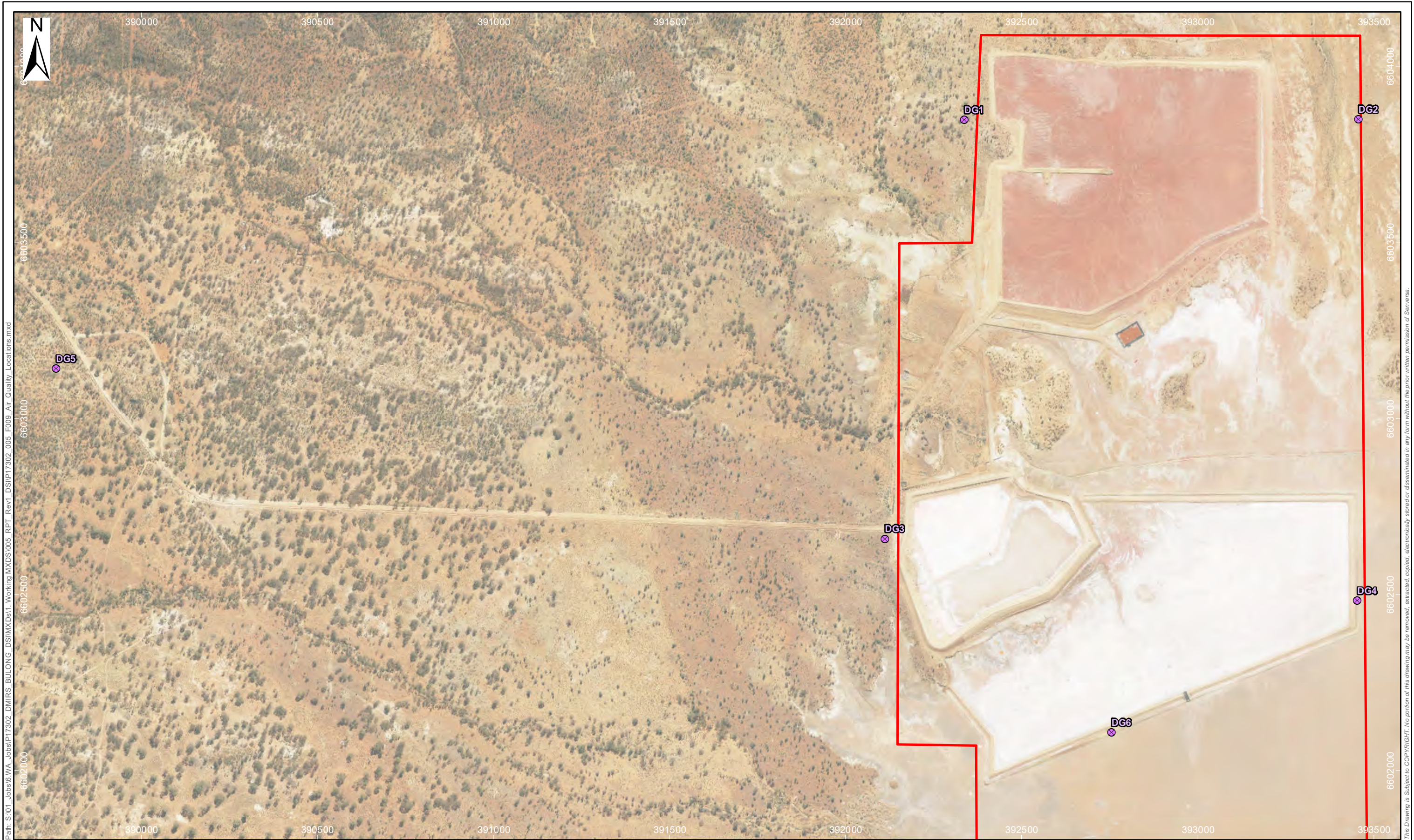
- Bedrock
- Lakebed sediments
- Evaporation Pond
- Settlement Pond
- Tailings

Aerial imagery © Landgate

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	(A3)
File:	P17302_005_F006_Preliminary_Site_Model		

Figure No:	6
Title:	Preliminary Conceptual Site Model
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS

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Path: S:\01_Jobs\6.WA_Jobs\P17302_DMIRS_BULONG_DSI\MXDs\1. Working\MXDS\005_F009_Air_Quality_Locations.mxd

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Legend

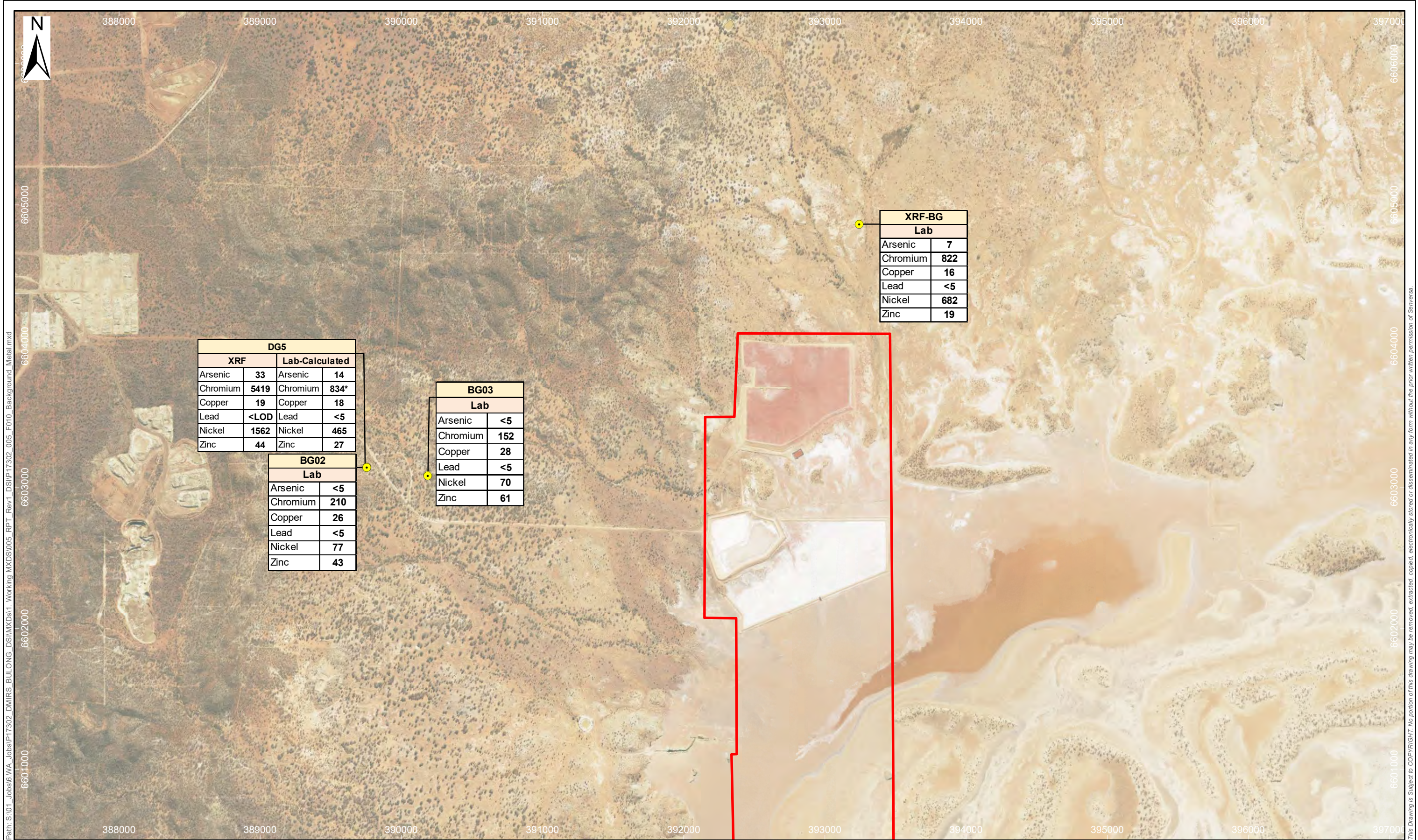
- Air Quality Sample Location
- Site Boundary

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:10,000 (A3)
File:	P17302_005_F009_Air_Quality_Locations		



Figure No:	9
Title:	Air Quality Sample Locations
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS

Aerial imagery © Landgate



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Legend

- Background Location
- Site Boundary

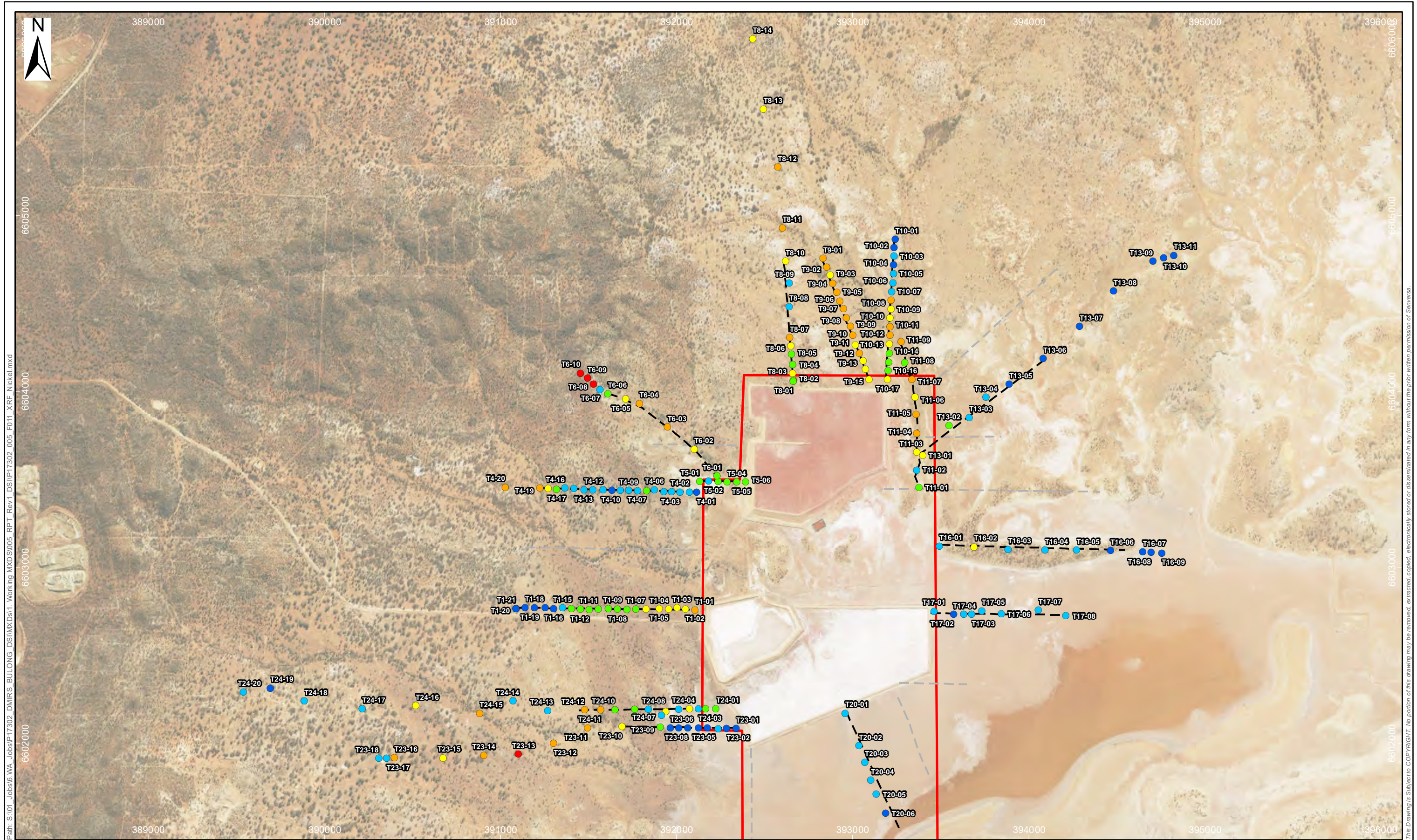
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Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:25,000 (A3)
File:	P17302_005_F010_Background_Metal		



Coordinate System: GDA 1994 MGA Zone 51

Aerial imagery © Landgate

Figure No:	10
Title:	Background Metal Concentrations
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS



Path: S:\01_Jobs\6 WA_Jobs\P17302 DMIRS_BULONG_DSI\MXDs\1. Working MXD\S005_RPT_Rev1_DSI\P17302_005_F011_XRF_Nickel.mxd

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Legend

Nickel (mg/kg)
● 44 - 180
● 180.1 - 400
● 400.1 - 590
● 590.1 - 1000
● 1000.1 - 2000
● 2000.1 - 3001.7

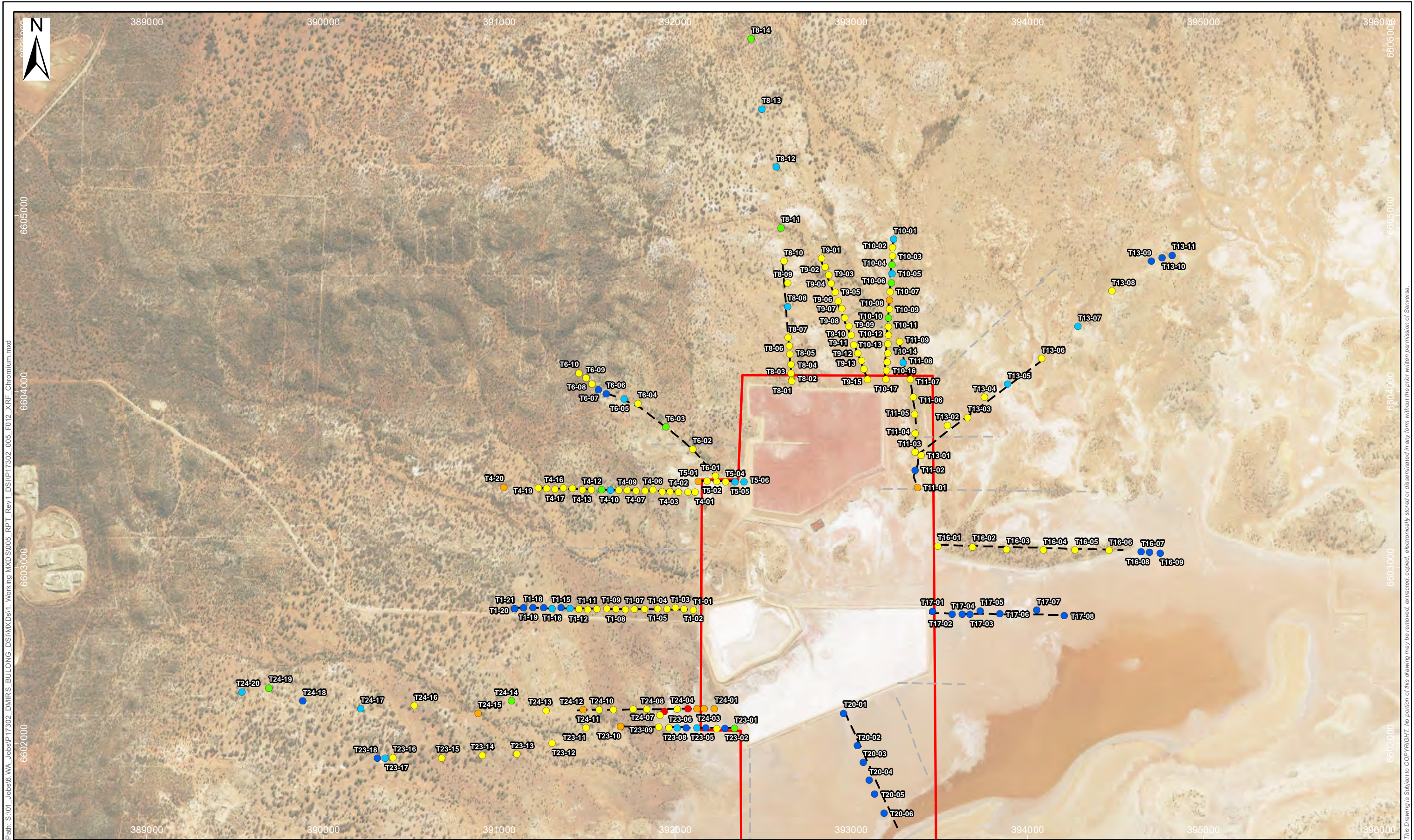
— — Transect Sampled
— — Transect Not Sampled
□ Site Boundary

Aerial imagery © Landgate

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:20,000 (A3)
File:	P17302_005_F011_XRF_Nickel		
<div><div><div>0</div><div>250</div><div>500</div><div>1,000</div><div>1,500</div></div><div><div></div><div></div><div></div><div></div><div></div></div><div>Metres</div></div> <div>Coordinate System: GDA 1994 MGA Zone 51</div>			

Figure No: 11
Title: Raw XRF Data - Nickel

Project: Detailed Site Investigation
Location: Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client: DMIRS



Path: S:\01_Jobs\6 WA_Jobs\P17302 DMIRS_BULONG_DSM\Ds1\ Working MXD\S005_RPT_Rev1_DSI\P17302_005_F012_XRF_Chromium.mxd

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Legend

Chromium (mg/kg)

- 54.7 - 790
- 790.1 - 1100
- 1100.1 - 1300
- 1300.1 - 5000
- 5000.1 - 10000
- 10000.1 - 13466.7

- - Transect Sampled
- - Transect Not Sampled
- Site Boundary

Aerial imagery © Landgate

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:20,000 (A3)
File:	P17302_005_F012_XRF_Chromium		

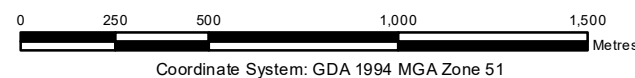
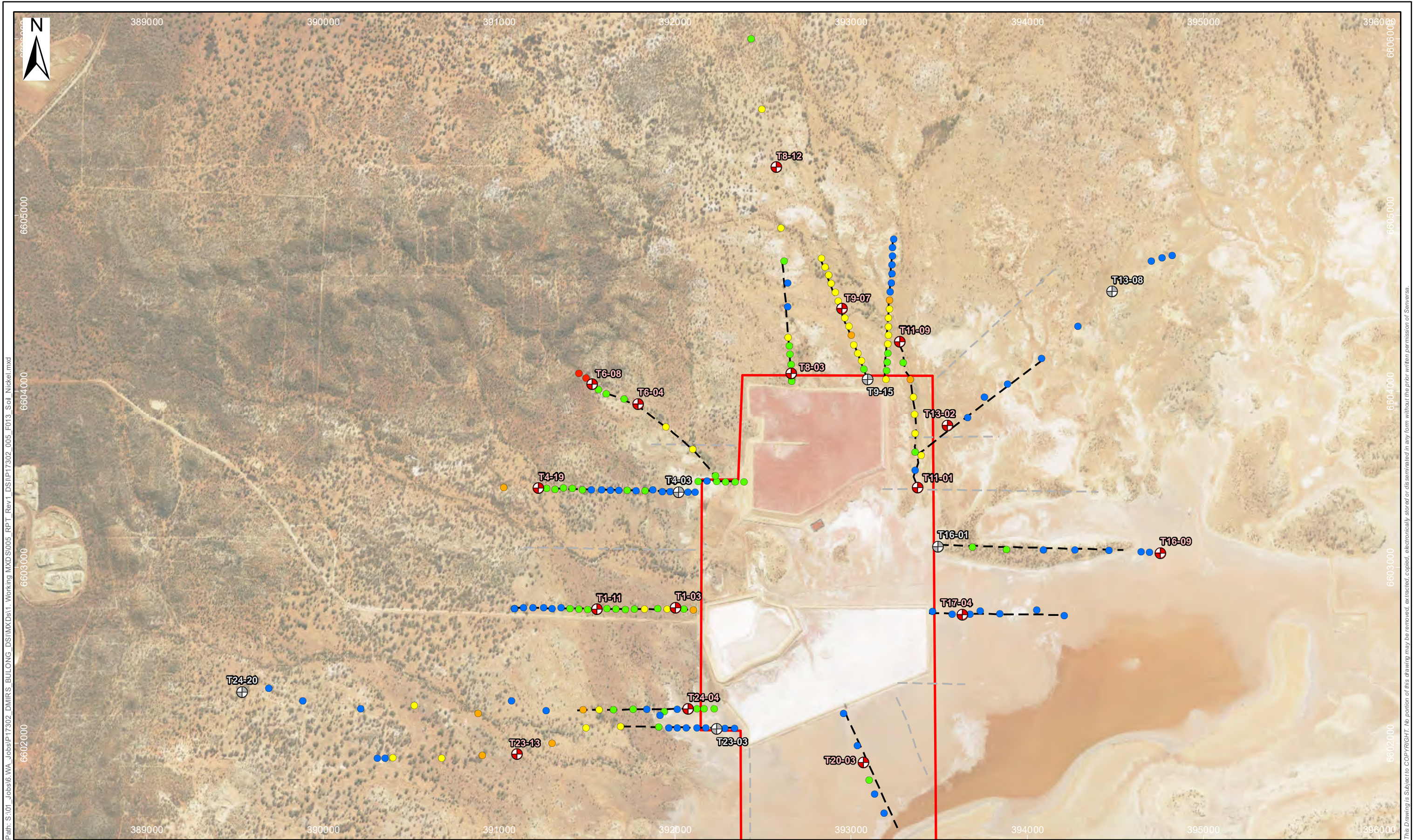


Figure No: 12
Title: Raw XRF Data - Chromium

Project: Detailed Site Investigation
Location: Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client: DMIRS



Path: S:\01_Jobs\6_WA_Jobs\P17302_DMIRS_BULONG_DSM\XDS\1_Working\MXD\S005_RPT_Rev1_DSI\P17302_005_F013_Soil_Nickel.mxd

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Legend

- Site Boundary
- Transect Sampled
- Transect Not Sampled
- Soil Sample Location
- Soil Sample Location (Nickel Exceeds EIL)

Nickel - Calculated Concentration from XRF Measurement (mg/kg)

- 150 - 210
- 211 - 300
- 301 - 400
- 401 - 500
- 501 - 763

Aerial imagery © Landgate

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:20,000 (A3)
File:	P17302_005_F013_Soil_Nickel		

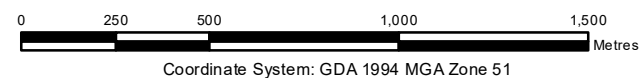
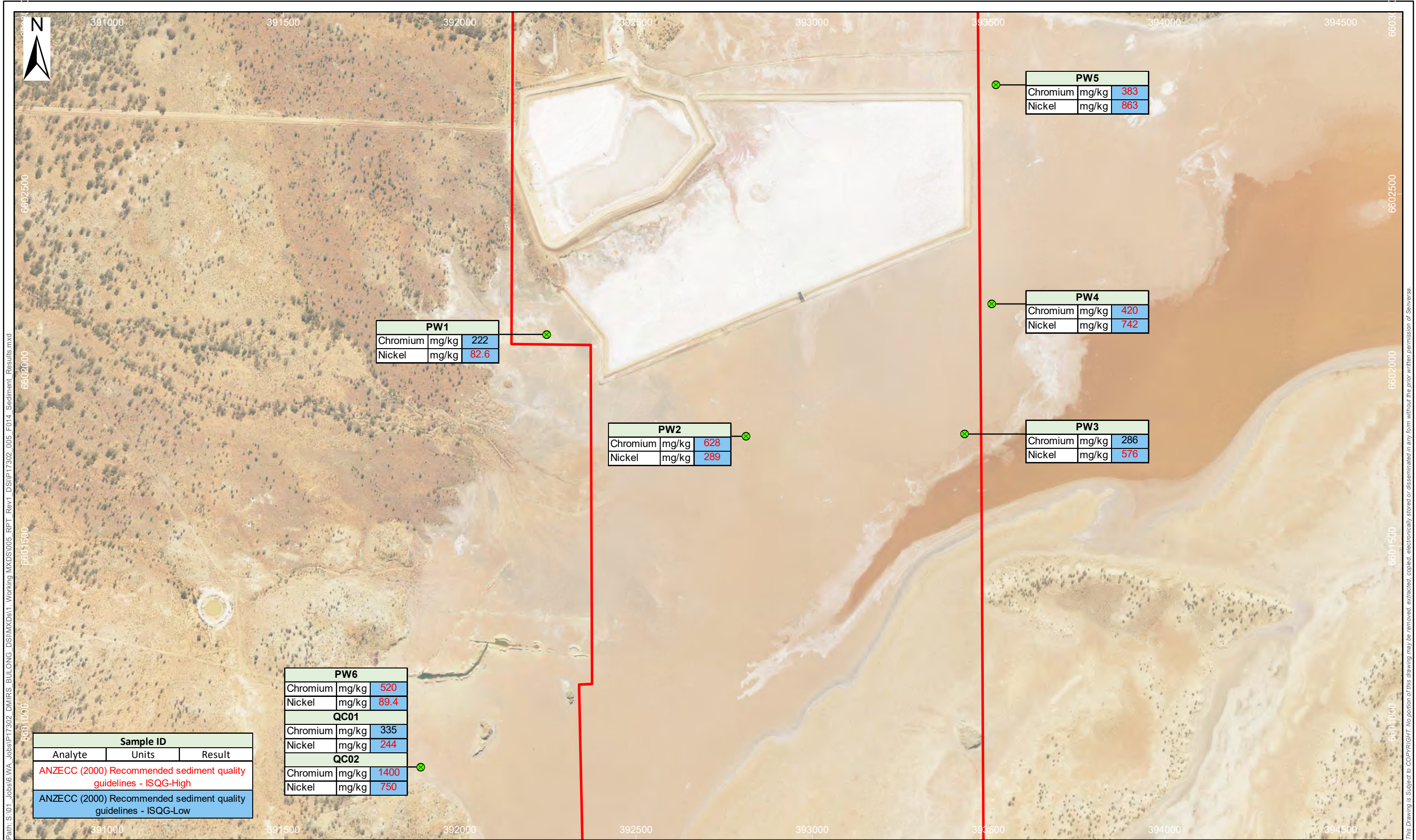


Figure No:	13
Title:	Guideline Exceedances - Nickel in Soil
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS



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Legend

- Sediment Sample Location
- Site Boundary

Designed: B. Coleman Date: 20/05/2020

Drawn: M. Sari Revision: 1

Checked: B. Coleman Scale: 1:10,000 (A3)

File: P17302_005_F014_Sediment_Results

0 50 100 200 300 400 500 Metres
Coordinate System: GDA 1994 MGA Zone 51

Figure No: 14

Title: Analytical Results - Sediment

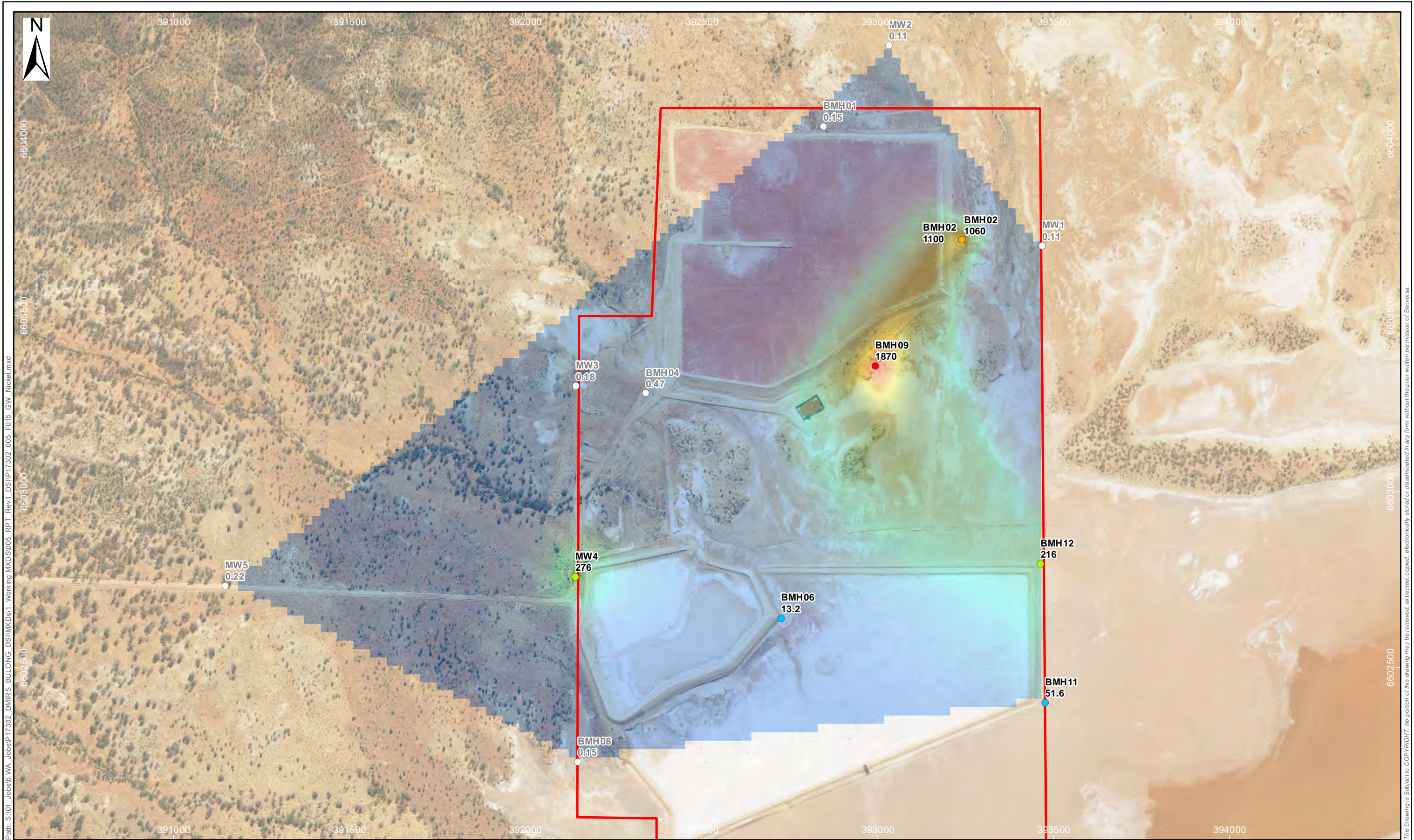
Project: Detailed Site Investigation

Location: Former 'Bulong' Mine Site, Bulong Road, Bulong, WA

Client: DMIRS

Path: S:\01_Jobs\6.WA_Jobs\P17302_DMIRS_BULONG_DSI\MXDs\1. Working\MXDS\005_RPT_Rev1_DSI\P17302_005_F014_Sediment_Results.mxd

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Path: S:\01_Jobs\6.WA_Jobs\P17302_DMIRS_BULONG_DS\IMGDs\1_Working\MXD\S005_RPT_Rev1_DS\IP17302_005_F015_GW_Nickel.mxd

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Address: Level 17, 140 St Georges Tce
Perth WA 6000
Phone: (08) 6324 0200
Website: www.senversa.com.au

Legend

 Site Boundary

Nickel ($\mu\text{g/L}$)

- 0.11 - 1
- 1.01 - 11
- 11.01 - 70
- 70.01 - 1000
- 1000.01 - 1500
- 1500.01 - 1870

Aerial imagery © Landgate

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:10,000 (A3)
File:	P17302_005_F015_GW_Nickel		

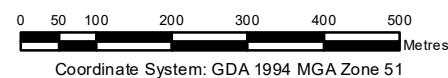
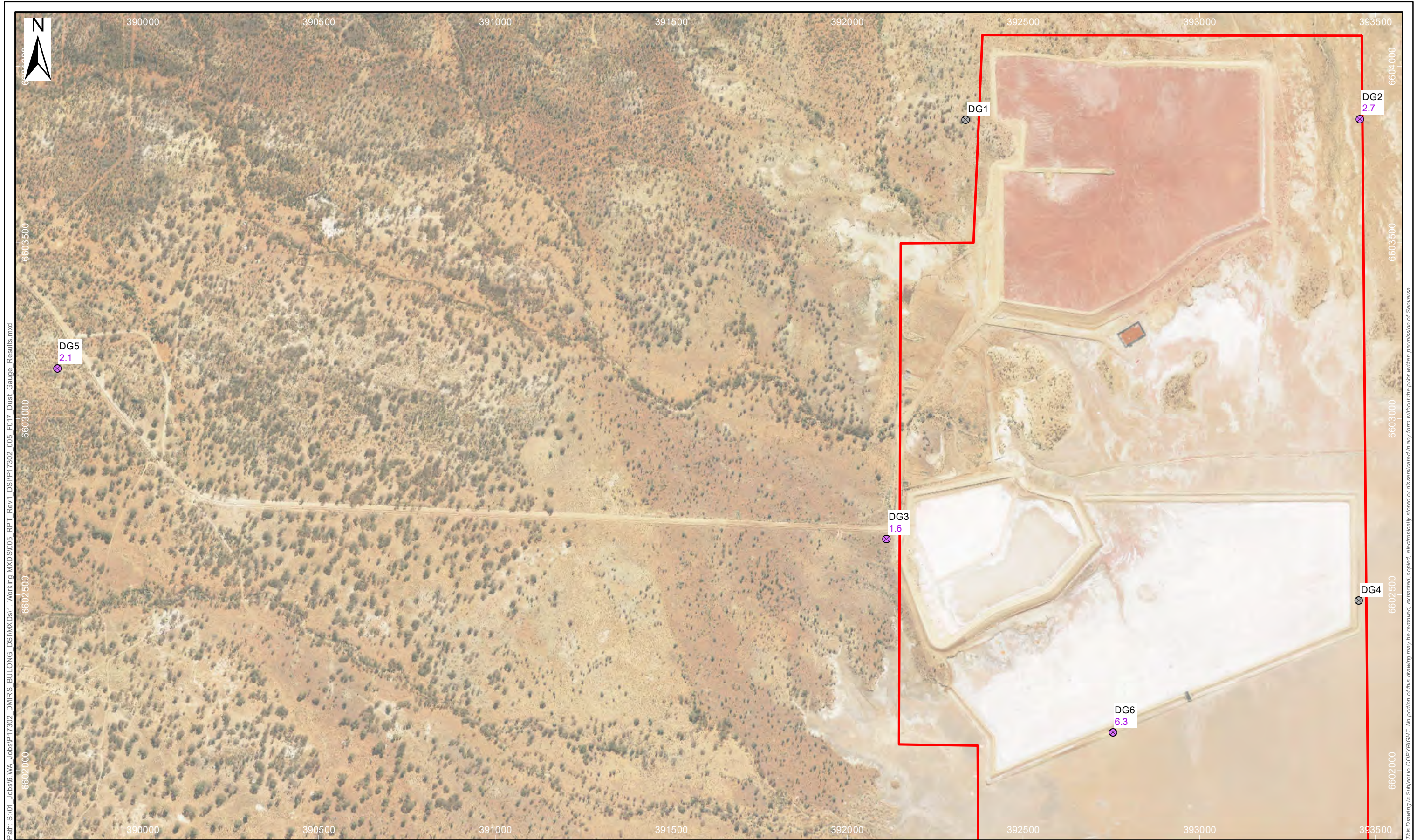


Figure No:	15
Title:	Groundwater Analytical Results - Nickel
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS



Address: Level 17, 140 St Georges Tce
Perth WA 6000
Phone: (08) 6324 0200
Website: www.senvorsa.com.au

Legend

- Site Boundary
- Dust Gauge Location (No Result)
- Dust Gauge Location (Sampled)
- Dust Gauge Location
- Total Solids (g/m²/month)

Designed:	B. Coleman	Date:	20/05/2020
Drawn:	M. Sari	Revision:	1
Checked:	B. Coleman	Scale:	1:10,000 (A3)
File:	P17302_005_F017_Dust_Gauge_Results		

0 50 100 200 300 400 500 Metres
Coordinate System: GDA 1994 MGA Zone 51

Figure No:	17
Title:	Dust Gauge Results
Project:	Detailed Site Investigation
Location:	Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Client:	DMIRS



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					Physical Parameters				Inorganics							
					Moisture Content	pH Redox	pH (Final)	Density	Redox Potential	Cyanide (Total)	Exchangeable Calcium	Exchangeable Magnesium	Exchangeable Potassium	Exchangeable Sodium	Cation Exchange Capacity	Exchangeable Sodium Percent
NEPM 2013 EILs for Areas of Ecological Significance					-	-	-	-	-	-	-	-	-	-	-	-
NEPM 2013 EILs for Urban, Residential and Open Space					-	-	-	-	-	-	-	-	-	-	-	-
NEPM 2013 HIL C (Recreational Land Use)					-	-	-	-	-	-	-	-	-	-	-	-
LoR					1	0.1	0.1	0.01	0.1	1	-	-	-	-	-	-
Units					%	pH units		g/cm3	mV	mg/kg	meq/100g					%
Location ID	Field ID	Date	Sample Type	Lab Report Number												
XRF_BG	XRF_BG	3/12/2019	Normal (background)	EP1913220	10.7	7.7	7.4	2.76		<1	7.2	5.5	0.5	0.2	13.3	1.2
BG2	BG2	24/02/2020	Normal (background)	EP2002272	9.2	8.3	7.4	2.58	190	<1	13.2	2.0	1.0	0.1	0.6	21.5
BG3	BG3	24/02/2020	Normal (background)	EP2002272	6.1	8.4	7.5	2.59	188	<1	5.7	1.7	0.5	<0.1	1.1	13.3
T1-3	T1-3	8/12/2019	Normal	EP1913220	21.3	-	8.4	-	-	<1	-	-	-	-	-	-
	T1-3_0.3-0.4	8/12/2019	Normal	EP1913220	9.2	-	-	-	-	-	-	-	-	-	-	-
T1-11	T1-11	8/12/2019	Normal	EP1913220	2.4	-	-	-	-	-	-	-	-	-	-	-
	T1-11_0.3-0.4	8/12/2019	Normal	EP1913220	26.8	-	-	-	-	-	-	-	-	-	-	-
T4-3	T4-3	8/12/2019	Normal	EP1913220	17.0	8.2	-	2.73	204	-	-	-	-	-	-	-
	T4-3_0.3-0.4	8/12/2019	Normal	EP1913220	8.1	-	-	-	-	-	-	-	-	-	-	-
T6-4	T6-4	11/12/2019	Normal	EP1913250	1.3	-	-	-	-	-	-	-	-	-	-	-
	T6-8	11/12/2019	Normal	EP1913250	1.9	-	-	2.58	-	-	-	-	-	-	-	-
T8-3	T8-3	9/12/2019	Normal	EP1913220	17.9	-	7.7	2.67	-	<1	-	-	-	-	-	-
	T8-3_0.3-0.4	9/12/2019	Normal	EP1913220	25.5	-	-	-	-	-	-	-	-	-	-	-
T8-12	T8-12	9/12/2019	Normal	EP1913220	37.1	-	-	-	-	-	-	-	-	-	-	-
	T8-12_0.3-0.4	9/12/2019	Normal	EP1913220	29.8	-	-	-	-	-	-	-	-	-	-	-
T9-7	T9-7	9/12/2019	Normal	EP1913220	5.8	-	8.2	2.72	-	<1	-	-	-	-	-	-
	T9-7_0.3-0.4	9/12/2019	Normal	EP1913220	24.0	-	-	-	-	-	-	-	-	-	-	-
T9-T15	T9-T15	9/12/2019	Normal	EP1913220	8.0	-	-	-	-	-	-	-	-	-	-	-
	T9-T15_0.15-0.25	9/12/2019	Normal	EP1913220	16.0	-	-	-	-	-	-	-	-	-	-	-
T11-1	T11-1	11/12/2019	Normal	EP1913250	4.7	-	-	2.60	-	-	-	-	-	-	-	-
T11-9	T11-9	11/12/2019	Normal	EP1913250	<1	-	8.9	-	-	<1	-	-	-	-	-	-
T13-2	T13-2	9/12/2019	Normal	EP1913220	17.8	-	-	-	-	-	-	-	-	-	-	-
	T13-2_0.3-0.4	9/12/2019	Normal	EP1913220	16.5	-	-	-	-	-	-	-	-	-	-	-
T13-8	T13-8	9/12/2019	Normal	EP1913220	14.7	-	-	-	-	-	-	-	-	-	-	-
	T13-8_0.3-0.4	9/12/2019	Normal	EP1913220	18.1	-	-	-	-	-	-	-	-	-	-	-
T16-0	T16-0.3-0.4	11/12/2019	Normal	EP1913250	-	-	-	2.89	-	-	-	-	-	-	-	-
T16-1	T16-1	11/12/2019	Normal	EP1913250	1.3	-	7.6	2.91	-	<1	-	-	-	-	-	-
T16-9	T16-9	11/12/2019	Normal	EP1913250	15.5	-	-	-	-	-	-	-	-	-	-	-
T17-4	T17-4	9/12/2019	Normal	EP1913220	18.3	-	-	-	-	-	-	-	-	-	-	-
	T17-4_0.05-0.15	9/12/2019	Normal	EP1913220	32.1	-	-	-	-	-	-	-	-	-	-	-

In relation to the above table:

* indicates that the NEPM 2013 EILs for Areas of Ecological Significance assessment level for total chromium has been adopted from the assessment level value for Chromium III.

	Physical Parameters				Inorganics								
	Moisture Content	pH Redox	pH (Final)	Density	Redox Potential	Cyanide (Total)	Exchangeable Calcium	Exchangeable Magnesium	Exchangeable Potassium	Exchangeable Sodium	Cation Exchange Capacity	Exchangeable Sodium Percent	
NEPM 2013 EILs for Areas of Ecological Significance	-	-	-	-	-	-	-	-	-	-	-	-	
NEPM 2013 EILs for Urban, Residential and Open Space	-	-	-	-	-	-	-	-	-	-	-	-	
NEPM 2013 HIL C (Recreational Land Use)	-	-	-	-	-	-	-	-	-	-	-	-	
LoR	1	0.1	0.1	0.01	0.1	1	-	-	-	-	-	-	
Units	%	pH units		g/cm3	mV	mg/kg	meq/100g				%		
Location ID	Field ID	Date	Sample Type	Lab Report Number									
T19-4	T19-4	8/12/2019	Normal	EP1913220	4.8	7.6	6.5	4.64	193	<1	-	-	-
	T19-4_0.3-0.4	8/12/2019	Normal	EP1913220	22.0	-	-	-	-	-	-	-	-
T20-3	T20-3	11/12/2019	Normal	EP1913250	23.4	-	7.4	-	-	<1	-	-	-
T23-3	T123-3	8/12/2019	Normal	EP1913220	32.0	-	7.6	-	-	<1	-	-	-
	T23-3_0.3-0.4	8/12/2019	Normal	EP1913220	15.6	-	-	-	-	-	-	-	-
T23-13	T23-13	8/12/2019	Normal	EP1913220	27.1	-	7.7	-	-	<1	-	-	-
	T23-13_0.3-0.4	8/12/2019	Normal	EP1913220	7.8	-	-	-	-	-	-	-	-
T24-4	T24-4	9/12/2019	Normal	EP1913220	22.1	-	8.4	2.49	-	<1	-	-	-
T24-20	T24-20	9/12/2019	Normal	EP1913220	20.0	-	-	-	-	-	-	-	-
	T24-20_0.3-0.4	9/12/2019	Normal	EP1913220	24.8	-	-	-	-	-	-	-	-

In relation to the above table:

¹ indicates that the NEPM 2013 EILs for Areas of Ecological Significance assessment level for total chromium has been adopted from the assessment level value for Chromium III.

					Metals (total)													Particle Size
					Arsenic	Cadmium	Chromium	Chromium(VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Clay in soils <2um
NEPM 2013 EILs for Areas of Ecological Significance					40	-	330	-	-	65	-	470	-	-	210	-	170	-
NEPM 2013 EILs for Urban, Residential and Open Space					100	-	570	-	-	80	-	1,100	-	-	380	-	560	-
NEPM 2013 HIL C (Recreational Land Use)					300	90	-	240	300	17,000	-	600	19,000	80	1,200	700	30,000	-
LoR					2	0.4	2		2	5	20	5	5	0.1	2	2	5	1
Units					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
Location ID	Field ID	Date	Sample Type	Lab Report Nun														
XRF_BG	XRF_BG	3/12/2019	Normal (background)	EP1913220	7	<1	822	<0.5	49	16	50,300	<5	514	<0.1	682	<5	19	11
BG2	BG2	24/02/2020	Normal (background)	EP2002272	<5	<1	210	<2.5	15	26	40,700	<5	821	<0.1	77	<5	43	11
BG3	BG3	24/02/2020	Normal (background)	EP2002272	<5	<1	152	<0.5	24	28	52,600	<5	2,120	<0.1	70	<5	61	13
T1-3	T1-3	8/12/2019	Normal	EP1913220	6	<1	1,060	-	22	19	62,200	6	486	<0.1	260	<5	41	-
	T1-3_0.3-0.4	8/12/2019	Normal	EP1913220	9	<1	1,040	-	29	30	61,800	6	431	<0.1	278	<5	36	-
T1-11	T1-11	8/12/2019	Normal	EP1913220	6	1	1,260	-	30	18	70,000	7	745	<0.1	291	<5	44	-
	T1-11_0.3-0.4	8/12/2019	Normal	EP1913220	7	<1	857	-	29	28	52,900	5	702	<0.1	267	<5	31	-
T4-3	T4-3	8/12/2019	Normal	EP1913220	6	<1	708	-	21	24	53,700	5	431	<0.1	180	<5	38	9
	T4-3_0.3-0.4	8/12/2019	Normal	EP1913220	8	<1	360	-	21	36	41,700	<5	318	<0.1	138	<5	46	-
T6-4	T6-4	11/12/2019	Normal	EP1913250	6	1	326	-	39	36	45,600	<5	1,220	<0.1	477	<5	44	-
	T6-8	11/12/2019	Normal	EP1913250	41	1	843	-	50	36	39,800	<5	1,520	<0.1	686	<5	19	8
T8-3	T8-3	9/12/2019	Normal	EP1913220	6	<1	590	<0.5	36	26	60,600	7	1,000	<0.1	324	<5	48	16
	T8-3_0.3-0.4	9/12/2019	Normal	EP1913220	7	<1	394	-	29	37	30,800	<5	363	<0.1	307	<5	20	-
T8-12	T8-12	9/12/2019	Normal	EP1913220	6	<1	385	-	40	36	41,600	<5	956	<0.1	458	<5	42	-
	T8-12_0.3-0.4	9/12/2019	Normal	EP1913220	12	<1	221	-	20	39	30,000	<5	296	<0.1	215	<5	27	-
T9-7	T9-7	9/12/2019	Normal	EP1913220	6	<1	507	<0.5	48	21	43,000	<5	645	<0.1	514	<5	23	8
	T9-7_0.3-0.4	9/12/2019	Normal	EP1913220	11	<1	503	-	31	19	39,300	<5	356	<0.1	383	<5	18	-
T9-T15	T9-T15	9/12/2019	Normal	EP1913220	<5	<1	511	-	21	12	51,700	6	528	<0.1	184	<5	24	-
	T9-T15_0.15-0.25	9/12/2019	Normal	EP1913220	<5	<1	578	-	28	13	42,700	6	714	<0.1	199	<5	15	-
T11-1	T11-1	11/12/2019	Normal	EP1913250	7	<1	367	-	27	32	38,800	<5	633	<0.1	244	<5	30	3
T11-9	T11-9	11/12/2019	Normal	EP1913250	5	<1	429	-	28	18	36,400	<5	567	<0.1	290	<5	17	-
T13-2	T13-2	9/12/2019	Normal	EP1913220	<5	<1	458	-	12	11	47,100	<5	271	<0.1	109	<5	25	-
	T13-2_0.3-0.4	9/12/2019	Normal	EP1913220	10	<1	732	-	28	29	60,200	<5	432	<0.1	302	<5	40	-
T13-8	T13-8	9/12/2019	Normal	EP1913220	<5	<1	172	-	4	7	27,100	<5	119	<0.1	22	<5	9	-
	T13-8_0.3-0.4	9/12/2019	Normal	EP1913220	6	<1	92	-	9	35	22,600	<5	154	<0.1	54	<5	20	-
T16-0	T16-0.3-0.4	11/12/2019	Normal	EP1913250	-	-	-	-	-	-	-	-	-	-	-	-	-	4
T16-1	T16-1	11/12/2019	Normal	EP1913250	<5	1	758	-	25	11	52,000	7	756	<0.1	174	<5	20	5
T16-9	T16-9	11/12/2019	Normal	EP1913250	<5	<1	441	-	24	12	39,900	<5	613	<0.1	221	<5	20	-
T17-4	T17-4	9/12/2019	Normal	EP1913220	7	<1	358	-	40	18	34,600	<5	1,030	<0.1	402	<5	25	-
	T17-4_0.05-0.15	9/12/2019	Normal	EP1913220	<5	<1	202	-	68	35	34,100	<5	473	<0.1	315	<5	104	-

In relation to the above table:

* indicates that the NEPM 2013 EILs for Areas of Ecological Significance assessment level for total chromium has been adopted from the assessment level value for Chromium III.

					Metals (total)											Particle Size		
					Arsenic	Cadmium	Chromium	Chromium(VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Clay in soils <2um
NEPM 2013 EILs for Areas of Ecological Significance					40	-	330	-	-	65	-	470	-	-	210	-	170	-
NEPM 2013 EILs for Urban, Residential and Open Space					100	-	570	-	-	80	-	1,100	-	-	380	-	560	-
NEPM 2013 HIL C (Recreational Land Use)					300	90	-	240	300	17,000	-	600	19,000	80	1,200	700	30,000	-
LoR					2	0.4	2		2	5	20	5	5	0.1	2	2	5	1
Units					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
Location ID	Field ID	Date	Sample Type	Lab Report Num														
T19-4	T19-4	8/12/2019	Normal	EP1913220	8	<1	823	<0.5	54	18	51,900	<5	567	<0.1	728	<5	21	10
	T19-4_0.3-0.4	8/12/2019	Normal	EP1913220	8	<1	718	-	52	20	50,000	<5	594	<0.1	699	<5	21	-
T20-3	T20-3	11/12/2019	Normal	EP1913250	8	<1	386	-	49	25	39,000	<5	469	<0.1	648	<5	31	-
T23-3	T123-3	8/12/2019	Normal	EP1913220	10	<1	432	<0.5	12	17	30,900	<5	230	<0.1	120	<5	18	-
	T23-3_0.3-0.4	8/12/2019	Normal	EP1913220	<5	<1	4	-	<2	<5	540	<5	9	<0.1	<2	<5	<5	-
T23-13	T23-13	8/12/2019	Normal	EP1913220	6	<1	719	<0.5	62	27	54,600	<5	851	<0.1	786	<5	36	-
	T23-13_0.3-0.4	8/12/2019	Normal	EP1913220	6	<1	784	-	57	21	55,800	<5	628	<0.1	737	<5	25	-
T24-4	T24-4	9/12/2019	Normal	EP1913220	15	<1	1,190	<0.5	32	22	70,800	8	713	<0.1	280	<5	22	4
T24-20	T24-20	9/12/2019	Normal	EP1913220	<5	<1	289	-	25	27	50,600	<5	1,480	<0.1	163	<5	50	-
	T24-20_0.3-0.4	9/12/2019	Normal	EP1913220	6	<1	186	-	15	22	35,500	<5	438	<0.1	93	<5	28	-

In relation to the above table:

¹ indicates that the NEPM 2013 EILs for Areas of Ecological Significance assessment level for total chromium has been adopted from the assessment level value for Chromium III.

Table 2: Soil Leachate Analytical Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

				Physical Parameters					Inorganics						
				Moisture Content	pH Redox	pH (Final)	pH (Lab)	Density	Redox Potential	Cyanide (Total)	Exchangeable Calcium	Exchangeable Magnesium	Exchangeable Potassium	Exchangeable Sodium	Cation Exchange Capacity
Maintenance of Ecosystems: 95% Protection, Freshwater				-	-	-	-	-	-	-	-	-	-	-	-
Maintenance of Ecosystems: 95% Protection, Marine				-	-	-	-	-	-	-	-	-	-	-	-
LoR				1	0.1	0.1	0.1	-	0.1	1	0.1	0.1	0.1	0.1	0.1
Units				%	pH units			g/cm3	mV	mg/kg	meq/100g				%
Field ID	Date	Sample Type	Lab Report Number												
XRF_BG	3/12/2019	Normal (background)	EP1913220	10.7	7.7	7.4	6.2	2.76	182	<1	7.2	5.5	0.5	0.2	13.3
T1-3	8/12/2019	Normal	EP1913220	21.3	-	8.4	-	-	-	<1	-	-	-	-	-
T8-3	9/12/2019	Normal	EP1913220	17.9	-	7.7	-	2.67	-	<1	-	-	-	-	-
T9-7	9/12/2019	Normal	EP1913220	5.8	-	8.2	-	2.72	-	<1	-	-	-	-	-
T11-9	11/12/2019	Normal	EP1913250	<1	-	8.9	-	-	-	<1	-	-	-	-	-
T16-1	11/12/2019	Normal	EP1913250	1.3	-	7.6	-	2.91	-	<1	-	-	-	-	-
T19-4	8/12/2019	Normal	EP1913220	4.8	7.6	6.5	6.2	4.64	193	<1	-	-	-	-	-
T20-3	11/12/2019	Normal	EP1913250	23.4	-	7.4	-	-	-	<1	-	-	-	-	-
T23-3	8/12/2019	Normal	EP1913220	32.0	-	7.6	-	-	-	<1	-	-	-	-	-
T23-13	8/12/2019	Normal	EP1913220	27.1	-	7.7	-	-	-	<1	-	-	-	-	-
T24-4	9/12/2019	Normal	EP1913220	22.1	-	8.4	-	2.49	-	<1	-	-	-	-	-

				Metals (total)												Particle Size Clay in soils <2um	
				Arsenic	Cadmium	Chromium	Chromium(VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium		Zinc
Maintenance of Ecosystems: 95% Protection, Freshwater				0.0023 ²	0.0007	-	0.0033	0.001	0.0013	-	0.0044	0.08	0.0001	0.007	0.003	0.015	-
Maintenance of Ecosystems: 95% Protection, Marine				0.013	0.0002	-	0.0027	0.0014	0.0014	0.3	0.0034	1.9	0.00006	0.011	0.005	0.008	-
LoR				0.001	0.0001	0.001	0.01	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.005	1
Units				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	%
Field ID	Date	Sample Type	Lab Report Number														
XRF_BG	3/12/2019	Normal (background)	EP1913220	0.003	<0.0001	0.088	<0.01	0.004	0.002	3.09	<0.001	0.039	<0.0001	0.076	<0.01	<0.005	11
T1-3	8/12/2019	Normal	EP1913220	0.004	<0.0001	0.044	<0.01	0.002	0.002	1.76	<0.001	0.041	<0.0001	0.015	<0.01	<0.005	-
T8-3	9/12/2019	Normal	EP1913220	<0.001	<0.0001	0.026	<0.01	0.002	0.002	1.63	<0.001	0.044	<0.0001	0.016	<0.01	<0.005	16
T9-7	9/12/2019	Normal	EP1913220	0.005	<0.0001	0.038	<0.01	0.004	0.003	2.18	<0.001	0.056	<0.0001	0.053	<0.01	<0.005	8
T11-9	11/12/2019	Normal	EP1913250	0.002	<0.0001	0.003	<0.01	<0.001	0.001	<0.05	<0.001	<0.001	<0.0001	0.001	<0.01	<0.005	-
T16-1	11/12/2019	Normal	EP1913250	<0.001	<0.0001	0.004	<0.01	<0.001	<0.001	<0.05	<0.001	0.006	<0.0001	0.003	<0.01	<0.005	5
T19-4	8/12/2019	Normal	EP1913220	0.006	<0.0001	0.270	<0.01	0.032	0.009	11.60	0.002	0.323	<0.0001	0.494	<0.01	0.071	10
T20-3	11/12/2019	Normal	EP1913250	0.001	<0.0001	<0.001	<0.01	0.001	0.002	<0.05	<0.001	<0.001	<0.0001	0.097	<0.01	<0.005	-
T23-3	8/12/2019	Normal	EP1913220	<0.001	<0.0001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	0.006	-
T23-13	8/12/2019	Normal	EP1913220	0.002	<0.0001	0.007	<0.01	<0.001	0.002	0.41	<0.001	0.013	<0.0001	0.016	<0.01	<0.005	-
T24-4	9/12/2019	Normal	EP1913220	<0.001	<0.0001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005	4

In relation to the above table:

² indicates that the Maintenance of Ecosystems: 95% Protection (Freshwater) assessment level for total arsenic has been adopted from the assessment level value for Arsenic III.

Table 4: Sediment Analytical Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

				Physical Parameters and Inorganics				Particle Size Distribution					Arsenic	Chromium - trivalent	Chromium - hexavalent	Cadmium				Cobalt
				Moisture Content	pH (Final)	Density	Total Organic Carbon	Clay in soils <2µm	Gravel (>2mm)	Sand (0.06-2.00 mm)	Silt (2-60 µm)	Cobbles (>6cm)				Total	SEM	SEM	SEM / AVS	
ANZECC (2000) Recommended sediment quality guidelines - 0				-	-	-	-	-	-	-	-	-	70	370	-	10	-	-	-	-
ANZECC (2000) Recommended sediment quality guidelines - 0				-	-	-	-	-	-	-	-	-	20	80	-	1.5	-	-	-	-
LoR				0.1	0.1	0.01	200	-	-	-	-	-	1	1	0.5	0.1	0.1	0.01	-	0.5
Units				%	pH units	g/cm3	mg/kg	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mmol/kg	-	mg/kg
Field ID	Date	Sample Type	Lab Report Number																	
PW1	2/12/2019	Normal	EP1912834	15.9	6.2	2.57	1,000	8	<1	20	72	<1	6.32	222	<0.5	<0.1	<0.1	<0.01	<1	7.4
PW2	2/12/2019	Normal	EP1912834	28.1	6.1	2.76	1,500	4	<1	39	57	<1	6.22	628	<0.5	<0.1	<0.1	<0.01	<1	29.9
PW3	2/12/2019	Normal	EP1912834	26.3	6.3	2.76	10,200	<1	2	38	60	<1	5.67	286	<0.5	<0.1	<0.1	<0.01	<1	46.7
PW4	2/12/2019	Normal	EP1912834	23.9	6.4	2.75	2,200	7	<1	33	60	<1	9.35	420	<0.5	<0.1	<0.1	<0.01	<1	54.0
PW5	2/12/2019	Normal	EP1912834	24.6	6.4	2.45	4,300	15	<1	39	46	<1	8.42	383	<0.5	<0.1	<0.1	<0.01	<1	59.3
PW6	2/12/2019	Normal	EP1912834	19.6	8.4	2.80	1,400	4	1	94	1	<1	2.63	520	<0.5	<0.1	<0.1	<0.01	<1	13.2
QC01	2/12/2019	Duplicate	EP1912834	17.0	7.7	2.81	1,800	<1	<1	47	53	<1	4.47	335	<0.5	<0.1	<0.1	<0.01	<1	24.2
QC02	2/12/2019	Triplicate	694415	25.0	-	-	-	-	-	-	-	-	16	1,400	-	<0.4	-	-	-	58

				Copper					Lead						Nickel			
				Total	SEM	SEM	SEM / AVS		Iron	Total	SEM	SEM			SEM / AVS	Manganese	Mercury	Total
ANZECC (2000) Recommended sediment quality guidelines - C				270		-	-	-	220		-	-	-	1	52	-	-	-
ANZECC (2000) Recommended sediment quality guidelines - D				65		-	-	-	50		-	-	-	0.15	21	-	-	-
LoR				1	1	0.01	0.01	20	0.01	1	0.01	-	10	0.01	1	1	0.01	-
Units				mg/kg	mg/kg	mmol/kg	mmol/kg	mg/kg	mg/kg	mg/kg	mmol/kg	-	mg/kg	mg/kg	mg/kg	mg/kg	mmol/kg	-
Field ID	Date	Sample Type	Lab Report N															
PW1	2/12/2019	Normal	EP1912834	5.6	<1	<0.01	<1	21,400	<0.01	<1	<0.01	<1	136	<0.01	82.6	4.1	0.07	0.70
PW2	2/12/2019	Normal	EP1912834	19.6	1.4	0.02	0.04	54,700	<0.01	1.7	<0.01	<1	469	<0.01	289	14.3	0.24	0.77
PW3	2/12/2019	Normal	EP1912834	18.3	3.6	0.06	0.20	2,700	<0.01	1.2	<0.01	<1	492	<0.01	576	195	3.34	11.13
PW4	2/12/2019	Normal	EP1912834	24.3	4.5	0.07	0.18	1,960	<0.01	1.8	<0.01	<1	1,340	<0.01	742	165	2.82	7.05
PW5	2/12/2019	Normal	EP1912834	29.0	5.5	0.09	0.09	46,000	0.01	2.1	0.01	0.002	1,030	<0.01	863	296	5.05	5.05
PW6	2/12/2019	Normal	EP1912834	14.0	2.1	0.03	0.06	420	<0.01	2.0	<0.01	<1	127	<0.01	89.4	5	0.08	0.16
QC01	2/12/2019	Duplicate	EP1912834	11.7	1.2	0.02	0.05	29,700	<0.01	<1	<0.01	<1	495	<0.01	244	39.5	0.67	1.68
QC02	2/12/2019	Triplicate	694415	28.0	-	-	-	80,000	-	-	-	-	940	<0.1	750	-	-	-

				Selenium	Silver				Zinc				Sum of SEM (Cd, Cu, Pb, Ni, Ag, Zn)	Acid Volatile Sulfides	SEM - AVS	VOLUME
					Total	SEM	SEM	SEM / AVS	Total	SEM	SEM	SEM / AVS				
ANZECC (2000) Recommended sediment quality guidelines - Cd				-	3.7	-	-	-	410	-	-	-	-	-	-	-
ANZECC (2000) Recommended sediment quality guidelines - Cu				-	1	-	-	-	200	-	-	-	-	-	-	-
LoR				0.1	1	1	0.01	-	1	1	0.01	-	0.01	0.3	0.01	0.001
Units				mg/kg	mg/kg	mg/kg	mmol/kg	-	mg/kg	mg/kg	mmol/kg	-	mmol/kg	mmol/kg	mmol/kg	L
Field ID	Date	Sample Type	Lab Report Number													
PW1	2/12/2019	Normal	EP1912834	0.2	<1	<1	<0.01	<1	9.2	1.9	0.03	0.30	0.1	0.4	<0.01	0.01
PW2	2/12/2019	Normal	EP1912834	0.2	<1	<1	<0.01	<1	60.4	2.2	0.03	0.10	0.31	0.5	<0.01	0.034
PW3	2/12/2019	Normal	EP1912834	0.2	<1	<1	<0.01	<1	26.3	3.1	0.05	0.17	3.45	<0.3	3.45	0.013
PW4	2/12/2019	Normal	EP1912834	0.3	<1	<1	<0.01	<1	39.3	3.8	0.06	0.02	2.96	0.4	2.54	<0.001
PW5	2/12/2019	Normal	EP1912834	0.2	<1	<1	<0.01	<1	48.8	3.9	0.06	0.01	5.21	1	4.21	-
PW6	2/12/2019	Normal	EP1912834	0.1	<1	<1	<0.01	<1	32.7	2.6	0.04	0.24	0.17	0.5	<0.01	-
QC01	2/12/2019	Duplicate	EP1912834	0.1	<1	<1	<0.01	<1	28.5	1.8	0.03	0.04	0.72	0.4	0.31	0.03
QC02	2/12/2019	Triplicate	694415	<2	-	-	-	-	52.0	-	-	-	-	-	-	-

Table 5: Sediment Leachate Analytical Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

				Physical Parameters pH (Final)	Metals (total)												
					Arsenic	Cadmium	Chromium	Chromium(VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Zinc
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Freshwater				-	0.013 ¹	0.0002	-	-	0.0014	0.0014	0.3	0.0034	1.9	0.00006	0.011	0.005	0.008
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Marine				-	0.0023 ²	0.00076	-	-	0.001	0.0013	-	0.0044	0.08	0.0001	0.007	0.003	0.015
LoR				0.1	0.001	0.0001	0.001	0.01	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.005
Units				pH units	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
Field ID	Date	Sample Type	Lab Report Number														
PW1	2/12/2019	Normal	EP1913434	6.2	<0.001	<0.0001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005
PW2	2/12/2019	Normal	EP1913434	6.1	0.002	<0.0001	0.001	<0.01	<0.001	<0.001	<0.05	<0.001	0.016	<0.0001	0.010	<0.01	0.008
PW3	2/12/2019	Normal	EP1913434	6.3	0.003	<0.0001	0.001	<0.01	<0.001	0.002	<0.05	<0.001	0.002	<0.0001	0.051	<0.01	<0.005
PW4	2/12/2019	Normal	EP1913434	6.4	0.002	<0.0001	0.001	<0.01	<0.001	0.001	<0.05	<0.001	0.009	<0.0001	0.036	<0.01	<0.005
PW5	2/12/2019	Normal	EP1913434	6.4	0.002	<0.0001	0.001	<0.01	<0.001	0.002	<0.05	<0.001	0.005	<0.0001	0.031	<0.01	<0.005
PW6	2/12/2019	Normal	EP1913434	8.4	<0.001	<0.0001	<0.001	<0.01	<0.001	0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005

In relation to the above table:

¹ indicates that the more conservative value (As V) out of the available values for arsenic species (III and V) was adopted for initial screening purposes.

² indicates that the more conservative value (As III) out of the available values for arsenic species (III and V) was adopted for initial screening purposes.

Table 6: Sediment and Sediment Leachate QA/ QC Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

					Physical Parameters		Metals												
					Moisture Content	pH (Final)	Arsenic	Cadmium	Chromium	Chromium(VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Zinc
ANZECC (2000) Maintenance of Ecosystems - 95% Protection - Freshwater					-	-	0.013 ¹	0.0002	-	-	0.0014	0.0014	0.3	0.0034	1.9	0.00006	0.011	0.005	0.008
ANZECC (2000) Maintenance of Ecosystems - 95% Protection - Marine					-	-	0.0023 ²	0.00076	-	-	0.001	0.0013	-	0.0044	0.08	0.0001	0.007	0.003	0.015
LoR					1	0.1	0.001	0.0001	0.001	0.01	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.005
Units					%	pH units	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
Location		Field ID	Date	Sample Type	Lab Report Number														
PW2	QC01	2/12/2019	Duplicate	EP1913434	17	7.7	<0.001	<0.0001	<0.001	<0.01	<0.001	<0.001	<0.05	<0.001	0.024	<0.0001	0.006	<0.01	0.011

In relation to the above table:

¹ indicates that the more conservative value (As V) out of the available values for arsenic species (III and V) was adopted for initial screening purposes.

² indicates that the more conservative value (As III) out of the available values for arsenic species (III and V) was adopted for initial screening purposes.

					Physical Parameters and Inorganics				Simultaneously Extracted Metals (SEM)											
									Cadmium				Copper				Lead			
					Moisture Content	pH (Final)	Density	Total Organic Carbon	SEM	SEM	SEM / AVS	Total	SEM	SEM	SEM / AVS	Total	SEM	SEM	SEM / AVS	Total
ANZECC (2000) Recommended sediment quality guidelines - ISQG-High					-	-	-	-	10	-	-	-	270	-	-	-	220	-	-	-
ANZECC (2000) Recommended sediment quality guidelines - ISQG-Low					-	-	-	-	1.5	-	-	-	65	-	-	-	50	-	-	-
LoR					0.1	0.1	0.01	200	0.1	0.01	-	0.1	1	0.01	-	1	1	0.01	-	0.01
Units					%	pH units	g/cm3	mg/kg	mg/kg	mmol/kg	---	mg/kg	mg/kg	mmol/kg	---	mg/kg	mg/kg	mmol/kg	---	mg/kg
Location	Field ID	Date	Sample Type	Lab Report Number																
PW2	QC01	2/12/2019	Duplicate	EP1912834	17	7.7	2.81	1,800	<0.1	<0.01	<1	<0.1	1.2	0.02	0.05	11.7	<1	<0.01	<1	<0.01
PW2	QC02	2/12/2019	Triplicate	694415	25	-	-	-	-	-	-	<0.4	-	-	-	28.0	-	-	-	-

					Simultaneously Extracted Metals (SEM)										Other					
					Nickel				Silver				Zinc							
					SEM	SEM	SEM / AVS	Total	SEM	SEM	SEM / AVS	Total	SEM	SEM	SEM / AVS	Total	Sum of SEM (Cd, Cu, Pb, Ni, Ag, Zn)	Acid Volatile Sulfides	SEM - AVS	VOLUME
ANZECC (2000) Recommended sediment quality guidelines - ISQG-High					52	-	-	-	3.7	-	-	-	410	-	-	-	-	-	-	-
ANZECC (2000) Recommended sediment quality guidelines - ISQG-Low					21	-	-	-	1	-	-	-	200	-	-	-	-	-	-	-
LoR					1	0.01	-	1	1	0.01	1	1	1	0.01	-	1	0.01	0.3	0.01	0.001
Units					mg/kg	mmol/kg	---	mg/kg	mg/kg	mmol/kg	---	mg/kg	mg/kg	mmol/kg	---	mg/kg	mmol/kg	mmol/kg	mmol/kg	L
Location	Field ID	Date	Sample Type	Lab Report Number																
PW2	QC01	2/12/2019	Duplicate	EP1912834	39.5	0.67	1.68	244	<1	<0.01	<1	<1	1.8	0.03	0.04	28.5	0.72	0.4	0.31	0.03
PW2	QC02	3/12/2019	Triplicate	694415	-	-	-	750	-	-	-	-	-	-	-	52.0	-	-	-	-

Table 7: Groundwater Field Chemistry and Gauging Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

		Gauging Results			Survey Information			
		Groundwater Depth	Groundwater Elevation	Well Depth	TOC Elevation	Ground Elevation	Northing	Easting
LoR		0.001	0.001	0.001	0.001	0.001	-	-
Units		mBTC	mAHD	mBTC	mAHD	mAHD	m	m
Field ID	Date							
MW1	8/12/2019	3.110	318.520	8.05	321.630	NS	393468.198	6603697.631
MW2	9/12/2019	9.121	319.600	12.72	328.721	328.159	393032.812	6604265.693
MW3	8/12/2019	3.431	320.313	17.28	323.744	NS	392142.908	6603298.338
MW4	8/12/2019	6.889	319.832	18.09	326.721	NS	392141.081	6602757.226
MW5	9/12/2019	16.024	320.454	18.04	336.478	335.793	391147.211	6602731.246
BMH01	8/12/2019	9.912	320.574	12.25	330.486	330.076	392847.596	6604045.219
BMH02A	8/12/2019	5.313	318.505	9.47	323.818	323.078	393237.672	6603713.536
BMH04	8/12/2019	2.457	320.316	6.96	322.773	322.493	392351.075	6603293.624
BMH06	10/12/2019	1.617	318.426	6.11	320.043	319.693	392721.865	6602578.169
BMH08	8/12/2019	2.571	318.368	7.69	320.939	320.159	392157.839	6602265.960
BMH09	10/12/2019	1.328	318.806	3.18	320.134	319.851	392990.713	6603359.966
BMH11A	8/12/2019	2.020	317.951	4.58	319.971	319.261	393453.637	6602394.624
BMH12A	10/12/2019	2.082	317.835	4.59	319.917	319.367	393451.258	6602787.088

In relation to the above table:

"NS" indicated that the ground level was "not surveyed".

		Field Parameters								
		pH (field)	EC	DO	Redox	Temperature	Turbidity	Colour	Odour	Sheen
LoR		0.01	1	0.01	0.1	0.01	-	-	-	-
Units		pH units	µS/cm	mg/L	mV	°C	-	-	-	-
Field ID	Date									
MW1	8/12/2019	Not recorded - data lost								
MW2	9/12/2019	7.12	NR	2.32	-60.0	24.30	Highly turbid	Green-grey	No odour	No sheen
MW3	8/12/2019	Not recorded - data lost								
MW4	8/12/2019	Not recorded - data lost								
MW5	9/12/2019	6.75	NR	4.74	-6.3	22.20	Slightly turbid	Brown	No odour	No sheen
BMH01	8/12/2019	5.88	NR	3.04	61.8	30.00	Non-turbid	Colourless	No odour	No sheen
BMH02A	8/12/2019	6.56	NR	1.46	41.1	22.50	Non-turbid	Colourless	No odour	No sheen
BMH04	8/12/2019	7.22	NR	3.00	28.2	29.00	Non-turbid	Colourless	No odour	No sheen
BMH06	10/12/2019	6.79	NR	0.15	-47.8	29.50	Non-turbid	Colourless	No odour	No sheen
BMH08	8/12/2019	6.93	NR	1.15	-1.7	31.00	Non-turbid	Colourless	No odour	No sheen
BMH09	10/12/2019	6.62	NR	0.11	-164.0	31.20	Non-turbid	Colourless	No odour	No sheen
BMH11A	8/12/2019	6.71	NR	0.36	-52.5	29.80	Non-turbid	Colourless	No odour	No sheen
BMH12A	10/12/2019	6.91	NR	0.07	21.9	26.30	Non-turbid	Colourless	No odour	No sheen

In relation to the above table:

"NR" indicates that the EC was "not recorded" due to a malfunction of the water quality meter in the field.

Table 8: Groundwater Analytical Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

				Physical Parameters and Inorganics								Major Ions								
				pH (Lab)	Cyanide (Total)	Ammonia (as N)	Nitrate (as N)	Nitrite (as N)	Total Oxidised Nitrogen (as N)	Total Kjeldahl Nitrogen	Total Nitrogen (as N)	Calcium (filtered)	Chloride	Magnesium (filtered)	Potassium (filtered)	Sulfate (as SO4) (filtered)	Sodium (filtered)	Anions Total	Cations Total	Ionic Balance
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Freshwater				-	0.007	0.9	2.4	-	-	-	-	-	-	-	-	-	-	-		
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Marine				-	0.004	0.91	2.4	-	-	-	-	-	-	-	-	-	-	-		
LoR				0.01	0.004	0.01	0.01	0.01	0.01	0.1	0.1	1	1	1	1	1	0.01	0.01	0.01	
Units				pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%	
Field ID	Date	Sample Type	Lab Report Number																	
MW1	8/12/2019	Normal	EP1913212	7.18	<0.040	0.11	0.40	<0.01	0.40	<0.5	<0.5	926	60,000	3,860	310	5,580	39,600	1,810	2,090	7.26
MW2	9/12/2019	Normal	EP1913212	7.27	<0.040	0.11	2.55	0.05	2.60	0.8	3.4	694	36,100	2,760	115	4,130	23,200	1,110	1,270	6.99
MW3	8/12/2019	Normal	EP1913212	7.14	<0.040	0.18	5.97	0.10	6.07	1.5	7.6	559	48,300	4,040	153	5,240	30,800	1,470	1,700	7.24
MW4	8/12/2019	Normal	EP1913212	6.83	<0.040	276	39.70	0.99	40.70	264.0	305.0	865	60,000	7,180	345	18,400	42,100	2,080	2,470	8.64
MW5	9/12/2019	Normal	EP1913212	7.15	<0.040	0.22	1.57	0.07	1.64	0.6	2.2	340	21,200	2,170	134	3,990	14,500	696	830	8.73
BMH01	8/12/2019	Normal	EP1913213	5.76	<0.040	0.15	0.45	<0.01	0.45	0.4	0.8	1,210	47,400	3,510	104	5,320	32,300	1,450	1,760	9.64
BMH02A	8/12/2019	Normal	EP1913213	6.63	<0.040	1,100	17.10	0.31	17.40	1,140	1,160	694	65,600	10,800	247	26,300	49,700	2,400	3,090	12.60
BMH04	8/12/2019	Normal	EP1913213	7.12	<0.040	0.47	17.40	<0.01	17.40	4.0	21.4	1,140	57,000	4,870	104	4,750	39,500	1,710	2,180	12.10
BMH06	10/12/2019	Normal	EP1913247	6.53	<0.040	13.2	185.00	0.02	185.00	422.0	607.0	1,500	118,000	10,300	184	5,670	73,500	3,450	4,120	8.95
BMH08	8/12/2019	Normal	EP1913213	7.01	<0.040	0.15	13.80	<0.01	13.80	1.4	15.2	959	91,700	7,240	344	6,520	74,300	2,720	3,880	17.60
BMH09	10/12/2019	Normal	EP1913247	6.73	<0.040	1,870	19.50	0.58	20.10	2,060	2,080	663	71,600	14,500	450	42,700	57,700	2,910	3,750	12.60
BMH11A	8/12/2019	Normal	EP1913213	6.69	<0.040	51.60	31.70	0.02	31.70	52.9	84.6	1,290	116,000	8,340	418	10,500	90,500	3,490	4,700	14.70
BMH12A	10/12/2019	Normal	EP1913247	6.91	<0.040	216	22.60	5.33	27.90	237.0	265.0	809	105,000	8,070	255	12,400	66,700	3,220	3,610	5.73
QC07	8/12/2019	Duplicate	EP1913213	6.67	<0.040	1,060	16.90	0.22	17.10	1,120	1,140	692	66,200	10,800	256	27,400	50,600	2,440	3,130	12.40

Table 8: Groundwater Analytical Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

				Alkalinity					Metals													
				Bicarbonate Alkalinity (as CaCO ₃)	Carbonate Alkalinity (as CaCO ₃)	Hydroxide Alkalinity (as CaCO ₃)	Total Alkalinity (as CaCO ₃)	Hardness (as CaCO ₃)	Mercury (dissolved)	Arsenic Total	Cadmium Total	Chromium Trivalent	Chromium - Hexavalent	Chromium Total	Cobalt Total	Copper Total	Iron Total	Lead Total	Manganese Total	Nickel Total	Selenium Total	Zinc Total
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Freshwater				-	-	-	-	-	0.00006	24	-	3.3	-	-	1.4	1.4	-	3.4	1900	11	11	8
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Marine				-	-	-	-	-	0.0001	-	-	27	-	-	1	1.3	-	4.4	80	70	-	15
LoR				1	1	1	1	1	0.00004	1	0.1	1	1	1	1	1	10	50	1	1	1	1
Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Field ID	Date	Sample Type	Lab Report Number																			
MW1	8/12/2019	Normal	EP1913212	114	<1	<1	114	18,200	<0.00020	<1	1.3	3.4	<1	3.4	16	10	24	<1	10,600	52	4.1	34
MW2	9/12/2019	Normal	EP1913212	158	<1	<1	158	13,100	<0.00008	1.0	1.9	1.0	2	2.9	18	18	<5	<1	8,880	130	8.3	7.5
MW3	8/12/2019	Normal	EP1913212	121	<1	<1	121	18,000	<0.00008	1.2	2.1	1.6	<1	1.6	12	46	74	<1	3,090	120	6.8	12
MW4	8/12/2019	Normal	EP1913212	242	<1	<1	242	31,700	<0.00008	1.0	4.4	1.5	<1	1.5	68	41	130	<1	26,800	430	13.0	40
MW5	9/12/2019	Normal	EP1913212	770	<1	<1	770	9,780	<0.00004	<1	1.4	1.6	<1	1.6	42	9.7	78	<1	15,900	87	4.3	19
BMH01	8/12/2019	Normal	EP1913213	2	<1	<1	2	17,500	<0.00020	1.9	1.3	2.4	7	9.4	21	7.5	9.6	2.4	1,100	410	6.8	100
BMH02A	8/12/2019	Normal	EP1913213	194	<1	<1	194	46,200	<0.00020	2.1	5.5	<1	2	1.9	<1	3.8	48	<1	1,770	200	6.4	18
BMH04	8/12/2019	Normal	EP1913213	34	<1	<1	34	22,900	<0.00020	1.4	3.6	5.0	6	11.0	<1	50	<5	1.5	12	21	7.6	290
BMH06	10/12/2019	Normal	EP1913247	12	<1	<1	12	46,200	<0.00020	1.4	1.9	8.0	16	24.0	1.5	8.3	11	1.5	390	29	14.0	74
BMH08	8/12/2019	Normal	EP1913213	38	<1	<1	38	32,200	<0.00020	1.5	2.4	21.0	89	110	<1	31	65	5.9	9	15	14.0	120
BMH09	10/12/2019	Normal	EP1913247	139	<1	<1	139	61,400	<0.00020	2.4	5.6	1.0	1	1.0	19	3.1	9.2	1.0	69,700	4,090	4.2	69
BMH11A	8/12/2019	Normal	EP1913213	16	<1	<1	16	37,600	<0.00020	1.7	2.7	5.0	5	10.0	1	7.1	31	1.0	63	7.6	3.3	19
BMH12A	10/12/2019	Normal	EP1913247	44	<1	<1	44	35,200	<0.00020	1.5	5.6	1.0	2	1.5	17	2	5	1.0	4,110	990	2.9	22
QC07	8/12/2019	Duplicate	EP1913213	199	<1	<1	199	46,200	<0.00020	1.4	5.9	1.0	2	2.0	1	2.3	48	1.0	1,820	210	6.1	14

Table 9: Groundwater QA/ QC Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

				Physical Parameters and Inorganics							Major Ions									
				pH (Lab)	Cyanide (Total)	Ammonia (as N)	Nitrate (as N)	Nitrite (as N)	Total Oxidised Nitrogen (as N)	Total Kjeldahl Nitrogen	Total Nitrogen (as N)	Calcium (filtered)	Chloride	Magnesium (filtered)	Potassium (filtered)	Sulfate (as SO4) (filtered)	Sodium (filtered)	Anions Total	Cations Total	Ionic Balance
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Freshwater				-	0.007	0.9	2.4	-	-	-	-	-	-	-	-	-	-	-		
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Marine				-	0.004	0.91	2.4	-	-	-	-	-	-	-	-	-	-	-		
LoR				0.01	0.004	0.01	0.01	0.01	0.01	0.1	0.1	1	1	1	1	1	0.01	0.01	0.01	
Units				pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%	
Field ID	Date	Sample Type	Lab Report Number																	
QC03	2/12/2019	Rinsate	EP1912834	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
QC06	10/12/2019	Rinsate	EP1913213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
QC13	10/12/2019	Rinsate	EP1913213	5.89	<0.004	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<1	<1	<1	<1	<1	<0.01	<0.01	-	
QC14	10/12/2019	Rinsate	EP1913213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
QC15	10/12/2019	Rinsate	EP1913212	6.75	<0.004	0.02	6.61	<0.01	6.61	<0.5	6.6	<1	40	4	1	8	40	1.87	2.09	5.75
QC16	10/12/2019	Rinsate	EP1913212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
QC17	10/12/2019	Rinsate	EP1913247	5.78	<0.004	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<1	<1	<1	<1	<1	<0.01	<0.01	-	
QC18	10/12/2019	Rinsate	EP1913247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Table 9: Groundwater QA/ QC Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

	Alkalinity					Metals															
	Bicarbonate Alkalinity (as CaCO3)	Carbonate Alkalinity (as CaCO3)	Hydroxide Alkalinity (as CaCO3)	Total Alkalinity (as CaCO3)	Hardness (as CaCO3)	Arsenic Total	Cadmium Total	Chromium Total	Cobalt Total	Copper Total	Iron Total	Lead Total	Manganese Total	Mercury (dissolved)	Nickel Total	Selenium Total	Zinc Total				
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Freshwater	-	-	-	-	-	24	-	-	1.4	1.4	-	3.4	1900	0.00006	11	11	8				
ANZECC (2000) Maintenance of Ecosystems, 95% Protection, Marine	-	-	-	-	-	-	-	-	1	1.3	-	4.4	80	0.0001	70	-	15				
LoR	1	1	1	1	1	0.001	0.0001	0.001	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.005				
Units	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				
Field ID	Date	Sample Type	Lab Report Number																		
QC03	2/12/2019	Rinsate	EP1912834	-	-	-	-	-	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005	
QC06	10/12/2019	Rinsate	EP1913213	-	-	-	-	-	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005	
QC13	10/12/2019	Rinsate	EP1913213	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	<0.00004	-	-	-	-	
QC14	10/12/2019	Rinsate	EP1913213	-	-	-	-	-	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005	
QC15	10/12/2019	Rinsate	EP1913212	5	<1	<1	5	16	-	-	-	-	-	-	-	<0.00004	-	-	-	-	
QC16	10/12/2019	Rinsate	EP1913212	-	-	-	-	-	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005	
QC17	10/12/2019	Rinsate	EP1913247	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	
QC18	10/12/2019	Rinsate	EP1913247	-	-	-	-	-	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.0001	<0.001	<0.01	<0.005	

Table 10: Dust Analytical Results (Occupational Exposure)
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

					Inhalable Dust (weight)	Metals (by weight)											
						Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Zinc
NOHSC (1995) Time-Weighted Averages for Personal Exposure					-	50	-	500	-	1,000	-	150	-	-	1,000	-	-
LoR					10	10	5	5	5	5	10	10	5	0.5	5	10	5
Units					µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
Field ID	Date	Sample Type	Lab Report Number														
PVC2515042	5/12/2019	Normal	EN1908941	289	<10	<5	<5	<5	<5	11	<10	<5	<0.5	<5	<10	<5	
PVC2515043	9/12/2019	Normal	EN1908941	179	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	
PVC2515044	11/12/2019	Normal	EN1908941	207	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	
PVC2515045	10/12/2019	Normal	EN1908941	70	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	
PVC2515046	8/12/2019	Normal	EN1908941	134	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	

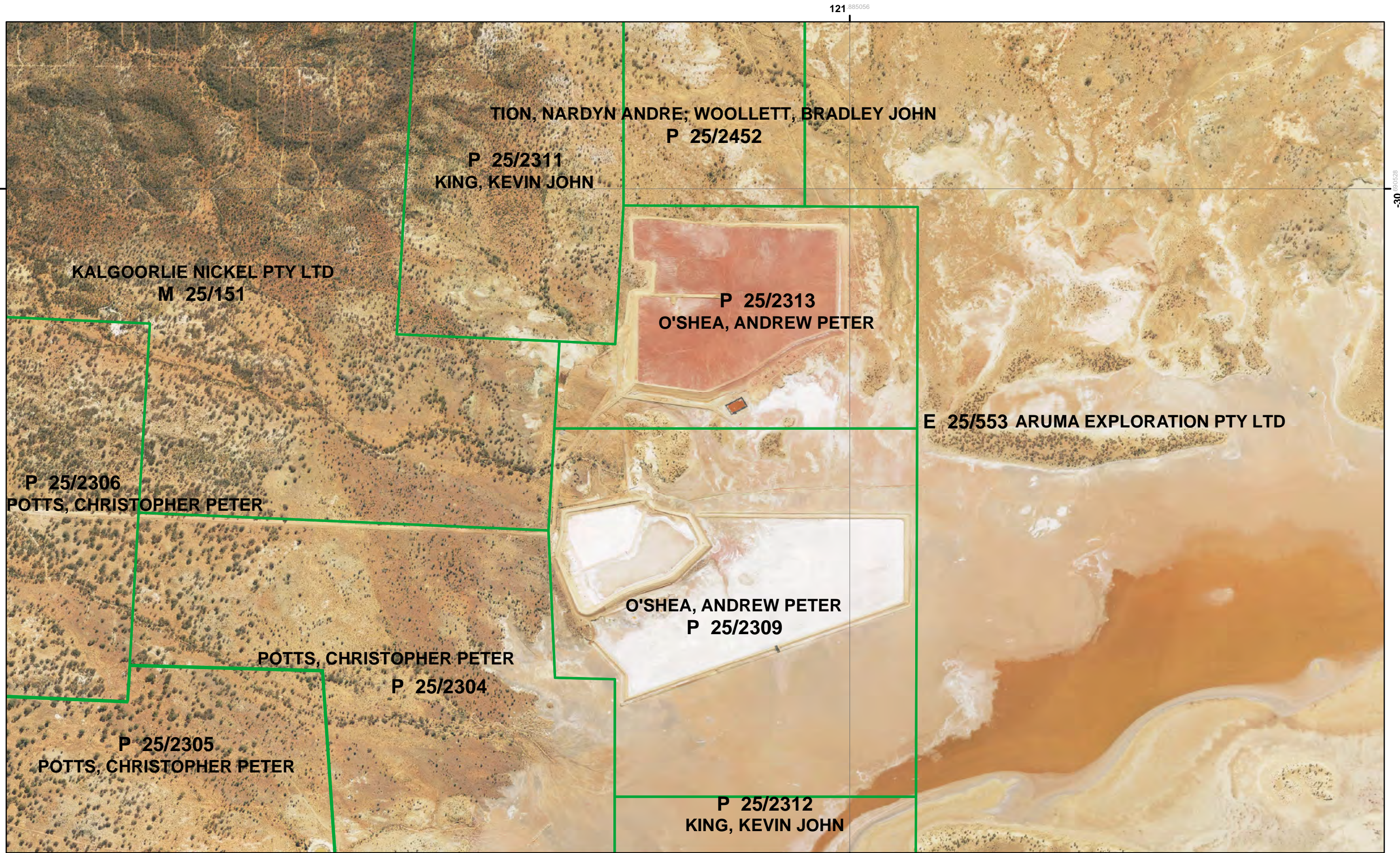
				Inhalable Dust (filter paper)	Metals (filter paper)												Volume
					Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	
NOHSC (1995) Time-Weighted Averages for Personal Exposure				-	50	-	500	-	1,000	-	150	-	-	1,000	-	-	-
LoR				10	10	5	5	5	5	10	10	5	0.5	5	10	5	1
Units				µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	µg/filter	L
Field ID	Date	Sample Type	Lab Report Number														
PVC2515042	5/12/2019	Normal	EN1908941	277	<10	<5	<5	<5	<5	11	<10	<5	<0.5	<5	<10	<5	958
PVC2515043	9/12/2019	Normal	EN1908941	198	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	1100
PVC2515044	11/12/2019	Normal	EN1908941	257	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	1240
PVC2515045	10/12/2019	Normal	EN1908941	76	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	1090
PVC2515046	8/12/2019	Normal	EN1908941	139	<10	<5	<5	<5	<5	<10	<10	<5	<0.5	<5	<10	<5	1030

Table 11: Dust Gauging Results
Detailed Site Investigation
Former 'Bulong' Mine Site, Bulong Road, Bulong, WA
Department of Mines, Industry Regulation and Safety

				Total Solids	Total Solids (mg)	Metals (by weight)										Volume
						Arsenic	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Selenium	Zinc	
DEC (2005) Maximum total deposited dust level				4	-	-	-	-	-	-	-	-	-	-	-	-
LoR				0.1	1	0.001	0.001	0.001	0.001	0.05	0.001	0.001	0.001	0.01	0.005	1
Units				g/m².month	mg	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mL
Field ID	Date	Sample Type	Lab Report Number													
DG2	24/02/2020	Normal	EN2001788	2.7	129	<0.001	0.005	0.00	0.01	0.58	0.00	0.03	0.02	<0.01	1.23	1100
DG3	24/02/2020	Normal	EN2001788	1.6	80	<0.001	0.00	<0.001	0.01	0.36	0.00	0.02	0.00	<0.01	1.36	1190
DG5	24/02/2020	Normal	EN2001788	2.1	105	<0.001	0.00	<0.001	0.01	0.34	0.00	0.03	0.00	<0.01	0.98	1380
DG6	24/02/2020	Normal	EN2001788	6.3	310	<0.001	0.02	0.01	0.02	2.55	0.02	0.07	0.06	<0.01	1.73	790



Appendix A: Tenement and Lease Information



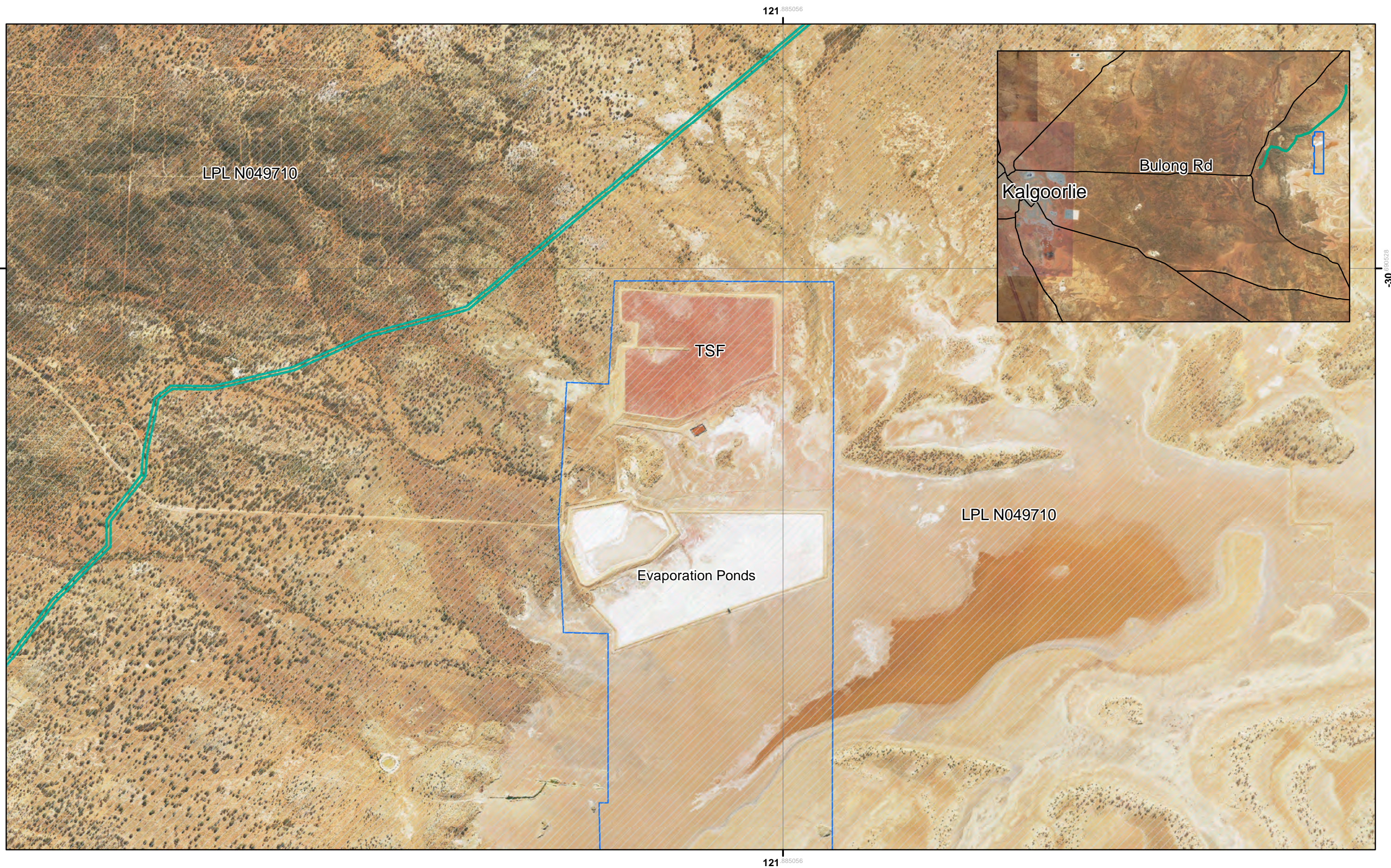
Bulong - Live Tenements

Legend
Surrounding tenements
 LIVE

Bulong DSI planning
Drawn: KH
Date: 16/05/2019




0 120 240 480 720 960 Meters





Bulong - Pastoral Lease and Road Reserve

Legend

-  Road Reserve - Bulong Road
-  Pastoral Lease
-  Dead Tenement M25/97

Bulong DSI planning
Drawn: KH
Date: 16/05/2019

0 0.2 0.4 0.8 1.2 1.6 Kilometers





Appendix B: Wind-Rose Data

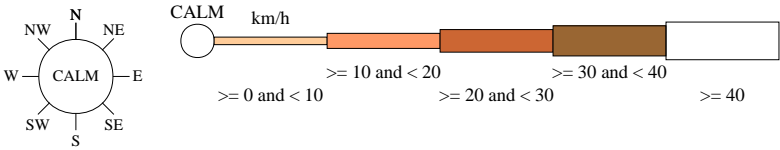
Rose of Wind direction versus Wind speed in km/h (22 Mar 1939 to 05 Apr 2016)

Custom times selected, refer to attached note for details

KALGOORLIE-BOULDER AIRPORT

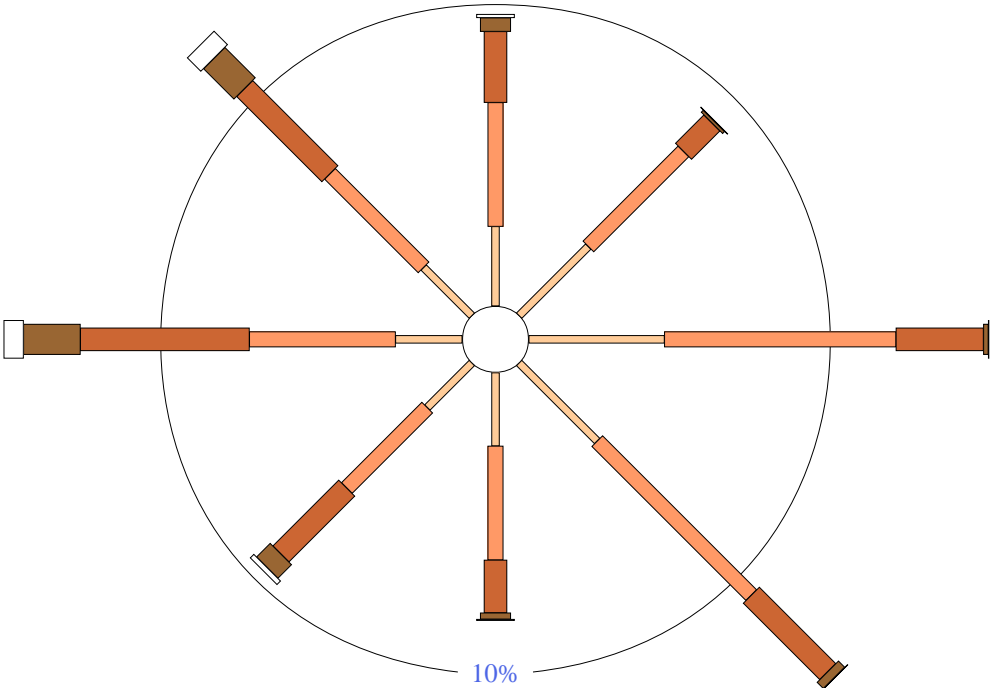
Site No: 012038 • Opened Feb 1939 • Still Open • Latitude: -30.7847° • Longitude: 121.4533° • Elevation 365.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
27999 Total Observations

Calm 5%



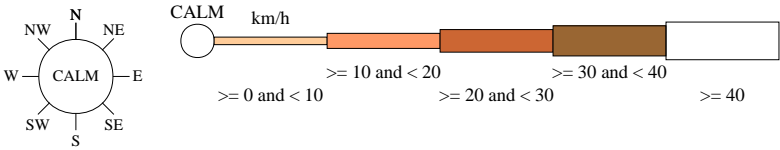
Rose of Wind direction versus Wind speed in km/h (22 Mar 1939 to 05 Apr 2016)

Custom times selected, refer to attached note for details

KALGOORLIE-BOULDER AIRPORT

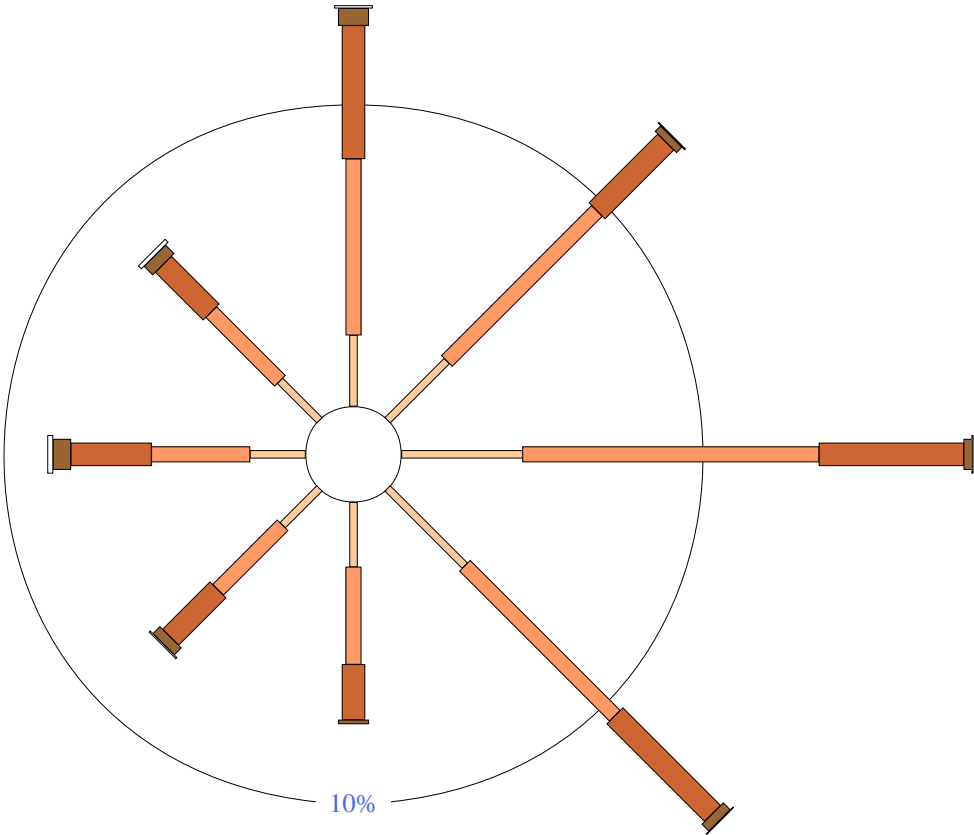
Site No: 012038 • Opened Feb 1939 • Still Open • Latitude: -30.7847° • Longitude: 121.4533° • Elevation 365.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
28060 Total Observations

Calm 8%





Appendix C: Record of XRF Training

CERTIFICATE OF COMPLETION

Is presented to

Matthew Hunt

I hereby certify that **Matthew** has successfully
completed all required elements of the

RADIATION THEORY & TRAINING IN THE USE OF PORTABLE XRF'S



Chris Brand—Managing Director
Portable XRF Services Pty Ltd

On **24 October 2019**

Certificate # 626



Radiation Health Qld Course Approval Number ED234 for Users License
EPA NSW Course Approved for Users License IA19
EPA SA License to Operate Ionising Radiation Apparatus (Section 31)
Radiological Council WA License for *Portable Mineral Analysers (X-ray)*
Department of Health NT Users License

CERTIFICATE OF COMPLETION

Is presented to

Brandon Henry

I hereby certify that **Brandon** has successfully
completed all required elements of the

RADIATION THEORY & TRAINING IN THE USE OF PORTABLE XRF'S



Chris Brand—Managing Director
Portable XRF Services Pty Ltd

On **25 November 2019**

Certificate # 639



Radiation Health Qld Course Approval Number ED234 for Users License
EPA NSW Course Approved for Users License IA19
EPA SA License to Operate Ionising Radiation Apparatus (Section 31)
Radiological Council WA License for *Portable Mineral Analysers (X-ray)*
Department of Health NT Users License



Appendix D: Calibration Certificates

Oil / Water Interface Meter

Instrument **Solinst Interface Meter (60M)**
Serial No. **312404**



Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity above 7.9v	✓	9.1v
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: _____ **Gaurav Kanwar**

Calibration date: **25-Nov-19**

Next calibration due: **23-May-20**

Calibration Certificate

AirMet Scientific P/L

7-11 Ceylon Street

Nunawading

VIC 3131, Australia

Tel: 03 8878 3300

Fax: 03 8878 3344

This document certifies that the instrument detailed has been calibrated to the parameters

Certificate Print Date: 8-Oct-2019

Call ID / Order No: 239639

Calibration Date: 07-Oct-2019

Job No / Pack No: S2396390001

Next Calibration Due: 7-Oct-2020

Customer: AMS - WA Rental-ID 399984

Serial No: 64513

Description: XR5000 Air Sampling Pump

Calibration Summary

Frequency: Yearly

Temp: 22°C

As Found: In Tolerance

Result: Pass

Humidity: 45%

Certificate: S2396390001

Desc	As Found		As Left (Cal Status)	
	Actual	Result	Actual	Result
1000 @ 40 "H ₂ O	981.0	Pass	981.0	Pass
2000 @ 50 "H ₂ O	1992.0	Pass	1992.0	Pass
4000 @ 20 "H ₂ O	3970.0	Pass	3970.0	Pass
5000 @ 10 "H ₂ O	4903.0	Pass	4903.0	Pass

Standard Used	
<u>Equip ID</u>	<u>Description</u>
RO811251M28	Magnahelic
115651	Defender

Completed By: Jason Hageman

Signed: 

Multi Parameter Water Meter

Instrument **YSI Quatro Pro Plus**
Serial No. **18J 104 340**



Item	Test	Pass	Comments
Battery	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
	Seal		
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. ORP in mV	✓	
	3. EC/Temp.	✓	
	4. D.O.	✓	
Alarms	Beeper	✓	
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Value	Standard		Instrument Reading
Temperature			Checked	24.2 °C
pH	pH 7	324988	Calibrated	7.01
pH	pH 4	324985	Calibrated	4.00
EC	Zero	Air	Checked	0.001 mS/cm
EC	2.76mS/cm	326685	Calibrated	2.76 mS/cm
ORP (mV)	240mV at 20°C	331622 / 330337	Calibrated	232.9 mV
DO Zero	Zero	Sodium sulphite sol	Calibrated	0 %
DO 100%	100%	Water saturated air	Calibrated	100.0 %

Calibrated by: Bianca McNair

Calibration date: **25-Nov-19**

Next calibration due **26-Dec-19**

Calibration Certificate

AirMet Scientific P/L

7-11 Ceylon Street

Nunawading

VIC 3131, Australia

Tel: 03 8878 3300

Fax: 03 8878 3344

This document certifies that the instrument detailed has been calibrated to the parameters

Certificate Print Date: 21-Oct-2019

Call ID / Order No: 239956

Calibration Date: 21-Oct-2019

Job No / Pack No: S2399560001

Next Calibration Due: 21-Oct-2020

Customer: AMS - WA Rental-ID 399984

Serial No: 71805

Description: XR5000 Air Sampling Pump

Calibration Summary

Frequency: Yearly

Temp: 22°C

As Found: In Tolerance

Result: Pass

Humidity: 45%

Certificate: S2399560001

<u>Desc</u>	<u>As Found</u>		<u>As Left (Cal Status)</u>	
	<u>Actual</u>	<u>Result</u>	<u>Actual</u>	<u>Result</u>
1000 @ 40 "H ₂ O	984.0	Pass	984.0	Pass
2000 @ 50 "H ₂ O	1980.0	Pass	1980.0	Pass
4000 @ 20 "H ₂ O	3987.0	Pass	3987.0	Pass
5000 @ 10 "H ₂ O	4977.0	Pass	4977.0	Pass

<u>Standard Used</u>		<u>Valid Until</u>	<u>Cert</u>
<u>Equip ID</u>	<u>Description</u>		
RO811251M28	Magnahelic	09/09/2020	
115651	Defender	01/04/2020	

Completed By: Eoin Doyle

Signed:











Appendix E: Field Forms

1. Field Plan

Friday, 29 November 2019 11:19 AM

File	Description
 04BulongSiteAccess	Site Access
 XRF transect - ...  P17302_00 4_F002_Si...	Heritage Site Avoidance Figures
 P17302_Transects	XRF Transects and PEM
 NEPM 2013 EIL and TE...	NEPM EIL Calculator
 EIL-calculati on-sprea...	EIL Calculator (Blair supplied)

Bulong Field Plan

Monday 2 Dec

7.10 am: Arrive Kalgoorlie (Virgin Flight VA1849)

Pickup Hire care (Hertz @ airport)

Pickup sample bottles from Toll West Kalgoorlie - Lot 8 Craig Rd, West Kalgoorlie WA 6430. Check on timeframes for getting samples delivered back to ALS
26 Rigali Way Wangara Western Australia 6065

Bunnings for large water containers (or source from Coles?)

9.30 am: drive to Bulong Site (call Kate H and let her know departure and expected arrival time on-site)

10.30 am: Arrive on-site.

Safety Toolbox meeting

Site Orientation (Drive access tracks together with Kate – plan how sites will be accessed – note presence of Heritage areas (access on foot only))

1.30 pm: Sediment Sampling (refer to SAQP)

Sediment samples to be collected – 7 bags (attached sample container email)

Collect surface water (if any nearby (within reason) each sediment sample location)

Samples to be couriered to Perth ASAP (don't wait and batch with others).

Dust Gauge Installation (if time permits)

4-5.00 pm: leave site

Dinner with drilling crew (if possible and ok with fatigue etc)

Tuesday 3 Dec

6.30 – 7am: Depart for site

7.30-8am: On-site safety briefing and orientation with drillers

Drilling Works: MH to install bores with drillers

Dust Gauges: BH to complete dust gauge installation where necessary

XRF Transects: background samples to be analysed (outside of site boundary, on track (on way to site). See SAQP and separate (attached) instructions on XRF.

Weds 4 Dec

As per Tuesday

Thurs – Sat

XRF Transects (both staff to undertake)

Sunday 8 Dec

GME (start with existing wells)

XRF TRANSECT NOTES

Background Samples: along road on way in. Use ppm value to calculate site-specific EIL (discuss with PM where possible).

Collect sample for PSD analysis (blue label colour – 2x 500 mL plastic bags)

Transects: Sample every 50m

Three readings on surface soil (take average)

Where reading exceeds EIL – use hand trowel to measure soil at 0.3m (three readings – take average).

Mark sample location with survey pin.

Extend transect to locations where EIL is not exceeded; or where it appears that surface impact is defined (contact PM if transects are too long!)

Travel back along transect and collect soil samples at 10% of locations (1 sample at lowest reading; bias others to the highest readings).

Soil jar requirements: (orange label – 2x 150 mL jars).

For the COC: all samples for Suite 1: Total Metals Suite 2: Redox, pH, Hexavalent Cr, Exchangeable Cations, Cyanide.

Highest sample for each transect for DI leach and metals.

PSD samples - ensure collected at frequency to cover changes in soil texture





GROUNDWATER SAMPLING NOTES

13 existing wells and all newly installed.

Use NMI just for the following metal analytes: Se, Co, Mn, Fe, As, Cd (total and VI), Cr, Cu, Pb, Ni, Zn (See separate NMI bottle order quote / COC in field notes folder).

Use ALS for the remainder (see ALS bottle order email)





1a. Proposal and Other Documents

Proposal/Variation File	Proposal/Variation Title
 P17302_001_PRP_Re...	Proposal
 17302_004_RPT_Rev2	SAQP
 SLR 2018	Historical PSI of the site - (SLR, 2018)
 Soilwater 2017	Historical PSI of the Tailings Storage Facility - (SWG, 2017)

1b. Laboratory Information

Friday, 29 November 2019





11:07 AM

File	Description	
 FW_ _EXTERN...	Description of the following: <ul style="list-style-type: none">- Location for pickup of lab bottles- Sample Container requirements and volumes	<u>Sediment Sampling</u> Qa
 EP-382-19 V2 Senver...	ALS Quote	
 M17302_C OC	COC (Blank)	
 NMI_CoC		

1c. Equipment Suppliers

Friday, 29 November 2019

11:20 AM

File	Description
 RE_ Bulong DSI - Dust...	PEM - Airmet
 RE_ Bulong DSI - Dust...	Dust Deposition Gauge - ECO Environmental
 RE_ Bulong DSI- Satell...	Satellite Phone
 XRF Hire	XRF

2. Health, Safety and Environment Plan



Project Name:

Project Number:




HSEP Induction Record

I have understood the HSEP induction completed by Senversa, been informed of the site safety requirements, have discussed the overall scope of work tasks and have been given the opportunity to discuss and understand the residual risk levels and proposed risk control measures outlined in the SWMS from both Senversa and my company to perform the tasks outlined. By signing below, I agree to abide by Senversa's HSEP requirements, as instructed.

Employee Name (Please print)	Employee Signature	Relevant Card Numbers (PRWC, Level 1, MSIC, White Card)	Company	Date	Phone Number
			Senversa		

File	HSEP and SWMS	Date	Extension	Size	Note
Xlsx and PDF	HSEP				
Xlsx and PDF	SWMS				

3. GME - Bulong DSI

File	Description
 GW Audit and Purge...	Purge Calculator
 SEN-TECH-0 40a_Rev2...	GW Sampling Forms - NOTE that you must save to desktop then upload to job folder.
 SEN-TECH-0 11F_Rev2...	Well Development

GW Gauging Data

Well ID	Date	SWL	TD	Stickup
MW1	10/12	3.11	8.05	0.61
MW2	9/12	9.121	12.72	0.562
MW3	10/12	3.431	17.28	0.661
MW4	10/12	6.889	18.09	0.652
MW5	9/12	16.024	18.04	0.685
BMH01	8/12	9.912	12.25	0.41
BMH02A	8/12	5.313	9.47	0.74
BMH04	8/12	2.457	6.96	0.28
BMH06	10/12	1.617	6.11	0.39
BMH08	8/12	2.571	7.69	0.78
BMH09	10/12	1.328	3.18	0.28
BMH11A	8/12	2.02	4.58	0.71
BMH12A	10/12	2.082	4.59	0.55

Well Development

3/12

09:30AM

MW1 - Started development.

Water Conditions: HT, grey brown, no odour/sheen.

10:00

Purged approx 20L from well. Grey brown water became less brown grey. MT after 15L. Potable water added to well to disturb water column more effectively.

4/12

15:30PM

MW4 - Started development.

Water Conditions: 20L - HT, brown, no odour/sheen.

First 35L - HT, brown, no odour/sheen.

35L to 40L - MT to LT, brown, no odour/sheen.

16:05PM

Successfully purged 40L of groundwater from MW4.

Potable water added to well to disturb water column more effectively and not clog the well development device.

4/12

16:30PM

MW2 - Started development. SWL: 9.123 m BTOC, TD: 12.57

Water Conditions: 0 - 40L: HT, grey green brown, no odour/sheen.

50L of potable water added to well to disturb water column more effectively and not clog the well development device. Significant silt present at bottom of well.

17:30

Purged 60L of water.

5/12

09:45AM

MW3 - Started development.

Water conditions: 0 -25L, HT, grey brown, no odour/sheen.

25-40L, MT, grey brown, no odour/sheen.

30L of potable water added to well to disturb water column and not clog the well development device. Significant silt present at bottom of well.

10:30AM

Purged 40L of water.

5/12

13:15PM

MW5 - Unable to develop as no water present in borehole.

4. QAQC Register

Project No	P17302	Project	Bulong DSI
Location	Bulong Abandoned Mine	Client	WA Govt.







QC Sample ID	Primary Sample ID	Date	Type	Sampled By	Matrix	Rinsate/Trip Blank Batch ID	Comments
QC01	PW2	2/12/2019	Duplicate	BH	Sed	-	-
QC02	PW2	2/12/2019	Triplicate	BH	Sed	-	-
QC03	Rinsate	2/12/2019	Rinsate	MH	W		Off nitrile glove.
QC04	MW1_0.05-0.15	3/12/2019	Duplicate	MH	Soil	-	-
QC05	MW1_0.05-0.15	3/12/2019	Triplicate	MH	Soil	-	-
QC06	Rinsate	3/12/2019	Rinsate	MH	Soil	-	Off hand auger.
QC07	BMH02A	8/12/2019	Duplicate	MH	Water	-	-
QC08	BMH02A	8/12/2019	Triplicate	MH	Water	-	-
QC09	T4-3	8/12/2019	Duplicate	BH	Soil	-	-
QC10	T4-3	8/12/2019	Triplicate	BH	Soil	-	-
QC11	T4-3_0.3	8/12/2019	Duplicate	BH	Soil	-	-
QC12	T4-3_0.3	8/12/2019	Triplicate	BH	Soil	-	-
QC13	Rinsate	8/12/2019	Rinsate	MH	Water	-	Off pump.
QC14	Rinsate	8/12/2019	Rinsate	BH	Water	-	Off HA.
QC15	Rinsate	9/12/2019	Rinsate	MH	Water	-	Off pump.
QC16	Rinsate	9/12/2019	Rinsate	MH	Water	-	Off HA.
QC17	Rinsate	10/12/2019	Rinsate	MH	Water	-	Off pump.
QC18	Rinsate	10/12/2019	Rinsate	MH	Water	-	Off HA
QC19	T6-8	11/12/2019	Duplicate	BH	Soil	-	-
QC20	T6-8	11/12/2019	Triplicate	BH	Soil	-	-
QC21	Rinsate	11/12/2019	Rinsate	MH	Water	-	Off HA.A

5. Contact List

Company	Job Component	Contact	Address	Phone No
		Kate Hryczyszyn		0450943 463

6. NEPM

Friday, 29 November 2019 11:51 AM

File	Volume & Description
 Volume 2 - Sch B1 - I...	Investigation Levels
 Volume 3 - Sch B2 - Si...	Site Characterisation
 Volume 5 - Sch B4 - H...	Health RA Methodology
 Volume 6 - Sch B5a - ...	Ecological RA
 Volume 7 - Sch B5b - ...	Methodology for EILs - Info on site specific EILs
 Volume 8 - Sch B5c - ...	EILs for metals

Contractor SWMS/JSEA

File	Name	Date	Extension	Size	Note

Borelogs/MIP/Historic Sample Logs

File	Name	Date	Extension	Size	Note

Stakeholder Information

File	Name	Date	Extension	Size	Note

Client specified controls

Communication plans











DBYD Searches












DBYD - XXXXXX - Template












Authority Name	Issues (orange are potentially affected assets)
APA Group Transmission (VIC)	No Assets within work area
Citipower - House	Citipower assets on site. Created a site visit request 24/07/2014
City of Melbourne	No City of Melbourne assets on site. City of Melbourne assets north and south of works area.
Multinet Gas Southern Region (Comdain Infrastructure)	No Assets within work area
Optus and/or Uecomm, Vic	No Assets within work area
South East Water Corporation	No Assets within work area
Telstra VICTAS	No Assets within work area
Port of Melbourne Corp	Low voltage, unknown and abandoned assets potentially located within the works area












DBYD Files









SOPS - List last updated on 9/8/19


File	Name	Date	Extension	Size	Note
 ZSEN-TECH-006bF_fie...	ZSEN-TECH-006bF_field_well construction_log.pdf	2017-04-13 10:28	.pdf	98,067	
 ZSEN-TECH-006aF_fie...	ZSEN-TECH-006aF_field_borelog.pdf	2017-04-13 10:31	.pdf	95,620	
 Volume Air Measure...	Volume Air Measurement Chain of Custody Record.xlsx	2018-09-19 08:44	.xlsx	49,876	
 SEN-TECH-052b Rev 0...	SEN-TECH-052b Rev 0 CL Soil Description Notes Abbreviations.pdf	2018-10-23 16:40	.pdf	185,822	
 SEN-TECH-052a Rev 0...	SEN-TECH-052a Rev 0 GEOTECH Soil Description Notes Abbreviations.pdf	2018-10-26 08:28	.pdf	203,306	
 SEN-TECH-051 Rev 0 ...	SEN-TECH-051 Rev 0 Rock Description Notes Abbreviations.pdf	2018-10-26 08:46	.pdf	128,098	
 SEN-TECH-50b Ambie...	SEN-TECH-50b Ambient Air Sampling logsheet.pdf	2019-04-12 11:05	.pdf	45,387	
 SEN-TECH-050a_Indo...	SEN-TECH-050a_Indoor Air Sampling logsheet.pdf	2017-04-13 10:31	.pdf	84,665	
 SEN-TECH-050_Rev0_...	SEN-TECH-050_Rev0_Amarok Booking Request.oft	2018-10-12 14:22	.oft	46,592	
 SEN-TECH-049_DRAF...	SEN-TECH-049_DRAFT_SW_Sampling.xltx	2016-05-17 14:52	.xltx	157,620	

 SEN-TECH-048_DRAFT...	SEN-TECH-048_DRAFT_GW Log.dotx	2017-04-13 11:44	.dotx	84,433	
 SEN-TECH-047_DRAFT...	SEN-TECH-047_DRAFT_Slug Test Log.xltx	2016-05-17 14:51	.xltx	38,962	
 SEN-TECH-046F_Bldg...	SEN-TECH-046F_Bldg_VI_inspection_record.pdf	2017-04-13 10:30	.pdf	105,256	
 SEN-TECH-045_Rev1_...	SEN-TECH-045_Rev1_Soil_Vapour_Sampling.pdf	2017-04-13 10:31	.pdf	263,955	
 SEN-TECH-044_Rev0_...	SEN-TECH-044_Rev0_Soil_Sampling.pdf	2017-04-13 10:30	.pdf	337,361	
 SEN-TECH-043S_LFG_...	SEN-TECH-043S_LFG_Monitoring.pdf	2017-04-13 10:29	.pdf	885,074	
 SEN-TECH-042_Monit...	SEN-TECH-042_Monitoring Well Drilling Design and Installation_SOP.pdf	2017-08-04 17:57	.pdf	1,009,677	
 SEN-TECH-041P_COC ...	SEN-TECH-041P_COC Protocol_DRAFT.pdf	2015-06-25 12:21	.pdf	357,605	
 SEN-TECH-040S_GW_...	SEN-TECH-040S_GW_Sampling.pdf	2017-04-13 10:29	.pdf	436,118	
 SEN-TECH-040a_Rev2...	SEN-TECH-040a_Rev2_Field and Groundwater Sampling Form.xlsm	2018-10-25 14:48	.xlsm	655,498	
 SEN-TECH-040a_Rev1...	SEN-TECH-040a_Rev1_Field and Groundwater Sampling Form.xltn	2017-03-14 18:20	.xltn	663,747	

 SEN-TECH-039F_Land...	SEN-TECH-039F_Landfill Gas Building Monitoring.dotx	2017-04-13 11:37	.dotx	84,142	
 SEN-TECH-038F_Land...	SEN-TECH-038F_Landfill Gas Weather Monitoring.dotx	2017-04-13 11:37	.dotx	83,755	
 SEN-TECH-037F_Land...	SEN-TECH-037F_Landfill Gas Surface Emissions Monitoring.dotx	2017-04-13 11:36	.dotx	83,373	
 SEN-TECH-036F_Land...	SEN-TECH-036F_Landfill Gas Subsurface Services Monitoring.dotx	2017-04-13 11:34	.dotx	85,546	
 SEN-TECH-035F_Land...	SEN-TECH-035F_Landfill Gas Flux Testing.dotx	2017-04-13 11:32	.dotx	84,119	
 SEN-TECH-034S_Loggi...	SEN-TECH-034S_Logging.pdf	2017-04-13 10:25	.pdf	338,775	
 SEN-TECH-033F_field ...	SEN-TECH-033F_field room checklist.pdf	2017-04-13 10:26	.pdf	94,111	
 SEN-TECH-031F_landf...	SEN-TECH-031F_landfill gas bore monitoring record.pdf	2017-04-13 10:26	.pdf	90,961	
 SEN-TECH-030F_field ...	SEN-TECH-030F_field box checklist.pdf	2017-04-13 10:25	.pdf	58,217	
 SEN-TECH-023F_Rev2...	SEN-TECH-023F_Rev2_Soil_Gas_Sampling.xlsx	2019-05-24 14:10	.xlsx	984,343	
 SEN-TECH-022F_trenc...	SEN-TECH-022F_trench log.pdf	2017-04-13 10:25	.pdf	83,102	

 SEN-TECH-0 21F_stock...	SEN-TECH-021F_stockpile_log.pdf	2017-04-13 10:23	.pdf	84,492	
 SEN-TECH-0 20F_well ...	SEN-TECH-020F_well bail-down test form.pdf	2017-04-13 10:24	.pdf	98,028	
 SEN-TECH-0 19F_qaqc...	SEN-TECH-019F_qaqc sample register.pdf	2017-04-13 10:24	.pdf	87,276	
 SEN-TECH-0 18F_coc	SEN-TECH-018F_coc.xltm	2019-04-02 12:07	.xltm	94,837	
 SEN-TECH-0 17F_wate...	SEN-TECH-017F_water quality meter calibration form.pdf	2017-04-13 10:23	.pdf	87,141	
 SEN-TECH-0 16F_LEL ...	SEN-TECH-016F_LEL meter calibration form.pdf	2017-04-13 10:23	.pdf	85,631	
 SEN-TECH-0 15F_Rev1...	SEN-TECH-015F_Rev1_PID calibration log.pdf	2017-04-13 10:23	.pdf	86,207	
 SEN-TECH-0 14F_grou...	SEN-TECH-014F_groundwater sampling record.pdf	2013-05-22 14:16	.pdf	98,793	
 SEN-TECH-0 13F_grou...	SEN-TECH-013F_groundwater gauging record.pdf	2017-04-10 17:24	.pdf	90,707	
 SEN-TECH-0 12F_well ...	SEN-TECH-012F_well condition checklist.pdf	2012-08-17 15:56	.pdf	92,608	
 SEN-TECH-0 11F_Rev1...	SEN-TECH-011F_Rev1_well development record.xltx	2019-05-29 13:11	.xltx	90,883	

 SEN-TECH-010F_mate...	SEN-TECH-010F_materials tracking record_NSW.pdf	2015-12-11 11:30	.pdf	104,887	
 SEN-TECH-010F_mate...	SEN-TECH-010F_materials tracking record_landscape.pdf	2017-04-10 17:24	.pdf	87,600	
 SEN-TECH-009cF_vali...	SEN-TECH-009cF_validation_log_UST.pdf	2019-05-24 15:30	.pdf	255,814	
 SEN-TECH-009bF_vali...	SEN-TECH-009bF_validation_log_grid.pdf	2017-04-10 17:24	.pdf	91,115	
 SEN-TECH-009aF_vali...	SEN-TECH-009aF_validation_log.pdf	2017-04-10 17:24	.pdf	81,540	
 SEN-TECH-008F_bore...	SEN-TECH-008F_borehole register.pdf	2017-04-10 17:23	.pdf	82,974	
 SEN-TECH-007F_Soil_...	SEN-TECH-007F_Soil_Chart_Nov18_Rev0.pdf	2018-12-12 10:41	.pdf	372,375	
 SEN-TECH-006bF_fiel...	SEN-TECH-006bF_field_well construction_log.pdf	2012-08-17 11:10	.pdf	96,713	
 SEN-TECH-006aG_Rev...	SEN-TECH-006aG_Rev0_geotech_borelog.pdf	2018-12-21 12:02	.pdf	61,974	
 SEN-TECH-006aCL_Re...	SEN-TECH-006aCL_Rev2_contaminated land_borelog.pdf	2018-12-21 12:02	.pdf	49,918	
 SEN-TECH-005P_sam...	SEN-TECH-005P_sample nomenclature.pdf	2019-02-05 10:10	.pdf	127,692	

 SEN-TECH-0 03F_site_...	SEN-TECH-003F_site_inspection_record - Copy.pdf	2017-04-10 17:23	.pdf	113,716	
 SEN-TECH-0 02F_field ...	SEN-TECH-002F_field equipment checklist.pdf	2017-04-10 17:23	.pdf	98,289	
 SEN-TECH-0 01F_daily...	SEN-TECH-001F_daily_field_sheet.pdf	2017-04-10 17:23	.pdf	79,737	

Bore Construction Licenses

File	Name	Date	Extension	Size	Note

Site Inductions

File	Name	Date	Extension	Size	Note
					Expires: XX XX XXXX
					Expires: XX XX XXXX
					Expires: XX XX XXXX
					Expires: XX XX XXXX

H&S Inspection Forms

H&S Inspection Form



XX-XX-XXXX - Template

Project Number	
Site	
PD	
PM	
FM/Site personnel	
Subcontractors / Other	
Person conducting the Inspection	
Date and Time of Inspection	
Task/s being observed	
Weather / Conditions	
Other Comments	

Notes / Instructions

- Record the results of inspections on Inspection worksheets.
- Describe the hazard/risk items identified during observation of works.
- Outline the preventative/corrective action (Actions).
- Upon return to office, conduct review with the HSEQ Manager and obtain sign-off.
- Log any observations in the Incident Database and create Corrective Actions, where applicable. Include a copy of the completed Inspection Worksheet as an attachment.
- File the completed Worksheet in the project file/folder.

Item	Observed	At Risk	Comment
ADMINISTRATIVE CONTROLS			
HSEP is available at the site and has been signed by the Project Manager	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
SWMS is appropriate for the task and has been acknowledged by the Senversa Field Manager on the Daily Toolbox Form	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Personnel trained/competent	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Communication plan is understood by field staff and there is evidence it is being followed.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Relevant pre-start equipment checks have been conducted by Senversa/subcontractor staff	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
All personnel associated with the works, including visitors, have been inducted and signed the induction register	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Field notes and Senversa field forms (logs, gauging records, etc) are being generate and are legible	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Daily Toolbox meetings are being held, have been attended by all, and are recorded in the HSEP	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Any relevant permits (e.g. road opening) and traffic management plans are in place	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
PPE	Observed	At Risk	
Adequate (condition and currency), being worn correctly (by Senversa and subcontractors) and is appropriate for the tasks being conducted	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
WORK ENVIRONMENT	Observed	At Risk	
Senversa field vehicle is fit for purpose	<input type="checkbox"/> Yes	<input type="checkbox"/> Yes	

and any equipment is securely stowed	<input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> No	
Waste Management – Bins / drums / IBCs are securely located, labelled, and waste is being disposed and documented in accordance with regulatory requirements	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Slip and trip hazards have been identified and appropriate controls are in place	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
The work area is clearly defined and takes into account on-site and off-site traffic and other on and off-site activities	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Excavation management – Shoring /exclusion zones/ stability. Stockpile management has been considered to minimise dust, odour, erosion, and stormwater runoff	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Housekeeping is being maintained at a suitable standard (i.e. work and storage areas are tidy)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Temperature / lighting / electrical / noise / dust /odour / vibration hazards	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
MANUAL HANDLING	Observed	At Risk	
Risks associated with lifting, pulling and pushing have been considered and appropriate action taken	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Pinch points , sharp edges and rotating parts have been identified and controlled	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Site conditions, travel or task has increased potential to affect workers fitness for work	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
CHEMICAL EXPOSURE	Observed	At Risk	
Are SDSs required/current	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Field personnel have an awareness of the monitoring requirements for the task and any associated actions for exceedances	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Potential exposure to chemicals is being managed in accordance with the HSEP/SWMS requirements	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
TOOLS & EQUIPMENT (Senversa and Subcontractor)	Observed	At Risk	
Fit for Task / Safe Condition	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Appropriately Stored / Guarded	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Drill Rig / Heavy Machinery induction has been completed by operator for Senversa personnel	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Fire Safety Equipment – Available and in service date	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
SUBCONTRACTORS	Observed	At Risk	
Subcontractor is on the list of Senversa approved suppliers or has been engaged using the Project Subcontractor Evaluation process?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Subcontractors have SWMSs to control the hazards associated with their work and they have been implemented	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Equipment is adequately maintained (e.g. maintenance logs available, pre-start checks on equipment etc.)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Subcontractors have attended tool box meetings and their participation has been recorded in the plan	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
All subcontractors at the site meet the training and/or license requirements for the project	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
All subcontractors at the site are wearing the minimum PPE	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Subcontractor personnel are aware of the emergency response requirements	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	
HIGH RISK TASKS	Observed	At Risk	
Any high risk tasks involved and are they being effectively managed in accordance with SWMSs? o Confined space entry o Heights / Ladders / Climbing o Working with asbestos	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No	

OBSERVATIONS AND CORRECTIVE ACTIONS				
Observations / Risks / Hazards / Comment	Action(s) require	Due Timeframe	Responsibility	Date Completed

Please forward worksheets to the HSEQ Manager once inspection form has been completed.
All Actions satisfactorily identified?

☐ Yes
☐ No

Signature:

Date:

HSEQ Manager
SEN-HSE-008a-Rev3_H&S Inspection Form

Field Briefing

To be completed by Field Manager/PM and provided to Field Staff before commencement of site work.

Project Name:				Job Number:	
Client:				Site Location/Map:	
Field Manager:		PM/PD:		Date:	
Item No.	Requirement				Complete
1)	<u>Background</u> <ul style="list-style-type: none"> • Site information. • Former site use, contaminants of concern. • Other site features/potential sources of contamination should you be looking for...think outside the box. 				
2)	<u>Objective</u> <ul style="list-style-type: none"> • What are we trying to achieve, e.g. investigate distribution of chlorinated solvent contamination in groundwater, characterisation of all stockpiles on site 				
3)	<u>Reference Documents</u> <ul style="list-style-type: none"> <input type="checkbox"/> Proposal, previous site report/logs, aerial photos: hard copy / link <input type="checkbox"/> Collector app: hard copy / link <input type="checkbox"/> Site Map: hard copy / link 		See OneNote: PRP Site Map		
4)	<u>Work Scope:</u> <i>Example</i> <ul style="list-style-type: none"> • Service Clearance, all location • Push tube 3 soil bores to 5 m bgl • Collect soil samples for every 1m, or lithological changes. 				
5)	<u>Health and Safety</u> HSEP link: <ul style="list-style-type: none"> • Key site-specific changes/requirements to HSEP / SMWS • Key COPC • Nearby sensitive receptors? e.g. are noise, vapours or dust going to impact anyone? 		See page in OneNote		
			<u>Communication Plan</u> Contact PM/PD upon arrival and departure from site each day <input type="checkbox"/> Additional Requirements: e.g. Due to remoteness of site, contact PM every two hours		
6)	<u>Work Permits</u> <ul style="list-style-type: none"> <input type="checkbox"/> Site specific work permits <input type="checkbox"/> Well permits/BCLs <input type="checkbox"/> Traffic management, construction card, rail safety/training card 				
7)	<u>Site/Client Contact</u>				
8)	<u>Access</u> <ul style="list-style-type: none"> <input type="checkbox"/> Site Access, how, when, who <input type="checkbox"/> Contacts for access 				
9)	<u>Inductions</u> <ul style="list-style-type: none"> <input type="checkbox"/> Client Where: (e.g. site, online@) <input type="checkbox"/> Site Where: (e.g. site office, weighbridge) When: (e.g. upon arrival at site, Tuesday mornings) <input type="checkbox"/> Daily sign in required 				
10)	<u>Contractors</u> Senversa Approved Subcontractors		Non Approved Suppliers/Others*		
	<input type="checkbox"/> Service clearance: Choose company.				
	<input type="checkbox"/> Drilling: Choose company				
	<input type="checkbox"/> Equipment hire: Choose company.				
	<input type="checkbox"/> Traffic Management: Choose company.				
	<input type="checkbox"/> Waste disposal: Choose company				
	<input type="checkbox"/> Surveyor: Choose company				
	<input type="checkbox"/> Primary Lab: Choose company				
	<input type="checkbox"/> Secondary Lab: Choose company				
11)	<u>Methodology</u> <ul style="list-style-type: none"> <input type="checkbox"/> Soil: Choose a method. <input type="checkbox"/> Groundwater well installation: Choose a method. <input type="checkbox"/> Groundwater sampling: Choose a method. <input type="checkbox"/> Soil Vapour: Choose a method. <input type="checkbox"/> Variation from SOPs: specify <input type="checkbox"/> Potential conditions that may affect SOPs (e.g. well goes dry, combined geotech drilling) 				
12)	<u>Equipment / Consumables</u> <ul style="list-style-type: none"> <input type="checkbox"/> Standard kit: <input type="checkbox"/> Additional equipment: e.g. PID, fire extinguisher, etc 				
13)	<u>Sampling</u> <ul style="list-style-type: none"> • Sampling frequency: 0.2 m bgl, 0.5 m bgl, 1.0 m bgl and every metre thereafter/ change of strata/ evidence of staining 				
	<u>Nomenclature</u>		Schedule of Analysis		
	Primary samples:				
	Duplicate samples:				
	TriPLICATE samples:				

	Rinsates:			
	Trip Blanks:			
14)	<u>QA Forms / Requirements</u> <input type="checkbox"/> Fill out QC register <input type="checkbox"/> Frequency (e.g. 1 rinsate and trip blank per day, two sets of soil QAQC samples)			
15)	<u>Waste Disposal</u> <input type="checkbox"/> Soil: Choose a method of disposal <input type="checkbox"/> Water: Choose a method of disposal	Arrangements: <i>e.g. who is bringing drums to site? how many? when? labels provided? Who is the waste disposal contractor? If left on site, mark up location of figure.</i>		
16)	<u>Transport</u> <input type="checkbox"/> Type: Choose vehicle type. <input type="checkbox"/> Hire vehicle: Choose company.			
17)	<u>Budget / Expenses</u> Fieldwork start date: 17/07/2018 Work hours: Field work budget: Travel allowance: <i>Note: Call PM if field work is going slowly or will definitely surpass the allocated/budgeted time.</i>			
18)	<u>Deliverables</u> <ul style="list-style-type: none"> • Complete field documents, including HSE docs, and save to network • Deliverable: <i>Specify Report Date</i> Click to enter a date. 			

*All safety sensitive subcontractors in this column that are engaged by Senversa must have a Project Evaluation completed prior to commencement

P17302 GME Rev3

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:	P17302					Well ID:	MW02		Gatic Type (old, new):	New				
Project Name:	Abandoned Mine DSI					Well Construction (flush, stickup):	Stickup		Well Diameter (mm):	50				
Client:	WA DWIRS					Surface Casing Height (m bgl):	0.562		Key Type (e.g. 8mm gatic):	None				
Location:	Bulong Abandoned Mine					Survey Mark Present?:	No		Well Condition:	New				
Well Gauging						Well Purging								
Date:	9/12/2019	Time:	9:03 AM	Probe Type & ID No.	312404	Date:	9/12/2019	Start	9:16 AM	Finish	9:59 AM			
Depth to Product:	-	m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):	Low flow		Depth to Water with Pump:	8.957				
Depth to Water:	9.121	m bTOC	Product Description:	-		Depth (pump intake setting bTOC):	10.121		Sediment Thickness in Well (m)	-				
Total Depth of Well:	12.72	m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#	3.1		Screen Interval (m bgl):	-				
Field Chemistry						Observations								
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
9:23 AM	1CPM	40/20	0.1	9.173	5.55	66519	7.71	53.9	24.9	Highly turbid	green grey	no odour	no sheen	
9:28 AM	1CPM	40/20	0.6	9.187	3.62	98063	7.16	-0.4	26.7	Highly turbid	green grey	no odour	no sheen	
9:33 AM	1CPM	40/20	1.1	9.253	3.69	93162	7.16	-27.8	26.2	Highly turbid	green grey	no odour	no sheen	
9:38 AM	1CPM	40/20	1.6	9.265	3.19	99041	7.12	-42.4	24.3	Highly turbid	green grey	no odour	no sheen	
9:43 AM	1CPM	40/20	2.1	9.337	2.87	95931	7.12	-55.7	24.6	Highly turbid	green grey	no odour	no sheen	
9:47 AM	1/2CPM	60/60	2.35	9.336	2.72	94351	7.13	-58	25.5	Highly turbid	green grey	no odour	no sheen	
9:51 AM	1/2CPM	60/60	2.6	9.338	2.95	98438	7.12	-58.8	25.5	Highly turbid	green grey	no odour	no sheen	
9:55 AM	1/2CPM	60/60	2.85	9.334	2.45	99459	7.12	-58.9	25.4	Highly turbid	green grey	no odour	no sheen	
9:59 AM	1/2CPM	60/60	3.1	9.333	2.32	999943	7.12	-60	24.3	Highly turbid	green grey	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	8/12/2019	Start	10:03 AM	Finish	10:41 AM	Recharge Ability:	Poor <0.1L/min		Other Comments:					
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?	N/A							
SWL at end of Sampling:			9.351 m bTOC			Reaction with Preservatives?	Yes							
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:	-						
MW02	Inorganics	1	Metals (Filtered)	2	Y [□] N [□]	ALS/NMI	Any Odours During Sampling							
	Pres Inorganics	1	Cyanide	2	Y [□] N [□]		no odour							
					Y [□] N [□]		Purge Volume (if required):			7.06				
Total Containers		6		Waste Disposal:		Evaporation Pond		# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2]^2 x 0.00314 (only relevant non-low flow methods)						
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH	Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.							
Checked By:			Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.							

P17302 GME Rev3

P17302 GME Rev3

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information							
Job Number:	P17302					Well ID:	MW05		Gatic Type (old, new):	New			
Project Name:	Abandoned Mine DSI					Well Construction (flush, stickup):	Stickup		Well Diameter (mm):	50			
Client:	WA DMIRS					Surface Casing Height (m bgl):	0.685		Key Type (e.g. 8mm gatic):	None			
Location:	Bulong Abandoned Mine					Survey Mark Present?:	No		Well Condition:	New			
Well Gauging						Well Purging							
Date:	9/12/2019	Time:	7:15 AM	Probe Type & ID No.	312404	Date:	9/12/2019	Start	7:31 AM	Finish	8:10 AM		
Depth to Product:	-	m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):	Low flow		Depth to Water with Pump:	15.916			
Depth to Water:	16.024	m bTOC	Product Description:	-		Depth (pump intake setting bTOC):	17.024		Sediment Thickness in Well (m)	-			
Total Depth of Well:	18.04	m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#	2.35		Screen Interval (m bgl):	-			
Field Chemistry						Observations							
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen
7:39 AM	1CPM	40/20	0.1	16.084	4.91	68775	6.85	57.1	21.7	Highly turbid	brown	no odour	no sheen
7:44 AM	1CPM	40/20	0.6	16.189	5.26	67110	6.75	25	22.2	Moderately turbid	brown	no odour	no sheen
7:49 AM	1CPM	40/20	1.1	16.323	5.27	67290	6.74	11	22.2	Slightly turbid	brown	no odour	no sheen
7:54 AM	1/2CPM	60/60	1.35	16.336	5.12	67216	6.74	1.3	22.1	Slightly turbid	brown	no odour	no sheen
7:58 AM	1/2CPM	60/60	1.6	16.374	5.11	67232	6.74	-5.5	22.1	Slightly turbid	brown	no odour	no sheen
8:02 AM	1/2CPM	60/60	1.85	16.406	4.96	67152	6.74	-8.5	22.1	Slightly turbid	brown	no odour	no sheen
8:06 AM	1/2CPM	60/60	2.1	16.425	4.83	67119	6.75	-7.1	22.2	Slightly turbid	brown	no odour	no sheen
8:10 AM	1/2CPM	60/60	2.35	16.446	4.74	67102	6.75	-6.3	22.2	Slightly turbid	brown	no odour	no sheen
Sampling						Purging / Sampling Comments							
Date	9/12/2019	Start	8:12 AM	Finish	8:33 AM		Recharge Ability:	Poor <0.1L/min		Other Comments:			
Sampling Method (bailer, low flow, other):			Low flow				Air Bubbles in Vials?	No					
SWL at end of Sampling:			16.662 m bTOC				Reaction with Preservatives?	Yes					
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:	-					
MW05	Inorganics	1	Metals (Filtered)	2	Y ° N °	ALS/NMI	Any Odours During Sampling?		no odour				
	Pres Inorganics	1	Cyanide	2	Y ° N °		Purge Volume (if required):		3.96				
Total Containers			6			Waste Disposal:	Evaporation Pond			# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2]^2 x 0.00314 (only relevant non-low flow methods)			
Authorisation						* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)							
Sampled By:		MH	Signature:			** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.							
Checked By:			Signature:			^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.							

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:		P17302				Well ID:		BMH01		Gatic Type (old, new):		Old		
Project Name:		Abandoned Mine DSI				Well Construction (flush, stickup):		Stickup		Well Diameter (mm):		90		
Client:		WA DMIRS				Surface Casing Height (m bgl):		0.41		Key Type (e.g. 8mm gatic):		None		
Location:		Bulong Abandoned Mine				Survey Mark Present?:		No		Well Condition:		Average		
Well Gauging						Well Purging								
Date:	8/12/2019	Time:	11:43 AM	Probe Type & ID No.	312404	Date:	8/12/2019	Start	11:54 AM	Finish	12:32 PM			
Depth to Product:		-		m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):		Low flow		Depth to Water with Pump:		9.807
Depth to Water:		9.912		m bTOC	Product Description:	-		Depth (pump intake setting bTOC):		10.912		Sediment Thickness in Well (m)		-
Total Depth of Well:		12.25		m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#		2.6		Screen Interval (m bgl):		-
Field Chemistry						Observations								
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
11:58 AM	1CPM	40/20	0.1	9.902	3.4	125490	7.18	56.1	29.6	Non-turbid	colourless	no odour	no sheen	
12:03 PM	1CPM	40/20	0.6	10.002	3.09	126906	6.45	56	27.3	Non-turbid	colourless	no odour	no sheen	
12:08 PM	1CPM	40/20	1.1	10.101	3.14	126926	6.15	56.6	27.3	Non-turbid	colourless	no odour	no sheen	
12:12 PM	1/2CPM	60/60	1.35	10.154	2.97	125949	6.04	57.9	29	Non-turbid	colourless	no odour	no sheen	
12:16 PM	1/2CPM	60/60	1.6	10.196	2.94	126944	6	60.7	30.1	Non-turbid	colourless	no odour	no sheen	
12:20 PM	1/2CPM	60/60	1.85	10.231	3.03	126943	5.98	61.9	30	Non-turbid	colourless	no odour	no sheen	
12:24 PM	1/2CPM	60/60	2.1	10.273	3.16	126657	5.92	62.2	30.5	Non-turbid	colourless	no odour	no sheen	
12:28 PM	1/2CPM	60/60	2.35	10.314	2.96	126853	5.89	62.1	30.1	Non-turbid	colourless	no odour	no sheen	
12:32 PM	1/2CPM	60/60	2.6	10.362	3.04	126966	5.88	61.8	30	Non-turbid	colourless	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	8/12/2019	Start	12:34 PM	Finish	1:01 PM	Recharge Ability:		Poor <0.1L/min		Other Comments:				
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?		N/A						
SWL at end of Sampling:			10.743 m bTOC			Reaction with Preservatives?		Yes						
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:		-					
BMH01	Inorganics	1	Metals (Filtered)	2	Y [□] N [□]	ALS/NMI	Any Odours During Sampling?		None					
	Pres Inorganics	1	Cyanide	2	Y [□] N [□]		Purge Volume (if required):		14.87					
Total Containers		6		Waste Disposal:		Evaporation Pond		# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2] ² x 0.00314 (only relevant non-low flow methods)						
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH		Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.						
Checked By:				Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.						

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information											
Job Number:	P17302					Well ID:	BMH02A		Gatic Type (old, new):	Old							
Project Name:	Abandoned Mine DSI					Well Construction (flush, stickup):	Stickup		Well Diameter (mm):	50							
Client:	WA DMIRS					Surface Casing Height (m bgl):	0.74		Key Type (e.g. 8mm gatic):	None							
Location:	Bulong Abandoned Mine					Survey Mark Present?:	No		Well Condition:	Average							
Well Gauging						Well Purging											
Date:	8/12/2019		Time:	10:16 AM		Probe Type & ID No.	312404		Date:	8/12/2019		Start	10:55 AM		Finish	8:36 AM	
Depth to Product:			-	m bTOC		Product Thickness (m):	-		Method (bailer, low flow, other):	Low flow		Depth to Water with Pump:	5.296				
Depth to Water:	5.313		m bTOC		Product Description:	-		Depth (pump intake setting bTOC):	6.313		Sediment Thickness in Well (m)	-					
Total Depth of Well:	9.47		m bTOC		Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#	5.1		Screen Interval (m bgl):	-					
Field Chemistry						Observations											
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen				
8:01 AM	1CPM	40/20	0.1	5.297	0.73	162917	6.58	104	22.7	Non-turbid	colourless	no odour	no sheen				
8:06 AM	1CPM	40/20	0.6	5.296	0.41	162632	6.57	81	22.8	Non-turbid	colourless	no odour	no sheen				
8:11 AM	1CPM	40/20	1.1	5.296	0.21	162284	6.57	76	22.7	Non-turbid	colourless	no odour	no sheen				
8:16 AM	1CPM	40/20	1.6	5.296	0.13	162616	6.57	63	22.7	Non-turbid	colourless	no odour	no sheen				
8:21 AM	1CPM	40/20	2.1	5.296	0.17	162787	6.57	51	22.7	Non-turbid	colourless	no odour	no sheen				
8:24 AM	2CPM	20/10	2.7	5.299	0.69	162533	6.57	47	22.7	Non-turbid	colourless	no odour	no sheen				
8:27 AM	2CPM	20/10	3.3	5.299	1.05	162266	6.56	44	22.7	Non-turbid	colourless	no odour	no sheen				
8:30 AM	2CPM	20/10	3.9	5.299	1.41	162282	6.56	42.3	22.7	Non-turbid	colourless	no odour	no sheen				
8:33 AM	2CPM	20/10	4.5	5.301	1.44	162814	6.56	41.2	22.5	Non-turbid	colourless	no odour	no sheen				
8:36 AM	2CPM	20/1-0	5.1	5.3	1.46	162671	6.56	41.1	22.5	Non-turbid	colourless	no odour	no sheen				
Sampling						Purging / Sampling Comments											
Date	8/12/2019		Start	8:37 AM		Finish	9:06 AM		Recharge Ability:	Good >0.4L/min		Other Comments:					
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?			N/A		Could not sample BMH02 as only 45 cm of water in well. SWL at 5.252 and						
SWL at end of Sampling:			5.303 m bTOC			Reaction with Preservatives?			Yes								
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:		-								
BMH02A	Inorganics	3	Metals (Filtered)	6	Y ⁺ N ⁺	ALS/NMI	Any Odours During Sampling?		no odour								
QC07	Pres Inorganics	3	Cyanide	6	Y ⁺ N ⁺	ALS/NMI	Purge Volume (if required):		8.16								
QC08					Y ⁺ N ⁺	Eurofins											
Total Containers			18			Waste Disposal:			Evaporation Pond			# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2] ² x 0.00314 (only relevant non-low flow methods)					
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)																	
Authorisation																	
Sampled By:			MH		Signature:									** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.			
Checked By:					Signature:									^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.			

P17302 GME Rev3

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:	P17302					Well ID:	BMH06		Gatic Type (old, new):	Old				
Project Name:	Bulong DSI					Well Construction (flush, stickup):	Stickup		Well Diameter (mm):	50				
Client:	DMIRS					Surface Casing Height (m bgl):	0.35		Key Type (e.g. 8mm gatic):	None				
Location:	Bulong, Western Australia					Survey Mark Present?:	No		Well Condition:	Average				
Well Gauging						Well Purging								
Date:	10/12/2019	Time:	9:03 AM	Probe Type & ID No.	#REF!	Date:	10/12/2019	Start	9:07 AM	Finish	9:47 AM			
Depth to Product:	-	m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):	Low flow		Depth to Water with Pump:	1.591				
Depth to Water:	1.617	m bTOC	Product Description:	-		Depth (pump intake setting bTOC):	2.617		Sediment Thickness in Well (m)	-				
Total Depth of Well:	6.11	m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L): [#]	3.1		Screen Interval (m bgl):	-				
Field Chemistry						Observations								
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
9:11 AM	1CPM	40/20	0.1	1.655	0.45	225796	7.01	2.2	27.4	Non-turbid	colourless	no odour	no sheen	
9:16 AM	1CPM	40/20	0.6	1.728	0.38	225998	6.95	12.3	27.7	Non-turbid	colourless	no odour	no sheen	
9:21 AM	1CPM	40/20	1.1	1.784	0.31	226620	6.88	1.9	27.9	Non-turbid	colourless	no odour	no sheen	
9:26 AM	1CPM	40/20	1.6	1.848	0.27	226573	6.83	-19.9	28.1	Non-turbid	colourless	no odour	no sheen	
9:31 AM	1CPM	40/20	2.1	1.886	0.24	226519	6.83	-26.7	28.1	Non-turbid	colourless	no odour	no sheen	
9:35 AM	1/2CPM	60/60	2.35	1.892	0.23	226281	6.82	-34.1	28.5	Non-turbid	colourless	no odour	no sheen	
9:39 AM	1/2CPM	60/60	2.6	1.903	0.21	226354	6.81	-40.6	28.8	Non-turbid	colourless	no odour	no sheen	
9:43 AM	1/2CPM	60/60	2.85	1.931	0.18	226538	6.8	-43.7	29.1	Non-turbid	colourless	no odour	no sheen	
9:47 AM	1/2CPM	60/60	3.1	1.948	0.15	226714	6.79	-47.8	29.5	Non-turbid	colourless	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	10/12/2019	Start	9:49 AM	Finish	10:21 AM	Recharge Ability:	Poor <0.1L/min		Other Comments:					
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?	N/A							
SWL at end of Sampling:			2.011 m bTOC			Reaction with Preservatives?	Yes							
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:	-						
BMH06	Inorganics	1	Metals (Filtered)	2	Y ^o N ^a	ALS/NMI	Any Odours During Sampling?							
	Pres Inorganics	1	Cyanide	2	Y ^o N ^o		no odour							
					Y ^o N ^o		Purge Volume (if required):			8.82				
Total Containers		6		Waste Disposal:		Evaporation Pond		* Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2] ² x 0.00314 (only relevant non-low flow methods)						
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH		Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.						
Checked By:				Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.						

P17302 GME Rev3

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:	P17302					Well ID:	BMH09		Gatic Type (old, new):	Old				
Project Name:	Bulong DSI					Well Construction (flush, stickup):	Stickup		Well Diameter (mm):	90				
Client:	DMIRS					Surface Casing Height (m bgl):	0.283		Key Type (e.g. 8mm gatic):	None				
Location:	Bulong, Western Australia					Survey Mark Present?:	No		Well Condition:	Average				
Well Gauging						Well Purging								
Date:	10/12/2019	Time:	11:28 AM	Probe Type & ID No.	#REF!	Date:	10/12/2019	Start	11:30 AM	Finish	12:24 PM			
Depth to Product:	-	m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):	Low flow		Depth to Water with Pump:	1.271				
Depth to Water:	1.328	m bTOC	Product Description:	-		Depth (pump intake setting bTOC):	2.238		Sediment Thickness in Well (m)	-				
Total Depth of Well:	3.18	m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L): [#]	4.1		Screen Interval (m bgl):	-				
Field Chemistry						Observations								
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
11:32 AM	1CPM	40/20	0.1	1.352	0.26	167422	6.78	25.8	28.9	Non-turbid	colourless	no odour	no sheen	
11:37 AM	1CPM	40/20	0.6	1.404	0.12	168041	6.75	11.7	29	Non-turbid	colourless	no odour	no sheen	
11:42 AM	1CPM	40/20	1.1	1.428	0.11	167883	6.74	1.5	29.3	Non-turbid	colourless	no odour	no sheen	
11:47 AM	1CPM	40/20	1.6	1.441	0.1	168274	6.72	-21.1	29.6	Non-turbid	colourless	no odour	no sheen	
11:52 AM	1CPM	40/20	2.1	1.453	0.09	167997	6.72	-55.3	29.3	Non-turbid	colourless	no odour	no sheen	
11:56 AM	1/2CPM	60/60	2.35	1.442	0.11	167914	6.69	-74.8	30.7	Non-turbid	colourless	no odour	no sheen	
12:00 PM	1/2CPM	60/60	2.6	1.415	0.12	167882	6.67	-90.7	30.7	Non-turbid	colourless	no odour	no sheen	
12:04 PM	1/2CPM	60/60	2.85	1.409	0.09	167613	6.66	-100.4	31	Non-turbid	colourless	no odour	no sheen	
12:08 PM	1/2CPM	60/60	3.1	1.401	0.09	168447	6.65	-123.8	31	Non-turbid	colourless	no odour	no sheen	
12:12 PM	1/2CPM	60/60	3.35	1.396	0.13	168331	6.65	-141.2	31	Non-turbid	colourless	no odour	no sheen	
12:16 PM	1/2CPM	60/60	3.6	1.391	0.13	168004	6.64	-157.9	30.9	Non-turbid	colourless	no odour	no sheen	
12:20 PM	1/2CPM	60/60	3.85	1.388	0.14	168227	6.63	-160.2	31	Non-turbid	colourless	no odour	no sheen	
12:24 PM	1/2CPM	60/60	4.1	1.39	0.11	167868	6.62	-164	31.2	Non-turbid	colourless	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	10/12/2019	Start	12:26 PM	Finish	12:56 PM		Recharge Ability:	Poor <0.1L/min		Other Comments:				
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?	No							
SWL at end of Sampling:			1.392 m bTOC			Reaction with Preservatives?	Yes							
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:		-					
BMH09	Inorganics	1	Metals (Filtered)	2	Y ^o N ^a	ALS/NMI	Any Odours During Sampling?		no odour					
	Pres Inorganics	1	Cyanide	2	Y ^o N ^a		Purge Volume (if required):		11.78					
Total Containers		6		Waste Disposal:		Evaporation Pond		* Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2] ² x 0.00314 (only relevant non-low flow methods)						
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH		Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.						
Checked By:				Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.						

P17302 GME Rev3

P17302 GME Rev3

4. QAQC Register

Project No	P17302	Project	Bulong DSI
Location	Bulong Abandoned Mine	Client	WA Govt.

QC Sample ID	Primary Sample ID	Date	Type	Sampled By	Matrix	Rinsate/Trip Blank Batch ID	Comments
QC01	PW2	2/12/2019	Duplicate	BH	Sed	-	-
QC02	PW2	2/12/2019	Triplicate	BH	Sed	-	-
QC03	Rinsate	2/12/2019	Rinsate	MH	W	-	Off nitrile glove.
QC04	MW1_0.05-0.15	3/12/2019	Duplicate	MH	Soil	-	-
QC05	MW1_0.05-0.15	3/12/2019	Triplicate	MH	Soil	-	-
QC06	Rinsate	3/12/2019	Rinsate	MH	Soil	-	Off hand auger.
QC07	BMH02A	8/12/2019	Duplicate	MH	Water	-	-
QC08	BMH02A	8/12/2019	Triplicate	MH	Water	-	-
QC09	T4-3	8/12/2019	Duplicate	BH	Soil	-	-
QC10	T4-3	8/12/2019	Triplicate	BH	Soil	-	-
QC11	T4-3_0.3	8/12/2019	Duplicate	BH	Soil	-	-
QC12	T4-3_0.3	8/12/2019	Triplicate	BH	Soil	-	-
QC13	Rinsate	8/12/2019	Rinsate	MH	Water	-	Off pump.
QC14	Rinsate	8/12/2019	Rinsate	BH	Water	-	Off HA.
QC15	Rinsate	9/12/2019	Rinsate	MH	Water	-	Off pump.
QC16	Rinsate	9/12/2019	Rinsate	MH	Water	-	Off HA.
QC17	Rinsate	10/12/2019	Rinsate	MH	Water	-	Off pump.
QC18	Rinsate	10/12/2019	Rinsate	MH	Water	-	Off HA
QC19	T6-8	11/12/2019	Duplicate	BH	Soil	-	-
QC20	T6-8	11/12/2019	Triplicate	BH	Soil	-	-
QC21	Rinsate	11/12/2019	Rinsate	MH	Water	-	Off HA.A
QC22	BG2	24/2/2020	Dup	BH	Soil	-	-
QC23	BG2	24/2/2020	Trip	BH	Soil	-	-



Senversa Field and Groundwater Sampling Forms - Rev 1.8

Job Number:	P17302
Project Name:	Bulong DSI
Client:	DMIRS
Project Manager:	Blaire Coleman
Location:	Bulong, Western Australia
Senversa Office	Perth
Field Personnel / Sampler	MH
Sampling Round	GME
Groundwater Sampling Equipment	Low flow
Pump intake setting	-
Waste Disposal	Evaporation Pond
Primary Laboratory	ALS (WA)
Laboratory - Purchase Order	
Laboratory - Quote No.	
Laboratory Report Recipient	Blaire.Coleman@senversa.com.au
Senversa Lab Contact	Matthew Hunt - 0448 797 725
Turn Around Time	Standard
Proposed Laboratory Analysis	

Produce Reports	
Create Front Page	
Create Relevant Field Forms	PID Daily Calibration Sheet ▼
Historical Groundwater Data	
Create Soil Sample Register	
Create Groundwater Gauging Record	
Create QAQC Sheet	
Create Stabilised Parameter Sheet	
Create Blank COC	
Create Compiled COC of Completed Wells	
Create Compiled COC of Soil Samples	
Go To Sheet	▼

Site Overview		
Wells to be completed	Wells completed	Wells completed by date
<div></div>	<div></div>	<div>▼</div> <div></div>



Senversa Field and Groundwater Sampling Sheet - Help

How to Begin

Fill in the job details on the main page

Create the required field forms once you have filled in the data

You can auto create the following field forms

- Cover Page
- Field Note Sheet

For Soil Programs

- Soil Sample Register
- QAQC Register
- COC Register
- PID Calibration Sheet
- PID Daily Calibration Sheet

For Groundwater Programs

- Gauging Sheet
- QAQC Register
- COC Register
- WQM Calibration Sheet
- WQM Daily Calibration Sheet
- **Auto Produced** - Monitoring Wells
- **Auto Produced** - Stabilised Parameters
- **Auto Produced** - Complication of COC at end of each field day
- **Auto Produced** - List of completed wells and wells to do
- **Select wells sampled by date**

Sheets

Groundwater Gauging Record

1. Create Groundwater_Gauging_Record
2. Fill in well details
3. Click "Create Well Sampling Sheet"
4. All wells will be created.
5. Click time and then Now button to extract exact time

Groundwater Sampling Sheet

1. Stabilisation will automatically change fill of the parameter
2. Multiple auto calculations will assist in filling the form
3. Click "Now" buttons to import date and time

COC Form

1. Insert analytes
2. Auto import groundwater samples from that day
3. Select analytes by clicking once
4. Auto calculate bottle numbers
5. Auto calculate sample bottle

Groundwater Stabilised Parameter Table

1. Create sheet at the completion of project
2. Data will be extracted from groundwater sampling sheets

QAQC

1. Once the QAQC form is full it will need to be copied and supersceded
2. Rename the new one as QAQC and old as suitable e.g QAQC_Comp

Important Features / Notes

- Groundwater parameters will turn green during stabilisation
- On completion of a well you can lock and secure the field sheet
- Stabilisation Parameters will extract the last reading (10% check)

Future Changes / updates

- Merging gauging sheets
- Importing other works
- Addition of signatures

Please direct any questions / recommendations / edits to:

jarrod.irving@senversa.com.au

About

Senversa field form generator and groundwater sampling sheets are based on Senversa field template files

Revision: Version 1.6

Changelog: Available upon request

Developer: Jarrod Irving - Senversa

© Senversa 2017

Job Number:	P17302	Project Name:	Bulong DSI
Date:	31/10/2018	Client:	DMIRS
Location:	DMIRS	Field Personnel:	MH
Probe Type/ID:	Senversa		

[illegible]

Notes

¹ Recorded to nearest 0.001 m; ² Recorded to nearest 0.01 m; All depths to be recorded to nearest mm.

P17302 GME Rev3

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:	P17302					Well ID:	MW02		Gatic Type (old, new):	New				
Project Name:	Abandoned Mine DSI					Well Construction (flush, stickup):	Stickup		Well Diameter (mm):	50				
Client:	WA DWIRS					Surface Casing Height (m bgl):	0.562		Key Type (e.g. 8mm gatic):	None				
Location:	Bulong Abandoned Mine					Survey Mark Present?:	No		Well Condition:	New				
Well Gauging						Well Purging								
Date:	9/12/2019	Time:	9:03 AM	Probe Type & ID No.	312404	Date:	9/12/2019	Start	9:16 AM	Finish	9:59 AM			
Depth to Product:	-	m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):	Low flow		Depth to Water with Pump:	8.957				
Depth to Water:	9.121	m bTOC	Product Description:	-		Depth (pump intake setting bTOC):	10.121		Sediment Thickness in Well (m)	-				
Total Depth of Well:	12.72	m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#	3.1		Screen Interval (m bgl):	-				
Field Chemistry						Observations								
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
9:23 AM	1CPM	40/20	0.1	9.173	5.55	66519	7.71	53.9	24.9	Highly turbid	green grey	no odour	no sheen	
9:28 AM	1CPM	40/20	0.6	9.187	3.62	98063	7.16	-0.4	26.7	Highly turbid	green grey	no odour	no sheen	
9:33 AM	1CPM	40/20	1.1	9.253	3.69	93162	7.16	-27.8	26.2	Highly turbid	green grey	no odour	no sheen	
9:38 AM	1CPM	40/20	1.6	9.265	3.19	99041	7.12	-42.4	24.3	Highly turbid	green grey	no odour	no sheen	
9:43 AM	1CPM	40/20	2.1	9.337	2.87	95931	7.12	-55.7	24.6	Highly turbid	green grey	no odour	no sheen	
9:47 AM	1/2CPM	60/60	2.35	9.336	2.72	94351	7.13	-58	25.5	Highly turbid	green grey	no odour	no sheen	
9:51 AM	1/2CPM	60/60	2.6	9.338	2.95	98438	7.12	-58.8	25.5	Highly turbid	green grey	no odour	no sheen	
9:55 AM	1/2CPM	60/60	2.85	9.334	2.45	99459	7.12	-58.9	25.4	Highly turbid	green grey	no odour	no sheen	
9:59 AM	1/2CPM	60/60	3.1	9.333	2.32	999943	7.12	-60	24.3	Highly turbid	green grey	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	8/12/2019	Start	10:03 AM	Finish	10:41 AM	Recharge Ability:	Poor <0.1L/min		Other Comments:					
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?	N/A							
SWL at end of Sampling:			9.351 m bTOC			Reaction with Preservatives?	Yes							
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:	-						
MW02	Inorganics	1	Metals (Filtered)	2	Y ° N °	ALS/NMI	Any Odours During Sampling							
	Pres Inorganics	1	Cyanide	2	Y ° N °		no odour							
					Y ° N °		Purge Volume (if required):		7.06					
Total Containers		6	Waste Disposal:		Evaporation Pond		# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2]^2 x 0.00314 (only relevant non-low flow methods)							
Authorisation						* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)								
Sampled By:		MH	Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.							
Checked By:			Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.							

P17302 GME Rev3

P17302 GME Rev3

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:	P17302					Well ID:	MW05		Gatic Type (old, new):	New				
Project Name:	Abandoned Mine DSI					Well Construction (flush, stickup):	Stickup		Well Diameter (mm):	50				
Client:	WA DMIRS					Surface Casing Height (m bgl):	0.685		Key Type (e.g. 8mm gatic):	None				
Location:	Bulong Abandoned Mine					Survey Mark Present?:	No		Well Condition:	New				
Well Gauging						Well Purging								
Date:	9/12/2019	Time:	7:15 AM	Probe Type & ID No.	312404	Date:	9/12/2019	Start	7:31 AM	Finish	8:10 AM			
Depth to Product:	-	m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):	Low flow		Depth to Water with Pump:	15.916				
Depth to Water:	16.024	m bTOC	Product Description:	-		Depth (pump intake setting bTOC):	17.024		Sediment Thickness in Well (m)	-				
Total Depth of Well:	18.04	m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#	2.35		Screen Interval (m bgl):	-				
Field Chemistry						Observations								
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
7:39 AM	1CPM	40/20	0.1	16.084	4.91	68775	6.85	57.1	21.7	Highly turbid	brown	no odour	no sheen	
7:44 AM	1CPM	40/20	0.6	16.189	5.26	67110	6.75	25	22.2	Moderately turbid	brown	no odour	no sheen	
7:49 AM	1CPM	40/20	1.1	16.323	5.27	67290	6.74	11	22.2	Slightly turbid	brown	no odour	no sheen	
7:54 AM	1/2CPM	60/60	1.35	16.336	5.12	67216	6.74	1.3	22.1	Slightly turbid	brown	no odour	no sheen	
7:58 AM	1/2CPM	60/60	1.6	16.374	5.11	67232	6.74	-5.5	22.1	Slightly turbid	brown	no odour	no sheen	
8:02 AM	1/2CPM	60/60	1.85	16.406	4.96	67152	6.74	-8.5	22.1	Slightly turbid	brown	no odour	no sheen	
8:06 AM	1/2CPM	60/60	2.1	16.425	4.83	67119	6.75	-7.1	22.2	Slightly turbid	brown	no odour	no sheen	
8:10 AM	1/2CPM	60/60	2.35	16.446	4.74	67102	6.75	-6.3	22.2	Slightly turbid	brown	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	9/12/2019	Start	8:12 AM	Finish	8:33 AM	Recharge Ability:	Poor <0.1L/min		Other Comments:					
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?	No							
SWL at end of Sampling:			16.662 m bTOC			Reaction with Preservatives?	Yes							
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:	-						
MW05	Inorganics	1	Metals (Filtered)	2	Y ° N °	ALS/NMI	Any Odours During Sampling?							no odour
	Pres Inorganics	1	Cyanide	2	Y ° N °		Purge Volume (if required):		3.96					
Total Containers		6		Waste Disposal:	Evaporation Pond		# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2]^2 x 0.00314 (only relevant non-low flow methods)							
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH		Signature:			** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.							
Checked By:				Signature:			^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.							

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:		P17302				Well ID:		BMH01		Gatic Type (old, new):		Old		
Project Name:		Abandoned Mine DSI				Well Construction (flush, stickup):		Stickup		Well Diameter (mm):		90		
Client:		WA DMIRS				Surface Casing Height (m bgl):		0.41		Key Type (e.g. 8mm gatic):		None		
Location:		Bulong Abandoned Mine				Survey Mark Present?:		No		Well Condition:		Average		
Well Gauging						Well Purging								
Date:	8/12/2019	Time:	11:43 AM	Probe Type & ID No.	312404	Date:	8/12/2019	Start	11:54 AM	Finish	12:32 PM			
Depth to Product:		-		m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):		Low flow		Depth to Water with Pump:		9.807
Depth to Water:		9.912		m bTOC	Product Description:	-		Depth (pump intake setting bTOC):		10.912		Sediment Thickness in Well (m)		-
Total Depth of Well:		12.25		m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#		2.6		Screen Interval (m bgl):		-
Field Chemistry										Observations				
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
11:58 AM	1CPM	40/20	0.1	9.902	3.4	125490	7.18	56.1	29.6	Non-turbid	colourless	no odour	no sheen	
12:03 PM	1CPM	40/20	0.6	10.002	3.09	126906	6.45	56	27.3	Non-turbid	colourless	no odour	no sheen	
12:08 PM	1CPM	40/20	1.1	10.101	3.14	126926	6.15	56.6	27.3	Non-turbid	colourless	no odour	no sheen	
12:12 PM	1/2CPM	60/60	1.35	10.154	2.97	125949	6.04	57.9	29	Non-turbid	colourless	no odour	no sheen	
12:16 PM	1/2CPM	60/60	1.6	10.196	2.94	126944	6	60.7	30.1	Non-turbid	colourless	no odour	no sheen	
12:20 PM	1/2CPM	60/60	1.85	10.231	3.03	126943	5.98	61.9	30	Non-turbid	colourless	no odour	no sheen	
12:24 PM	1/2CPM	60/60	2.1	10.273	3.16	126657	5.92	62.2	30.5	Non-turbid	colourless	no odour	no sheen	
12:28 PM	1/2CPM	60/60	2.35	10.314	2.96	126853	5.89	62.1	30.1	Non-turbid	colourless	no odour	no sheen	
12:32 PM	1/2CPM	60/60	2.6	10.362	3.04	126966	5.88	61.8	30	Non-turbid	colourless	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	8/12/2019	Start	12:34 PM	Finish	1:01 PM	Recharge Ability:		Poor <0.1L/min		Other Comments:				
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?		N/A						
SWL at end of Sampling:			10.743 m bTOC			Reaction with Preservatives?		Yes						
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:		-					
BMH01	Inorganics	1	Metals (Filtered)	2	Y ° N °	ALS/NMI	Any Odours During Sampling?		None					
	Pres Inorganics	1	Cyanide	2	Y ° N °		Purge Volume (if required):		14.87					
Total Containers		6		Waste Disposal:		Evaporation Pond		# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2]^2 x 0.00314 (only relevant non-low flow methods)						
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH		Signature:		** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.								
Checked By:				Signature:		^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.								

Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:		P17302				Well ID:		BMH02A		Gatic Type (old, new):		Old		
Project Name:		Abandoned Mine DSI				Well Construction (flush, stickup):		Stickup		Well Diameter (mm):		50		
Client:		WA DMIRS				Surface Casing Height (m bgl):		0.74		Key Type (e.g. 8mm gatic):		None		
Location:		Bulong Abandoned Mine				Survey Mark Present?:		No		Well Condition:		Average		
Well Gauging						Well Purging								
Date:	8/12/2019	Time:	10:16 AM	Probe Type & ID No.	312404	Date:	8/12/2019	Start	10:55 AM	Finish	8:36 AM			
Depth to Product:		-		m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):		Low flow		Depth to Water with Pump:		5.296
Depth to Water:		5.313		m bTOC	Product Description:	-		Depth (pump intake setting bTOC):		6.313		Sediment Thickness in Well (m)		-
Total Depth of Well:		9.47		m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L):#		5.1		Screen Interval (m bgl):		-
Field Chemistry										Observations				
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
8:01 AM	1CPM	40/20	0.1	5.297	0.73	162917	6.58	104	22.7	Non-turbid	colourless	no odour	no sheen	
8:06 AM	1CPM	40/20	0.6	5.296	0.41	162632	6.57	81	22.8	Non-turbid	colourless	no odour	no sheen	
8:11 AM	1CPM	40/20	1.1	5.296	0.21	162284	6.57	76	22.7	Non-turbid	colourless	no odour	no sheen	
8:16 AM	1CPM	40/20	1.6	5.296	0.13	162616	6.57	63	22.7	Non-turbid	colourless	no odour	no sheen	
8:21 AM	1CPM	40/20	2.1	5.296	0.17	162787	6.57	51	22.7	Non-turbid	colourless	no odour	no sheen	
8:24 AM	2CPM	20/10	2.7	5.299	0.69	162533	6.57	47	22.7	Non-turbid	colourless	no odour	no sheen	
8:27 AM	2CPM	20/10	3.3	5.299	1.05	162266	6.56	44	22.7	Non-turbid	colourless	no odour	no sheen	
8:30 AM	2CPM	20/10	3.9	5.299	1.41	162282	6.56	42.3	22.7	Non-turbid	colourless	no odour	no sheen	
8:33 AM	2CPM	20/10	4.5	5.301	1.44	162814	6.56	41.2	22.5	Non-turbid	colourless	no odour	no sheen	
8:36 AM	2CPM	20/1-0	5.1	5.3	1.46	162671	6.56	41.1	22.5	Non-turbid	colourless	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	8/12/2019	Start	8:37 AM	Finish	9:06 AM	Recharge Ability:		Good >0.4L/min		Other Comments: Could not sample BMH02 as only 45 cm of water in well. SWL at 5.252 and				
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?		N/A						
SWL at end of Sampling:			5.303 m bTOC			Reaction with Preservatives?		Yes						
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:		-					
BMH02A	Inorganics	3	Metals (Filtered)	6	Y* N*	ALS/NMI	Any Odours During Sampling?		no odour					
QC07	Pres Inorganics	3	Cyanide	6	Y* N*	ALS/NMI	Purge Volume (if required):		8.16					
QC08					Y* N*	Eurofins								
Total Containers		18		Waste Disposal:		Evaporation Pond		# Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2]^2 x 0.00314 (only relevant non-low flow methods)						
Authorisation								* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)						
Sampled By:		MH		Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.						
Checked By:				Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.						

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Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:		P17302				Well ID:		BMH06		Gatic Type (old, new):		Old		
Project Name:		Bulong DSI				Well Construction (flush, stickup):		Stickup		Well Diameter (mm):		50		
Client:		DMIRS				Surface Casing Height (m bgl):		0.35		Key Type (e.g. 8mm gatic):		None		
Location:		Bulong, Western Australia				Survey Mark Present?:		No		Well Condition:		Average		
Well Gauging						Well Purging								
Date:	10/12/2019	Time:	9:03 AM	Probe Type & ID No.	#REF!	Date:	10/12/2019	Start	9:07 AM	Finish	9:47 AM			
Depth to Product:		-		m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):		Low flow		Depth to Water with Pump:		1.591
Depth to Water:		1.617		m bTOC	Product Description:	-		Depth (pump intake setting bTOC):		2.617		Sediment Thickness in Well (m)		-
Total Depth of Well:		6.11		m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L): [#]		3.1		Screen Interval (m bgl):		-
Field Chemistry										Observations				
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
9:11 AM	1CPM	40/20	0.1	1.655	0.45	225796	7.01	2.2	27.4	Non-turbid	colourless	no odour	no sheen	
9:16 AM	1CPM	40/20	0.6	1.728	0.38	225998	6.95	12.3	27.7	Non-turbid	colourless	no odour	no sheen	
9:21 AM	1CPM	40/20	1.1	1.784	0.31	226620	6.88	1.9	27.9	Non-turbid	colourless	no odour	no sheen	
9:26 AM	1CPM	40/20	1.6	1.848	0.27	226573	6.83	-19.9	28.1	Non-turbid	colourless	no odour	no sheen	
9:31 AM	1CPM	40/20	2.1	1.886	0.24	226519	6.83	-26.7	28.1	Non-turbid	colourless	no odour	no sheen	
9:35 AM	1/2CPM	60/60	2.35	1.892	0.23	226281	6.82	-34.1	28.5	Non-turbid	colourless	no odour	no sheen	
9:39 AM	1/2CPM	60/60	2.6	1.903	0.21	226354	6.81	-40.6	28.8	Non-turbid	colourless	no odour	no sheen	
9:43 AM	1/2CPM	60/60	2.85	1.931	0.18	226538	6.8	-43.7	29.1	Non-turbid	colourless	no odour	no sheen	
9:47 AM	1/2CPM	60/60	3.1	1.948	0.15	226714	6.79	-47.8	29.5	Non-turbid	colourless	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	10/12/2019	Start	9:49 AM	Finish	10:21 AM	Recharge Ability:		Poor <0.1L/min		Other Comments:				
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?		N/A						
SWL at end of Sampling:			2.011 m bTOC			Reaction with Preservatives?		Yes						
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:		-					
BMH06	Inorganics	1	Metals (Filtered)	2	Y ° N °	ALS/NMI	Any Odours During Sampling?		no odour					
	Pres Inorganics	1	Cyanide	2	Y ° N °		Purge Volume (if required):		8.82					
Total Containers		6		Waste Disposal:		Evaporation Pond		* Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2] ² x 0.00314 (only relevant non-low flow methods)						
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH		Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.						
Checked By:				Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.						

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Groundwater Sampling and Field Chemical Characteristics Record

Site and Job Number						Well Information								
Job Number:		P17302				Well ID:		BMH09		Gatic Type (old, new):		Old		
Project Name:		Bulong DSI				Well Construction (flush, stickup):		Stickup		Well Diameter (mm):		90		
Client:		DMIRS				Surface Casing Height (m bgl):		0.283		Key Type (e.g. 8mm gatic):		None		
Location:		Bulong, Western Australia				Survey Mark Present?:		No		Well Condition:		Average		
Well Gauging						Well Purging								
Date:	10/12/2019	Time:	11:28 AM	Probe Type & ID No.	#REF!	Date:	10/12/2019	Start	11:30 AM	Finish	12:24 PM			
Depth to Product:		-		m bTOC	Product Thickness (m):	-		Method (bailer, low flow, other):		Low flow		Depth to Water with Pump:		1.271
Depth to Water:		1.328		m bTOC	Product Description:	-		Depth (pump intake setting bTOC):		2.238		Sediment Thickness in Well (m)		-
Total Depth of Well:		3.18		m bTOC	Product Confirmed by Bailer:	N/A		Total Volume Purged (L): [#]		4.1		Screen Interval (m bgl):		-
Field Chemistry										Observations				
Time	Pump Rate	Refill / Discharge	Volume (L)	WL (m bTOC)	DO (mg/L)** ±10% * ^	EC (µS/cm) ±3% *	pH ±0.05 *	Redox (mV) ±10mV *	Temp (°C) ±10% *	Turbidity	Colour	Odour	Sheen	
11:32 AM	1CPM	40/20	0.1	1.352	0.26	167422	6.78	25.8	28.9	Non-turbid	colourless	no odour	no sheen	
11:37 AM	1CPM	40/20	0.6	1.404	0.12	168041	6.75	11.7	29	Non-turbid	colourless	no odour	no sheen	
11:42 AM	1CPM	40/20	1.1	1.428	0.11	167883	6.74	1.5	29.3	Non-turbid	colourless	no odour	no sheen	
11:47 AM	1CPM	40/20	1.6	1.441	0.1	168274	6.72	-21.1	29.6	Non-turbid	colourless	no odour	no sheen	
11:52 AM	1CPM	40/20	2.1	1.453	0.09	167997	6.72	-55.3	29.3	Non-turbid	colourless	no odour	no sheen	
11:56 AM	1/2CPM	60/60	2.35	1.442	0.11	167914	6.69	-74.8	30.7	Non-turbid	colourless	no odour	no sheen	
12:00 PM	1/2CPM	60/60	2.6	1.415	0.12	167882	6.67	-90.7	30.7	Non-turbid	colourless	no odour	no sheen	
12:04 PM	1/2CPM	60/60	2.85	1.409	0.09	167613	6.66	-100.4	31	Non-turbid	colourless	no odour	no sheen	
12:08 PM	1/2CPM	60/60	3.1	1.401	0.09	168447	6.65	-123.8	31	Non-turbid	colourless	no odour	no sheen	
12:12 PM	1/2CPM	60/60	3.35	1.396	0.13	168331	6.65	-141.2	31	Non-turbid	colourless	no odour	no sheen	
12:16 PM	1/2CPM	60/60	3.6	1.391	0.13	168004	6.64	-157.9	30.9	Non-turbid	colourless	no odour	no sheen	
12:20 PM	1/2CPM	60/60	3.85	1.388	0.14	168227	6.63	-160.2	31	Non-turbid	colourless	no odour	no sheen	
12:24 PM	1/2CPM	60/60	4.1	1.39	0.11	167868	6.62	-164	31.2	Non-turbid	colourless	no odour	no sheen	
Sampling						Purging / Sampling Comments								
Date	10/12/2019	Start	12:26 PM	Finish	12:56 PM	Recharge Ability:		Poor <0.1L/min		Other Comments:				
Sampling Method (bailer, low flow, other):			Low flow			Air Bubbles in Vials?		No						
SWL at end of Sampling:			1.392 m bTOC			Reaction with Preservatives?		Yes						
Sample No:	Container	No. Samples	Container	No. Samples	QA QC	Laboratory	Headspace PID Readings:		-					
BMH09	Inorganics	1	Metals (Filtered)	2	Y ° N °	ALS/NMI	Any Odours During Sampling?		no odour					
	Pres Inorganics	1	Cyanide	2	Y ° N °		Purge Volume (if required):		11.78					
Total Containers		6		Waste Disposal:		Evaporation Pond		* Purge Volume = [TD (mbTOC)-SWL (mbTOC)] x [(D (mm))/2]^2 x 0.00314 (only relevant non-low flow methods)						
* Parameters considered stable when three consecutive readings three to five minutes apart are all within stated criteria (EPA Pub 669)														
Sampled By:		MH		Signature:				** If using galvanic DO probe (yellow cap), highest DO reading during discharge should be recorded.						
Checked By:				Signature:				^ Or sensor accuracy, whichever is greater. YSI ProPlus sensor accuracy is 0.2 mg/L.						

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Appendix F: QA / QC Assessment



Appendix D: Quality Assurance/ Quality Control Assessment

The data QA/ QC procedures adopted by Senversa provide a consistent approach to evaluation of whether the DQOs required by the project have been achieved. The process focuses on assessment of the useability of the data in terms of accuracy and reliability in forming conclusions on the condition of the element of the environment being investigated. The approach is generally based on guidance from the following sources:

- Standards Australia (2005) *Australian Standard AS4482.1 2005- Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds.*
- NEPC (1999) *NEPM: Schedule B2: Guideline on Site Characterisation.*
- NEPC (1999) *NEPM: Schedule B3 Guideline on Laboratory Analysis of Potentially Contaminated Soils.*
- US EPA (2006) *Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4.*
- US EPA (2002) *Guidance on Environmental Data Verification and Data Validation EPA QA/G-8.*
- HEPA (2018) *PFAS National Environmental Management Plan.*

Quality Assurance Procedures

The following DQIs, measures and acceptance criteria were adopted to verify compliance with the planned QA procedures, and are summarised in **Table D-1**.

Table D-1: Quality Assurance Procedures DQIs

QA Process	Data Quality Indicator/s	Measure	Acceptance Criteria
Standard Procedures	Comparability, Reproducibility, Representativeness	Standard field sampling procedures and forms used	Field forms are provided in Appendix E . Electronic record keeping was utilised in the field. The sampling records for groundwater wells MW1, MW3 and MW4 were corrupted and hence data for these wells was lost. No other deviation from standard procedures were noted.
Equipment Calibration	Accuracy	All equipment calibrated in accordance with manufacturers specifications	All equipment calibrated in accordance with manufacturers specifications. Equipment calibration forms are provided in Appendix C .
Testing Method Accreditation	Accuracy and Comparability	National Association of Testing Authorities, Australia (NATA) accredited methods used for all analyses determined	Primary and secondary laboratories to use NATA accredited methods for all analytes determined. Laboratory certificates are provided in Appendix H .

**Table D-1: Quality Assurance Procedures DQIs (continued)**

QA Process	Data Quality Indicator/s	Measure	Acceptance Criteria
Quality Control Sampling Frequency	Accuracy, Precision and Comparability	Laboratory QC analysis frequency in accordance with NEPC (2013), Schedule B3.	<p>Laboratory Duplicates – at least 1 in 10 analyses or one per process batch.</p> <p>Method Blanks – at least 1 per process batch.</p> <p>Surrogate Recoveries – all samples spiked where appropriate (e.g. chromatographic analysis of organics).</p> <p>Laboratory Control Samples – at least 1 per process batch.</p> <p>Matrix Spikes – at least 1 per matrix type per process batch.</p>
Sample Preservation, Handling and Holding Times	Accuracy	Samples appropriately preserved upon collection, stored and transported and analysed within holding times.	<p>Sample containers, holding times and preservation in accordance laboratory specific method requirements.</p> <p>Sample receipt notifications are provided in Appendix H.</p>
Data Management	Accuracy	No errors in data transcription.	<p>Entry of field data verified by peer.</p> <p>As described above, electronic records for sampling of MW1, MW3 and MW4 were lost.</p>
Data Useability	Completeness	Limits of reporting less than adopted beneficial use investigation levels. Sample volumes and analytical methods selected to enable required limits of reporting to be achieved.	Limits of reporting less than investigation levels.

Quality Control Sampling and Analysis

The following DQIs, measures and acceptance criteria were adopted to evaluate the validity of the analytical data produced, and are summarised in **Table D-2**.

Table D-2: Quality Control Sampling and Analysis DQIs

QC Process	Data Quality Indicator/s	Measure	Acceptance Criteria
Field Duplicate Sampling and Analysis	Precision and Field Repeatability	Field duplicate samples used assess the variability in analyte concentration between samples collected from the sample location and the reproducibility of the laboratory analysis. Where required, resubmission of previously analysed samples for chemicals within their holding times may be undertaken to further assess level of precision.	<p>Analysed for same chemicals as primary sample.</p> <p>RPD¹ <30% of mean concentration where both concentrations >20 x limit of reporting.</p> <p>RPD <50% of mean concentration where higher concentration 10 – 20 x limit of reporting.</p> <p>No RPD limit where both concentrations <10 x limit of reporting.</p>

¹ Relative Percent Difference (%): Calculated as: (Result No. 1 – Result No. 2/Mean Result)*100

**Table D-2: Quality Control Sampling and Analysis DQIs (continued)**

QC Process	Data Quality Indicator/s	Measure	Acceptance Criteria
Secondary Duplicate Sampling and Analysis	Accuracy	Results are accurate and free from laboratory error. Secondary duplicate samples sent to a secondary laboratory to assess the accuracy of the analyte concentrations reported by the primary laboratory	Analysed for same chemicals as primary sample. RPD <30% of mean concentration where both concentrations >20 x limit of reporting. RPD <50% of mean concentration where higher concentration 10 – 20 x limit of reporting. No RPD limit where both concentrations <10 x limit of reporting.
Field Rinsate Blank Preparation and Analysis	Accuracy and Representativeness	Cross contamination of samples does not occur between sampling locations due to carry-over from sampling equipment. Rinsate blank samples prepared for each sampling procedure. Where possible the rinsate blanks are prepared immediately after sampling locations known to contain concentrations of the chemicals of concern above the limit of quantification and / or before sampling locations where the chemicals being targeted in the laboratory analysis are to be compared to investigation levels near the limit of quantification of the chemical.	Analyte concentrations below limits of reporting.
Laboratory QC Analysis	Laboratory Precision and Accuracy	Laboratory duplicates	As specified by the laboratory.
		Laboratory control spike	Dynamic recovery limits as specified by the laboratory.
		Certified reference material	As specified by the laboratory (generally dynamic recovery limits).
		Surrogate recovery	Dynamic recovery limits as specified by the laboratory.
		Matrix spike recovery	Recovery 70% - 130% or dynamic recovery limits specified by laboratory. However, note that recovery of phenols is generally significantly lower and a recovery in the range 20% - 130% is considered acceptable by most laboratories.
		Matrix spike recovery duplicate	RPD <30%, or as specified by the laboratory.

Data Verification and Validation

The data validation process involved the checking of analytical procedure compliance with acceptance criteria and an assessment of the accuracy and precision of analytical data from the range of quality control indicators generated from both the sampling and analytical programmes.

The checks undertaken are summarised in the attached data validation checklist table. Field replicate and field blank analytical results are provided in **Table D-3**, **Table D-4**, **Table D-5** and **Table D-6**.

Instances where the data quality acceptance criteria were not achieved are discussed below.

**Table D-3: Soil Laboratory QA/ QC Compliance Summary**

Date	Work order number	NATA accredited	Samples received within holding time	Samples extracted/ analysed within holding time	Matrix spike	Laboratory duplicates	Laboratory control spikes	Method Blanks	Surrogates
3/12/2019	694415	✓	✓	✓	✓	✓	✓	✓	✓
8/12/2019	EP1913220	✓	1 x NC	4 x NC	1 x NC	✓	✓	✓	✓
	EP2000242	✓	✓	2 x NC	1 x NC	✓	✓	✓	✓
9/12/2019	EP1913252	✓	✓	1 x NC	3 x NC	✓	✓	✓	✓
11/12/2019	EP1913250	✓	✓	✓	3 x NC	✓	✓	✓	✓
24/02/2020	EP200272	✓	✓	1 x NC	3 x NC	✓	✓	✓	✓
	707123	✓	✓	✓	✓	✓	✓	✓	✓

Table D-4: Sediment Laboratory QA/ QC Compliance Summary

Date	Work order number	NATA accredited	Samples received within holding time	Samples extracted/ analysed within holding time	Matrix spike	Laboratory duplicates	Laboratory control spikes	Method Blanks	Surrogates
2/12/2019	EP1912834	✓	2 x NC	2 x NC	2 x NC	3 x NC	✓	✓	✓
	EP1913434	✓	✓	✓	✓	✓	✓	✓	✓

**Table D-5: Groundwater Laboratory QA/ QC Compliance Summary**

Date	Work order number	NATA accredited	Samples received within holding time	Samples extracted/ analysed within holding time	Matrix spike	Laboratory duplicates	Laboratory control spikes	Method Blanks	Surrogates
8-9/12/2019	EP1913212	✓	1 x NC	1 x NC	3 x NC	✓	✓	✓	✓
	EP1913213	✓	1 x NC	1 x NC	2 x NC	✓	✓	✓	✓
	EP1913247	✓	1 x NC	1 x NC	4 x NC	✓	✓	✓	✓
	RN1258403	✓	✓	✓	✓	✓	✓	✓	NA
	694415	✓	✓	✓	✓	✓	✓	✓	✓

In relation to the above tables, 'NC' indicates the number of 'non-conformances' and 'NA' indicates 'not applicable'.

Table D-6: Dust Laboratory QA/ QC Compliance Summary

Date	Work order number	NATA accredited	Samples received within holding time	Samples extracted/ analysed within holding time	Matrix spike	Laboratory duplicates	Laboratory control spikes	Method Blanks	Surrogates
5-11/12/2019	EN1908941	✓	✓	✓	✓	✓	✓	✓	✓
24/02/2020	EP2001788	✓	✓	✓	✓	✓	✓	✓	✓

Sample Holding Times

Soil

All soil samples were extracted and analysed within the required holding times with exception of:

- pH, moisture content and redox for the majority of samples.
- Total cyanide for sample XRF_BG.
- Total mercury for sample QC09.

The non-conformances for the physical parameters are considered to be minor on the basis that pH, moisture content and redox are not primary indicators of contamination and therefore do not adversely impact on conclusions drawn in this report in relation to potential site contamination and risk assessment.



Sample XRF_BG was extracted for total cyanide analysis two days outside of the recommended holding time. The total cyanide result for sample XRF_BG was below the LoR, which is consistent with all other results reported for this investigation. Given that the other soil work orders did not report a non-compliance for sample extraction and analysis for total cyanide, there is confidence that the result for sample XRF_BG is suitable for assessment purposes.

Sample QC09 was extracted and analysed for total mercury eight and nine days (respectively) outside of the recommended holding times. The total mercury result for sample QC09 was below the LoR, which is consistent with all other results reported for this investigation. Given that the other soil work orders did not report a non-compliance for sample extraction and analysis for total mercury, there is confidence that the result for sample QC09 is suitable for assessment purposes.

Sediment

All sediment samples were extracted and analysed within the recommended holding time with exception of:

- Analysis for simultaneously extracted metals, for all samples in the work order, which was extracted 14 days outside the recommended holding time.
- Analysis for simultaneously extracted metals and acid volatile sulphides, for all samples in the work order, which were analysed eight days outside the recommended holding time.

This non-conformance is considered to be minor on the basis that the samples had been immediately chilled when samples were received and were frozen on receipt at the laboratory and were still frozen when the extraction and analysis was completed. As such, there is no significant potential for chemical change within the soil samples in a frozen state.

Groundwater

All groundwater samples were received by the laboratory, extracted and analysed within the required holding times, with exception of pH which was performed outside the recommended holding time limit of six hours. Due to the nature of fieldwork, it was not practical for laboratory analysis to be undertaken within six hours of sampling. Given that the laboratory and field pH results were consistent with each other, and that pH is not a primary indicator of contamination, there is no reasonable expectation that the holding time exceedance for pH has affected the representativeness of the groundwater results.

Laboratory Duplicates

Soil

No laboratory duplicate sample non-compliances were reported for soil samples.

Sediment

The laboratory duplicate analysis for sediment samples exceeded the internal laboratory RPD acceptance criterion for iron, chromium and nickel for sample PW1. Given that the majority of the primary sample results for chromium and nickel, including PW1, exceeded the available freshwater and marine assessment levels, there is not considered to be any adverse impact on the results due to this non-compliance.

As there is no available adopted assessment level for iron, there is not considered to be a significant impact on these results in relation to a risk-based assessment.

Groundwater

No laboratory duplicate sample non-compliances were reported for groundwater samples.



Matrix Spike Recoveries

Soil

A limited number of matrix spike recovery non-compliances were identified for soil. Upon review of these non-compliances, it was determined that any non-compliances are minor in nature and do not have any significant or adverse impacts on the conclusions drawn in this report, on the following basis:

- Non-compliances relate to an anonymous sample from an unknown work order, and therefore does not relate to the site or site conditions.
- Non-compliances for samples relating to work order EP1913250 included in **Table D-3** included analysis of chromium, manganese and nickel for duplicate sample QC19. An RPD assessment of the primary/ duplicate/ triplicate results indicated a number of exceedances of the RPD acceptance criteria, with triplicate sample QC20 typically reporting the highest of the three results. As such, the highest and therefore most conservative result has been adopted for risk assessment purposes and therefore any minor non-compliance associated with the duplicate sample result is considered to be negligible.
- Non-compliances for samples relating to work order EP2002272 included in **Table D-3** included analysis of chromium and manganese for duplicate sample QC22 and hexavalent chromium for primary sample BG2. These two samples present a primary/ duplicate pair, and given that the RPD results for all analytes for the sample pair were below the acceptance criteria, any minor non-compliances with the matrix spike assessment is not considered to have adversely impacted the dataset.

Sediment

A limited number of matrix spike recovery non-compliances were identified for sediment, where the matrix spike recovery was not determined, and the background level was greater than or equal to the 4 times the spike level. Non-compliances for sample PW2 included analysis of chromium and nickel. Given that the chromium and nickel results for sample PW2 exceeded both the marine and freshwater assessment levels, there is not considered to be any adverse impact on the results due to this non-compliance.

Groundwater

A limited number of matrix spike recovery non-compliances were identified for groundwater, where the matrix spike recovery was not determined, and the background level was greater than or equal to the 4 times the spike level. Upon review of these non-compliances, it was determined that any non-compliances are minor in nature and do not have any significant or adverse impacts on the conclusions drawn in this report, on the following basis:

- Non-compliances relate to an anonymous sample from an unknown work order, and therefore does not relate to the site or site conditions.
- Non-compliances for samples relating to the work orders included in **Table D-5** included analysis of sulfate, chloride and NOX (Nitrite plus Nitrate as N). These analytes are not considered to be primary contaminants of concern and have not been used to make risk-based decisions.
- Non-compliances for samples relating to the work orders included in **Table D-5** included analysis of ammonia for sample BMH06. Given that the ammonia result for sample BMH06 exceeded both the marine and freshwater assessment levels, there is not considered to be any adverse impact on the results due to this non-compliance.



Laboratory Control Samples

No laboratory control sample non-compliances were reported for soil, sediment or groundwater samples.

Laboratory Control Spikes

No laboratory control spike non-compliances were reported for soil, sediment or groundwater samples.

Method Blanks

No method blank non-compliances were reported for soil, sediment or groundwater samples.

Surrogate Recovery

No surrogate recovery non-compliances were reported for soil, sediment or groundwater samples.

Limits of Reporting

Soil

All laboratory LoRs were below the adopted assessment levels for soil.

Sediment

All laboratory LoRs were below the adopted assessment levels for sediment.

Soil Leachate

The laboratory LoR exceeded the Maintenance of Ecosystems (95% Species Protection) assessment levels for freshwater (FW) or marine water (MW) for the following analytes:

- Chromium, with an LoR of 0.01 mg/L, which exceeded the FW assessment level of 0.0033 mg/L and the MW assessment level of 0.0027 mg/L.
- Mercury, with LoR some LORs of 0.000020 mg/L, which exceeded the MW assessment level of 0.00006 mg/L.

In both instances, the comparison against the MWG and FWG were used as an additional line of evidence rather than for direct assessment (with the more useful assessment being the comparison of total versus leachable concentrations for each metal). Further, in the case of mercury, total concentrations were below the adopted assessment criteria and hence this is not considered a COPC.

As such, any potential exceedance of the assessment level would be minor, and this is not considered to have impacted the overall reliability of the data for the purpose of the assessment.

Replicate and Blank Samples

Replicate and blank samples were collected during the soil, sediment and groundwater investigations to confirm the repeatability and validity of the sample collection methods and resultant data. The QA/QC sample information is provided in **Table D-7**, **Table D-8** and **Table D-9**, below.

**Table D-7: Soil Investigation QA/ QC Sample Summary**

Investigation phase	Date	Primary Sample ID	Duplicate Sample ID	Triplicate Sample ID	Rinsate Sample ID
Soil	3/12/2019	MW1_0.05-0.15	QC04	QC05	QC06
	8/12/2019	T4-3	QC09	QC10	QC14
		T4-3_0.3	QC11*	QC12	-
	9/12/2019	-	-	-	QC16
	10/12/2019	-	-	-	QC18
	11/12/2019	T6-8	QC19	QC20	QC21

In relation to **Table D-7**, '*' indicates that duplicate sample QC11 was submitted to the laboratory however analysis was not undertaken due to sample frequencies already being met. Triplicate sample QC12 was submitted for laboratory analysis in error.

Table D-8: Sediment Investigation QA/ QC Sample Summary

Investigation phase	Date	Primary Sample ID	Duplicate Sample ID	Triplicate Sample ID	Rinsate Sample ID
Sediment	2/12/2019	PW2	QC01	QC02	QC03

Table D-9: Groundwater Investigation QA/ QC Sample Summary

Investigation phase	Date	Primary Sample ID	Duplicate Sample ID	Triplicate Sample ID	Rinsate Sample ID
Groundwater	8/12/2019	BMH02A	QC07	QC08	QC13
	9/12/2019	-	-	-	QC15
	10/12/2019	-	-	-	QC17

Replicate dust samples were not collected due to the dynamic nature of the sampling methodology.

A comparison of the replicate samples was undertaken by conducting a RPD analysis using the following formula:

$$RPD (\%) = \left(\frac{\text{Primary Sample Result} - \text{Replicate Sample Result}}{\text{Mean of Primary and Replicate Sample Results}} \right) \times 100$$



Soil RPD Results

All soil RPDs were within the relevant acceptance criteria with exception of:

- Triplicate sample pair T4-3/ QC10:
 - Total chromium (43%)
 - Total iron (39%)
- Triplicate sample pair T4-3_0.3-0.4/ QC12:
 - Total chromium (83%)
 - Total iron (41%)
- Triplicate sample pair T6-8/ QC20:
 - Total chromium (62%)
 - Total cobalt (75%)
 - Total copper (34%)
 - Total iron (36%)
 - Total manganese (141%).
- Background triplicate sample pair BG2/ QC23:
 - Total chromium (53%)
 - Total copper (42%)
 - Total nickel (44%)
 - Total zinc (33%).

For all the above sample pairs, the triplicate result typically represents the highest concentration of the primary, duplicate and triplicate results. However, all analytes with an associated RPD exceedance (with the exception of zinc), all results (primary, duplicate and triplicate) have exceeded the adopted assessment level where an exceedance has occurred. Therefore, there is not considered to be a significant impact on the dataset as a result of these RPD exceedances.

For the zinc RPD exceedance for sample pair BG2/ QC23, the triplicate sample exceeds the NEPM 2013 EIL assessment level, and therefore it has also been assumed that the primary sample exceeds the EIL assessment level for risk-based assessment purposes.

The soil RPD calculations are provided in Table 12 (**Summary Tables**).

Sediment RPD Results

All sediment RPDs were within the relevant acceptance criteria with exception of:

- Duplicate sample pair PW2/ QC01:
 - Total copper (SEM) (51%)
 - Manganese (leached) (40%)
 - Nickel (SEM) (94%) and SEM AVS (74%)
 - Total zinc (SEM) (72%)
 - SEM – AVS (189%)



- Triplicate sample pair PW2/ QC02:
 - Total copper (SEM) (35%)
 - Total nickel (SEM) (89%)

A review of the RPD exceedances for sediment determined that for all for both of the above sample pairs, the triplicate result typically represents the highest concentration of the primary, duplicate and triplicate results. However, all analytes with an associated RPD exceedance, all results (primary, duplicate and triplicate) have exceeded the adopted assessment level where an exceedance has occurred. Therefore, there is not considered to be a significant impact on the dataset as a result of these RPD exceedances.

The sediment RPD calculations are provided in Table 13 and Table 14 (**Summary Tables**).

Groundwater RPD Results

All groundwater RPDs were within the relevant acceptance criteria with exception of a single exceedance for sample pair BMH02A (primary) and QC07 (duplicate), for nitrite, with the RPD value being 34%. Given that the primary sample is the highest result (and therefore the most conservative) of the two samples, the minor exceedance is not considered to have impacted the reliability of the groundwater results.

The groundwater RPD calculations are provided in Table 15 (**Summary Tables**).

Blank sample results

All blank sample results were reported below the laboratory LoR, with the exception of rinsate sample QC15. Sample QC15 measured a number of detections above the laboratory LoR for nutrients, ions and inorganics. Given that all other rinsate sample results were below the LoR, the detected analytes are not primary CoPCs, and the sample methodology was consistent throughout the fieldwork program, these results are considered to be anomalous and are not anticipated to have an impact on the reliability of the results.

Data Suitability

While a small number of QC results were outside specified acceptance criteria, these were not considered to significantly impact on the quality or representativeness of the data, and the majority of results indicated that the precision and accuracy of the data was within acceptable limits. The results are therefore considered to be representative of chemical concentrations in the environmental media sampled at the time of sampling, and to be suitable to be used for their intended purpose in forming conclusions relating to the contamination status of soil and groundwater at the site.



Appendix G: Drill Logs

PROJECT NAME Bulong DSI

PROJECT NUMBER P17302

PROJECT LOCATION Bulong, WA

DATE STARTED 3/12/20

COMPLETED 3/12/19

LOGGED BY MH

CHECKED BY SMS

CONTRACTOR Direct Push Probe

LOCATION (Easting, Northing, Zone) 393468.198 6603697.631 Z51J

EQUIPMENT Hand Auger, Solid Auger

DIMENSIONS 125 mm

INCLINATION Vertical

GROUNDWATER NOTES Water encountered at 6.5 m.

CASING LEVEL 321.630 mAHD

SURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
HA					x	ML	SILT: Non plastic, red brown, loose, dry, no odour.			
SFA					x		Non plastic, pale red-brown, friable, dry, no odour. Weakly cemented.			MW1 0.05 - 0.15 QC04/05.
					x					
					x					
					x					
					x					
				1	x	SCHIST	SCHIST: Very low strength, extremely weathered, green grey.			MW1 1.00 - 1.10
				2						MW1 2.00 - 2.10
				3						MW1 3.00 - 3.10
				4						MW1 4.00 - 4.10
				5		QUARTZITE SCHIST	QUARTZITE: High strength, slightly weathered, white. SCHIST: Low strength, extremely weathered, green grey.			
					x	ML	Clayey SILT: Low plasticity, green grey, soft, moist, dry of plastic limit, no odour.			
				6	x		Very soft, moist, wet of plastic limit, no odour.			
					x					
					x		Soft, wet, wet of plastic limit, no odour.			
				7	x					
					x					
					x					
					x					
				8	x					
							MW1 terminated at 8.00 m bgl Target depth reached.			
				9						
				10						

PROJECT NAME Bulong DSI

PROJECT NUMBER P17302

PROJECT LOCATION Bulong, WA

DATE STARTED 3/12/19

COMPLETED 3/12/19

LOGGED BY MH

CHECKED BY SMS

CONTRACTOR Direct Push Probe

LOCATION (Easting, Northing, Zone) 393032.812 6604265.693 Z51J

EQUIPMENT Hand Auger, Solid Auger

DIMENSIONS 125 mm

INCLINATION Vertical

GROUNDWATER NOTES Water encountered at 11.8 m.

CASING LEVEL 328.721 mAHD

SURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
HA						ML	SILT: Non plastic, red brown, loose, dry, no odour.			MW2_0.05 - 0.15
SFA							Non plastic, light red brown, friable, dry, no odour. Weakly cemented.			
				1						MW2_1.00 - 1.10
				2			Red brown, friable, dry, no odour. Weakly cemented.			MW2_2.00 - 2.10
				3						MW2_3.00 - 3.10
				4		SCHIST	SCHIST: Very low strength, extremely weathered, green grey.			MW2_4.00 - 4.10
				5			Very low strength, slightly weathered, green grey.			
				6			Low strength, slightly weathered, green grey.			MW2_5.00 - 5.10
				7						MW2_6.00 - 6.10
				8						
				9						MW2_9.40 - 9.50
				10						



MONITORING WELL MW2

PAGE 2 OF 2

PROJECT NAME Bulong DSIPROJECT NUMBER P17302PROJECT LOCATION Bulong, WADATE STARTED 3/12/19COMPLETED 3/12/19LOGGED BY MHCHECKED BY SMSCONTRACTOR Direct Push ProbeLOCATION (Easting, Northing, Zone) 393032.812 6604265.693 Z51JEQUIPMENT Hand Auger, Solid AugerDIMENSIONS 125 mmINCLINATION VerticalGROUNDWATER NOTES Water encountered at 11.8 m.CASING LEVEL 328.721 mAHDSURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
				11			Low strength, slightly weathered, green grey. <i>(continued)</i>			
				12		CH	Silty CLAY: High plasticity, trace fine grained, poorly graded, sub-rounded to sub-angular gravel, dark green, soft, moist, wet of plastic limit, no odour.			
						SCHIST	SCHIST: Moderate strength, slightly weathered, green-grey. MW2 terminated at 12.10 m bgl Target depth reached.			
				13						
				14						
				15						
				16						
				17						
				18						
				19						
				20						



MONITORING WELL MW3

PAGE 1 OF 2

PROJECT NAME Bulong DSI

PROJECT NUMBER P17302

PROJECT LOCATION Bulong, WA

DATE STARTED 5/12/20

COMPLETED 5/12/20

LOGGED BY MH

CHECKED BY SMS

CONTRACTOR Direct Push Probe

LOCATION (Easting, Northing, Zone) 392142.908 6603298.338 Z51J

EQUIPMENT Solid Auger

DIMENSIONS 125 mm

INCLINATION Vertical

GROUNDWATER NOTES Water encountered at 16.5 m.

CASING LEVEL 323.744 mAHD

SURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
SFA					x	ML	SILT: Non plastic, red brown, very soft, dry, no odour.			MW3_0.05 - 0.15
					x	SCHIST	SCHIST: Very low strength, extremely weathered, white grey.			
				1						
							Pale yellow brown.			
				2						
				3						
				4						
							Low strength, extremely weathered, green grey.			
				5						
				6						
				7						
				8						
				9						
				10						



MONITORING WELL MW3

PAGE 2 OF 2

PROJECT NAME Bulong DSIPROJECT NUMBER P17302PROJECT LOCATION Bulong, WADATE STARTED 5/12/20COMPLETED 5/12/20LOGGED BY MHCHECKED BY SMSCONTRACTOR Direct Push ProbeLOCATION (Easting, Northing, Zone) 392142.908 6603298.338 Z51JEQUIPMENT Solid AugerDIMENSIONS 125 mmINCLINATION VerticalGROUNDWATER NOTES Water encountered at 16.5 m.CASING LEVEL 323.744 mAHDSURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
						CL	Silty CLAY: Low plasticity, green grey, soft, moist, dry of plastic limit, no odour.			
				11						
				12						
				13		SCHIST	SCHIST: Very low strength, highly weathered, green grey.			
				14						
				15						
				16		ML	Clayey SILT: Low plasticity, green grey becoming dark green, soft, moist, dry of plastic limit, no odour.			
							Moist, near of plastic limit.			
				17						
				18				Moisture not identified in cuttings. Inflow identified when augers removed from bore.		
				19						
				20			MW3 terminated at 19.50 m bgl Target depth reached.			



MONITORING WELL MW4

PAGE 1 OF 2

PROJECT NAME Bulong DSIPROJECT NUMBER P17302PROJECT LOCATION Bulong, WADATE STARTED 4/12/20COMPLETED 4/12/20LOGGED BY MHCHECKED BY SMSCONTRACTOR Direct Push ProbeLOCATION (Easting, Northing, Zone) 392141.081 6602757.226 Z51JEQUIPMENT Solid AugerDIMENSIONS 125 mmINCLINATION VerticalGROUNDWATER NOTES Water encountered at 14.5 m.CASING LEVEL 326.721 mAHDSURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
SFA						FILL	FILL: SILT, non plastic, red brown, friable, dry, no odour. (Reworked natural material).			MW4_0.05 - 0.15
				1						
				2						
				3						
				4						
				5		ML	SILT: Non plastic, pale red brown, friable, dry, no odour. Weakly cemented.			
				6						
				7		SCHIST	Low strength, highly weathered, pale red brown becoming green brown.			
				8			Green brown.			
				9						
				10						



MONITORING WELL MW4

PAGE 2 OF 2

PROJECT NAME Bulong DSIPROJECT NUMBER P17302PROJECT LOCATION Bulong, WADATE STARTED 4/12/20COMPLETED 4/12/20LOGGED BY MHCHECKED BY SMSCONTRACTOR Direct Push ProbeLOCATION (Easting, Northing, Zone) 392141.081 6602757.226 Z51JEQUIPMENT Solid AugerDIMENSIONS 125 mmINCLINATION VerticalGROUNDWATER NOTES Water encountered at 14.5 m.CASING LEVEL 326.721 mAHDSURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
				11			Green brown. (continued)			
				12		ML	Clayey SILT: Low plasticity, green brown, firm, moist, near plastic limit, no odour.			
				13			Dark green brown, moist, wet of plastic limit.			
				14						
				15			Wet, wet of plastic limit.			
						SCHIST	SCHIST: Moderate strength, slightly weathered, green grey.			
				16			MW4 terminated at 15.20 m bgl Target depth reached.			
				17						
				18						
				19						
				20						

PAGE 1 OF 2



MONITORING WELL MW5

PAGE 2 OF 2

PROJECT NAME Bulong DSIPROJECT NUMBER P17302PROJECT LOCATION Bulong, WADATE STARTED 5/12/20COMPLETED 5/12/20LOGGED BY MHCHECKED BY SMSCONTRACTOR Direct Push ProbeLOCATION (Easting, Northing, Zone) 391147.211 6602731.246 Z51JEQUIPMENT Solid AugerDIMENSIONS 125 mmINCLINATION VerticalGROUNDWATER NOTES Water not encountered during drilling.CASING LEVEL 336.478 mAHDSURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
				11		SCHIST	SCHIST: Very low strength, extremely weathered, pale brown. <i>(continued)</i>			
				12			Pale brown.			
				13			Brown.			
				14	x x x x x x x	ML	Clayey SILT: Low plasticity, orange brown, soft, moist, dry of plastic limit, no odour.			
				15		SCHIST	SCHIST: Low strength, highly weathered, green brown.			
				16			Low strength, slightly weathered, green brown.			
				17						
				18			MW5 terminated at 17.50 m bgl Target depth reached.			
				19						
				20						

PROJECT NAME Bulong DSIPROJECT NUMBER P17302PROJECT LOCATION Bulong, WADATE STARTED 2/12/20COMPLETED 2/12/20LOGGED BY MH / BHCHECKED BY SMSCONTRACTOR -LOCATION (Easting, Northing, Zone) AHDEQUIPMENT Hand ExcavationDIMENSIONS -INCLINATION VerticalGROUNDWATER NOTES -CASING LEVEL -SURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
					x x x x x x x	ML	ClayeySILT: Low plasticity, pale grey white becoming red brown, stiff, moist, wet of plastic limit, no odour.			PW2_0.00 - 0.10 7 bags. QC01/02.
				0.5			PW2 terminated at 0.10 m bgl Target depth reached.			
				1.0						



BOREHOLE NUMBER PW3

PAGE 1 OF 1

PROJECT NAME Bulong DSI

PROJECT NUMBER P17302 PROJECT LOCATION Bulong, WA

DATE STARTED 2/12/20 COMPLETED 2/12/20 LOGGED BY MH / BH CHECKED BY SMS

CONTRACTOR - LOCATION (Easting, Northing, Zone) AHD

EQUIPMENT Hand Excavation DIMENSIONS - INCLINATION Vertical

GROUNDWATER NOTES - CASING LEVEL - SURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
					x x x x x x x	ML	Clayey SILT: Low plasticity,, pale grey white becoming red brown, stiff, moist, wet of plastic limit, no odour.			PW3_0.00 - 0.10 7 bags.
							PW3 terminated at 0.10 m bgl Target depth reached.			
				0.5						
				1.0						



BOREHOLE NUMBER PW4

PAGE 1 OF 1

PROJECT NAME Bulong DSI

PROJECT NUMBER P17302 PROJECT LOCATION Bulong, WA

DATE STARTED 2/12/20 COMPLETED 2/12/20 LOGGED BY MH / BH CHECKED BY SMS

CONTRACTOR - LOCATION (Easting, Northing, Zone) AHD

EQUIPMENT Hand Excavation DIMENSIONS - INCLINATION Vertical

GROUNDWATER NOTES - CASING LEVEL - SURFACE LEVEL -

GENERAL NOTES -

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
					x x x x x x x	ML	Clayey SILT: Low plasticity, pale grey white becoming red brown, stiff, moist, wet of plastic limit, no odour.			PW4 0.00 - 0.10 7 bags.
							PW4 terminated at 0.10 m bgl Target depth reached.			
				0.5						
				1.0						



BOREHOLE NUMBER PW5

PAGE 1 OF 1

PROJECT NAME Bulong DSI

PROJECT NUMBER P17302 PROJECT LOCATION Bulong, WA

DATE STARTED 2/12/20 COMPLETED 2/12/20 LOGGED BY MH / BH CHECKED BY SMS

CONTRACTOR - LOCATION (Easting, Northing, Zone) AHD

EQUIPMENT Hand Excavation DIMENSIONS - INCLINATION Vertical

GROUNDWATER NOTES - CASING LEVEL - SURFACE LEVEL -

GENERAL NOTES


DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
					x x x x x x x	ML	Clayey SILT: Low plasticity, pale grey white becoming red brown, hard, moist, dry of plastic limit, no odour.			PW5_0.00 - 0.10 7 bags.
							PW5 terminated at 0.10 m bgl Target depth reached.			
				0.5						
				1.0						

**BOREHOLE NUMBER PW6**

PAGE 1 OF 1

PROJECT NAME Bulong DSIPROJECT NUMBER P17302PROJECT LOCATION Bulong, WADATE STARTED 2/12/20COMPLETED 2/12/20LOGGED BY MH / BHCHECKED BY SMSCONTRACTOR -LOCATION (Easting, Northing, Zone) AHDEQUIPMENT Hand ExcavationDIMENSIONS -INCLINATION VerticalGROUNDWATER NOTES -CASING LEVEL -SURFACE LEVEL -

GENERAL NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING	
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Additional Observations	PID (ppm)	Sample ID & Interval (QA/QC)
						SP	Silty SAND: Fine grained, poorly graded, rounded sand, red brown, loose, dry.			PW6_0.00 - 0.10 7 bags.
							PW6 terminated at 0.10 m bgl Target depth reached.			
				0.5						
				1.0						



Appendix H: Laboratory Analytical Data

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Senversa Pty Ltd
www.senversa.com.au
ABN 89 132 231 380

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Blagioni / Client Services Coordinator
Phone: 08 9406 1301

Chain of Custody Documentation

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information							Container Information						
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles							
1	S19T4_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x	x	x	x	x	
2	S19T4_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x					
3	S3T4_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x	x	x	x		
4	S3T4_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x					
5	S13T23_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x			x		
6	S13T23_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x					
7	S11T1_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x					
8	S11T1_0.3-0.35	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x					
9	S3T23_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x			x		
10	S3T23_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x					
Total							40	10	10	2	2	2	3

Analysis Required														Comments: e.g. Highly contaminated sample; hazardous materials present, trace LORs etc.
8 Metals (S-02)	Total Metals by ICP-AES; Se, Co, Mn, Fe (EG005T)	Clay Content by Hydrometer	Redox Potential (1:5)	pH (CaCl)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cyanide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	8 Metals (Water/Leachable) ICPMS & FILMS As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS; Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	
x	x	x	x	x	x		x	x	x	x	x	x	x	Relabel T19-4
x	x												x	Relabel T19-4_0.3-0.4
x	x	x		x									x	Relabel T4-3
x	x												x	Relabel T4-3_0.3-0.4
x	x				x		x	x	x	x	x	x	x	Relabel T23-13
x	x												x	Relabel T23-13_0.3-0.4
x	x												x	Relabel T11-11
x	x												x	Relabel 1-11_0.3-0.4
x	x				x		x	x	x	x	x	x	x	Relabel T123-3
x	x												x	Relabel T23-3_0.3-0.4

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ABN 89 132 231 360

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Bagdon / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information					Container Information					8 Metals Fe EGC	Clay Content	Redox	pH (Ca)	Total Hg digestion	Exchange treatment	Total Cr Analysis	1:5 leach	Deionised	8 Metals FIMS	Water Sb, Co	Hexavalent	HOLD	
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles																	
11	XRF_BG	Soil	3/12/2019	-	2 jars, 2 bags	4	X	X	X		X	X	x	x	x	x	x	x	x	x	x		
12	MW1_0.05-0.15	Soil	3/12/2019	-	1 jar	1											x	x			x		
13	MW1_1.0-1.1	Soil	3/12/2019	-	1 jar	1															x		
14	MW1_2.0-2.1	Soil	3/12/2019	-	1 jar	1															x		
15	MW1_3.0-3.1	Soil	3/12/2019	-	1 jar	1															x		
16	MW1_4.0-4.1	Soil	3/12/2019	-	1 jar	1															x		
17	MW2_0.05-0.15	Soil	3/12/2019	-	1 jar	1															x		
18	MW2_0.5-0.6	Soil	3/12/2019	-	1 jar	1															x		
19	MW2_1.0-1.1	Soil	3/12/2019	-	1 jar	1															x		
20	MW2_2.0-2.1	Soil	3/12/2019	-	1 jar	1															x		
21	MW2_3.0-3.1	Soil	3/12/2019	-	1 jar	1															x		
22	MW2_4.0-4.1	Soil	3/12/2019	-	1 jar	1															x		
23	MW2_5.0-5.1	Soil	3/12/2019	-	1 jar	1															x		
24	MW2_6.0-6.1	Soil	3/12/2019	-	1 jar	1															x		
25	MW2_8.4-8.5	Soil	3/12/2019	-	1 jar	1															x		
26	MW4_0.05-0.15	Soil	5/12/2019	-	1 jar	1															x		
27	MW5_0.05-0.15	Soil	6/12/2019	-	1 jar	1															x		
28	MW3_0.05-0.15	Soil	6/12/2019	-	1 jar	1															x		
29	S3T1_0.05-0.15	Soil	8/12/2019	-	2 jars, 2 bags	4	X	x							x	x	x	x	x	x			Relabel T1-3
30	S3T1_03-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	X	x															Relabel T1-3, 0.3-0.4
Total							29	3	3	1	1	1	1	1	2	2	2	2	2	2	18		

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project
Sampler Name: Matthew Hunt/Brandon Henry
Signature: 
Date: 8/12/2019

Relinquished By:	Date:	Method of Shipment (if applicable):	Received by:	Date:
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO3) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic;
V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

SVA
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MS
ALS

12.12.19
Sam

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ABN 89 132 231 380

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Blagioni / Client Services Coordin
Phone: 08 9406 1301

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Tin	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information					Container Information		8 Metals	Total Metals Fe (EG005T)	Clay Content	Redox	pH (CaCl2)	Total Hexavalent Chromium digestion	Exchangeable Cations treatment	Total Cyanide Analysis	1:5 leach	Deionised Water Leach	8 Metals FIMS : As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles															
30	T9-T15	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
31	T9-T15_0.15-0.25	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
32	T9-7	Soil	9/12/2019		2 jars, 2 bags	4	X	X	X			x		x	x	x	x	x	x	X	
33	T9-7_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
34	T13-2	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
35	T13-2_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
36	T13-8	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
37	T13-8_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
38	T24-4	Soil	9/12/2019		2 jars, 2 bags	4	X	X	x			x		x	x	x	x	x	x	X	
39	T24-20	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
40	T24-20_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
41	T17-4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
42	T17-4_0.05-0.15	Soil	9/12/2019		2 jars	2	X	X												X	
43	T8-3	Soil	9/12/2019		2 jars, 2 bags	4	X	X	x			x		x	x	x	x	x	x	X	
44	T8-3_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
45	T8-12	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
46	T8-12_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
Total						66	17	17	3	0	0	3	0	3	3	3	3	3	3	17	

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures | Sampler Name: Matthew Hunt/Brandon Henry | Signature: | Date: 8/12/2019

Relinquished By:	Method of Shipment (if applicable):	Received by:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

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ABN 89 132 231 380

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Tm:	Standard
Project Manager:	Blair Coleman	Page:	of
Email Report To:	blair.coleman@senversa.com.au	Phone/Mobile:	+61 405 296 017

Sample Information							Container Information																	Comments
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals	Total M Fe (EG)	Clay Co	Redox	pH (Ca)	Total H ₂ O ₂ digestion	Exchange treatment	Total C ₁ Analytes	1:5 leach	Deionised	8 Metals FIMS	Water Co. Min	Hexave	HOLD				
48517	QC04	Soil	8/12/2019	-	2 jars, 2 bags	1														x				
-	QC05	Soil	8/12/2019	-	2 jars, 2 bags	1														x	FWD to Eurofins			
48448	QC09	Soil	8/12/2019	-	2 jars, 2 bags	4														x				
-	QC10	Soil	8/12/2019	-	2 jars, 2 bags	4	X	x				x	x	X	x	x	x	x	x		FWD to Eurofins			
48449	QC11	Soil	8/12/2019	-	2 jars, 2 bags	4														x				
-	QC12	Soil	8/12/2019	-	2 jars, 2 bags	4														x	FWD to Eurofins			

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or Date: 8/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO3) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic;
V = VOA Vol Hydrochloric Acid (HCl) Preserved; VS = VOA Vol Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L = Lugol's iodine preserved white plastic bottle; SW = sulfuric acid preserved wide mouth glass jar

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913220

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : 17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Matthew Hunt/Brandon Henry</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 4</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
--	--

Dates

Date Samples Received : 12-Dec-2019 08:00	Issue Date : 16-Dec-2019
Client Requested Due : 23-Dec-2019	Scheduled Reporting Date : 23-Dec-2019
Date	

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 8	Temperature : 20.2 - Ice present
Receipt Detail :	No. of samples received / analysed : 49 / 30

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
- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- **Clay Content analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Moisture Content : EA055		
T23-3_0.3-0.4	- Snap Lock Bag - Friable Asbestos/PSD Bag	- Soil Glass Jar - Unpreserved
Total Mercury by FIMS : EG035T		
T23-3_0.3-0.4	- Snap Lock Bag - Friable Asbestos/PSD Bag	- Soil Glass Jar - Unpreserved
Total Metals by ICP-AES : EG005T		
T23-3_0.3-0.4	- Snap Lock Bag - Friable Asbestos/PSD Bag	- Soil Glass Jar - Unpreserved

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	Client sampling date / time	Client sample ID	SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - EA075 Redox Potential (1:5)	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - S-02 8 Metals (incl. Digestion)
EP1913220-001	08-Dec-2019 00:00	T19-4	✓	✓	✓	✓	✓	✓	✓
EP1913220-002	08-Dec-2019 00:00	T19-4_0.3-0.4		✓			✓		✓
EP1913220-003	08-Dec-2019 00:00	T4-3	✓	✓	✓	✓	✓		✓
EP1913220-004	08-Dec-2019 00:00	T4-3_0.3-0.4		✓			✓		✓
EP1913220-005	08-Dec-2019 00:00	T23-13		✓			✓	✓	✓
EP1913220-006	08-Dec-2019 00:00	T23-13_0.3-0.4		✓			✓		✓
EP1913220-007	08-Dec-2019 00:00	T11-11		✓			✓		✓
EP1913220-008	08-Dec-2019 00:00	T11-11_0.3-0.4		✓			✓		✓
EP1913220-009	08-Dec-2019 00:00	T123-3		✓			✓	✓	✓
EP1913220-010	08-Dec-2019 00:00	T23-3_0.3-0.4		✓			✓		✓
EP1913220-011	03-Dec-2019 00:00	XRF_BG	✓	✓	✓	✓	✓	✓	✓
EP1913220-028	08-Dec-2019 00:00	T1-3		✓			✓	✓	✓
EP1913220-029	08-Dec-2019 00:00	T1-3_0.3-0.4		✓			✓		✓
EP1913220-030	09-Dec-2019 00:00	T9-T15		✓			✓		✓
EP1913220-031	09-Dec-2019 00:00	T9-T15_0.15-0.25		✓			✓		✓
EP1913220-032	09-Dec-2019 00:00	T9-7		✓		✓	✓	✓	✓
EP1913220-033	09-Dec-2019 00:00	T9-7_0.3-0.4		✓			✓		✓
EP1913220-034	09-Dec-2019 00:00	T13-2		✓			✓		✓
EP1913220-035	09-Dec-2019 00:00	T13-2_0.3-0.4		✓			✓		✓
EP1913220-036	09-Dec-2019 00:00	T13-8		✓			✓		✓
EP1913220-037	09-Dec-2019 00:00	T13-8_0.3-0.4		✓			✓		✓
EP1913220-038	09-Dec-2019 00:00	T24-4		✓		✓	✓	✓	✓
EP1913220-039	09-Dec-2019 00:00	T24-20		✓			✓		✓
EP1913220-040	09-Dec-2019 00:00	T24-20_0.3-0.4		✓			✓		✓
EP1913220-041	09-Dec-2019 00:00	T17-4		✓			✓		✓
EP1913220-042	09-Dec-2019 00:00	T17-4_0.05-0.15		✓			✓		✓
EP1913220-043	09-Dec-2019 00:00	T8-3		✓		✓	✓	✓	✓
EP1913220-044	09-Dec-2019 00:00	T8-3_0.3-0.4		✓			✓		✓



			SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - EA075 Redox Potential (1:5)	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - S-02 8 Metals (incl. Digestion)
EP1913220-045	09-Dec-2019 00:00	T8-12		✓			✓		✓
EP1913220-046	09-Dec-2019 00:00	T8-12_0.3-0.4		✓			✓		✓
			(On Hold) SOIL No analysis requested	SOIL - ED008 Def Exchangeable Cations with pre-treatment -	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EG048G Total Hexavalent Chromium (Alkaline digestion)	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - EN60-D1a Deionised Water Leach	SOIL - W-02W (ICPMS) 8 Metals (Water Leachable) ICPMS & FIMS
EP1913220-001	08-Dec-2019 00:00	T19-4			✓	✓	✓	✓	✓
EP1913220-005	08-Dec-2019 00:00	T23-13			✓	✓	✓	✓	✓
EP1913220-009	08-Dec-2019 00:00	T123-3			✓	✓	✓	✓	✓
EP1913220-011	03-Dec-2019 00:00	XRF_BG		✓	✓	✓	✓	✓	✓
EP1913220-012	03-Dec-2019 00:00	MW1_0.05-0.15	✓						
EP1913220-013	03-Dec-2019 00:00	MW1_1.0-1.1	✓						
EP1913220-014	03-Dec-2019 00:00	MW1_2.0-2.1	✓						
EP1913220-015	03-Dec-2019 00:00	MW1_3.0-3.1	✓						
EP1913220-016	03-Dec-2019 00:00	MW1_4.0-4.1	✓						
EP1913220-017	03-Dec-2019 00:00	MW2_0.05-0.15	✓						
EP1913220-018	03-Dec-2019 00:00	MW2_0.5-0.6	✓						
EP1913220-019	03-Dec-2019 00:00	MW2_1.0-1.1	✓						
EP1913220-020	03-Dec-2019 00:00	MW2_2.0-2.1	✓						
EP1913220-021	03-Dec-2019 00:00	MW2_3.0-3.1	✓						
EP1913220-022	03-Dec-2019 00:00	MW2_4.0-4.1	✓						
EP1913220-023	03-Dec-2019 00:00	MW2_5.0-5.1	✓						
EP1913220-024	03-Dec-2019 00:00	MW2_6.0-6.1	✓						
EP1913220-025	03-Dec-2019 00:00	MW2_9.4-9.5	✓						
EP1913220-026	06-Dec-2019 00:00	MW5_0.05-0.15	✓						
EP1913220-027	06-Dec-2019 00:00	MW3_0.05-0.15	✓						
EP1913220-028	08-Dec-2019 00:00	T1-3			✓		✓	✓	✓
EP1913220-032	09-Dec-2019 00:00	T9-7			✓	✓	✓	✓	✓
EP1913220-038	09-Dec-2019 00:00	T24-4			✓	✓	✓	✓	✓
EP1913220-043	09-Dec-2019 00:00	T8-3			✓	✓	✓	✓	✓
EP1913220-047	08-Dec-2019 00:00	QC04	✓						
EP1913220-048	08-Dec-2019 00:00	QC09	✓						
EP1913220-049	08-Dec-2019 00:00	QC11	✓						

Matrix: SOIL

Laboratory sample ID Client sampling date / time Client sample ID



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: SOIL

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
EA001: pH in soil using a 0.01M CaCl2 extract							
XRF_BG	Soil Glass Jar - Unpreserved	10-Dec-2019	16-Dec-2019	12-Dec-2019	✖	----	----

Requested Deliverables

Blaire Coleman

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Attachment - Report (SUBCO)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email blaire.coleman@senversa.com.au
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Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.au

CERTIFICATE OF ANALYSIS

Work Order : **EP1913220**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **Matthew Hunt/Brandon Henry**
Site : **----**
Quote number : **EP/382/19 V2**
No. of samples received : **49**
No. of samples analysed : **30**

Page : 1 of 11
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 08:00
Date Analysis Commenced : 13-Dec-2019
Issue Date : 24-Dec-2019 23:18



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Michael Byrne	Laboratory Technician	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EA150H: Soil particle density results for EP1913220-001 fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- EG005T: Total metals for sample #10 confirmed by re-extraction and re-analysis.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H^+ + Al^{3+}).



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				T19-4	T23-13	T123-3	XRF_BG	T1-3
Client sampling date / time				08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	03-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913220-001	EP1913220-005	EP1913220-009	EP1913220-011	EP1913220-028
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.006	0.002	<0.001	0.003	0.004
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	0.270	0.007	<0.001	0.088	0.044
Cobalt	7440-48-4	0.001	mg/L	0.032	<0.001	<0.001	0.004	0.002
Copper	7440-50-8	0.001	mg/L	0.009	0.002	<0.001	0.002	0.002
Lead	7439-92-1	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.323	0.013	<0.001	0.039	0.041
Nickel	7440-02-0	0.001	mg/L	0.494	0.016	<0.001	0.076	0.015
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	0.071	<0.005	0.006	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L	11.6	0.41	<0.05	3.09	1.76
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				T9-7	T24-4	T8-3	----	----
Client sampling date / time				09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	----	----
Compound	CAS Number	LOR	Unit	EP1913220-032	EP1913220-038	EP1913220-043	-----	-----
				Result	Result	Result	----	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.005	<0.001	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	0.038	<0.001	0.026	----	----
Cobalt	7440-48-4	0.001	mg/L	0.004	<0.001	0.002	----	----
Copper	7440-50-8	0.001	mg/L	0.003	<0.001	0.002	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.056	<0.001	0.044	----	----
Nickel	7440-02-0	0.001	mg/L	0.053	<0.001	0.016	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	----	----
Iron	7439-89-6	0.05	mg/L	2.18	<0.05	1.63	----	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T19-4	T19-4_0.3-0.4	T4-3	T4-3_0.3-0.4	T23-13
Client sampling date / time					08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-001	EP1913220-002	EP1913220-003	EP1913220-004	EP1913220-005
					Result	Result	Result	Result	Result
EA001: pH in soil using 0.01M CaCl extract									
pH (CaCl2)	----	0.1	pH Unit		6.2	----	6.2	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		4.8	22.0	17.0	8.1	27.1
EA075: Redox Potential									
Redox Potential	----	0.1	mV		193	----	204	----	----
pH Redox	----	0.1	pH Unit		7.6	----	8.2	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		10	----	9	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		4.64	----	2.73	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		54	52	21	21	62
Iron	7439-89-6	50	mg/kg		51900	50000	53700	41700	54600
Manganese	7439-96-5	5	mg/kg		567	594	431	318	851
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		8	8	6	8	6
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		823	718	708	360	719
Copper	7440-50-8	5	mg/kg		18	20	24	36	27
Lead	7439-92-1	5	mg/kg		<5	<5	5	<5	<5
Nickel	7440-02-0	2	mg/kg		728	699	180	138	786
Zinc	7440-66-6	5	mg/kg		21	21	38	46	36
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	----	----	----	<0.5
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	----	----	----	<1
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		6.5	----	----	----	7.7



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T23-13_0.3-0.4	T1-11	T1-11_0.3-0.4	T123-3	T23-3_0.3-0.4
Client sampling date / time					08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-006	EP1913220-007	EP1913220-008	EP1913220-009	EP1913220-010
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		7.8	2.4	26.8	32.0	15.6
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		57	30	29	12	<2
Iron	7439-89-6	50	mg/kg		55800	70000	52900	30900	540
Manganese	7439-96-5	5	mg/kg		628	745	702	230	9
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		6	6	7	10	<5
Cadmium	7440-43-9	1	mg/kg		<1	1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		784	1260	857	432	4
Copper	7440-50-8	5	mg/kg		21	18	28	17	<5
Lead	7439-92-1	5	mg/kg		<5	7	5	<5	<5
Nickel	7440-02-0	2	mg/kg		737	291	267	120	<2
Zinc	7440-66-6	5	mg/kg		25	44	31	18	<5
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		----	----	----	<0.5	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	----	----	<1	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	----	----	7.6	----

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	XRF_BG	T1-3	T1-3_0.3-0.4	T9-T15	T9-T15_0.15-0.25
Client sampling date / time				03-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	
Compound	CAS Number	LOR	Unit	EP1913220-011	EP1913220-028	EP1913220-029	EP1913220-030	EP1913220-031	
				Result	Result	Result	Result	Result	
EA001: pH in soil using 0.01M CaCl extract									
pH (CaCl2)	----	0.1	pH Unit	6.2	----	----	----	----	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%	10.7	21.3	9.2	8.0	16.0	
EA075: Redox Potential									
Redox Potential	----	0.1	mV	182	----	----	----	----	
pH Redox	----	0.1	pH Unit	7.7	----	----	----	----	
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%	11	----	----	----	----	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.76	----	----	----	----	
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g	7.2	----	----	----	----	
Exchangeable Magnesium	----	0.1	meq/100g	5.5	----	----	----	----	
Exchangeable Potassium	----	0.1	meq/100g	0.5	----	----	----	----	
Exchangeable Sodium	----	0.1	meq/100g	0.2	----	----	----	----	
Cation Exchange Capacity	----	0.1	meq/100g	13.3	----	----	----	----	
Exchangeable Sodium Percent	----	0.1	%	1.2	----	----	----	----	
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg	49	22	29	21	28	
Iron	7439-89-6	50	mg/kg	50300	62200	61800	51700	42700	
Manganese	7439-96-5	5	mg/kg	514	486	431	528	714	
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5	
Arsenic	7440-38-2	5	mg/kg	7	6	9	<5	<5	
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1	
Chromium	7440-47-3	2	mg/kg	822	1060	1040	511	578	
Copper	7440-50-8	5	mg/kg	16	19	30	12	13	
Lead	7439-92-1	5	mg/kg	<5	6	6	6	6	
Nickel	7440-02-0	2	mg/kg	682	260	278	184	199	
Zinc	7440-66-6	5	mg/kg	19	41	36	24	15	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	----	----	----	----	
EK026SF: Total CN by Segmented Flow Analyser									



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	XRF_BG	T1-3	T1-3_0.3-0.4	T9-T15	T9-T15_0.15-0.25
Client sampling date / time					03-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-011	EP1913220-028	EP1913220-029	EP1913220-030	EP1913220-031
					Result	Result	Result	Result	Result
EK026SF: Total CN by Segmented Flow Analyser - Continued									
Total Cyanide	57-12-5	1	mg/kg		<1	<1	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		7.4	8.4	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T9-7	T9-7_0.3-0.4	T13-2	T13-2_0.3-0.4	T13-8
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-032	EP1913220-033	EP1913220-034	EP1913220-035	EP1913220-036
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		5.8	24.0	17.8	16.5	14.7
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		8	----	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.72	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		48	31	12	28	4
Iron	7439-89-6	50	mg/kg		43000	39300	47100	60200	27100
Manganese	7439-96-5	5	mg/kg		645	356	271	432	119
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		6	11	<5	10	<5
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		507	503	458	732	172
Copper	7440-50-8	5	mg/kg		21	19	11	29	7
Lead	7439-92-1	5	mg/kg		<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		514	383	109	302	22
Zinc	7440-66-6	5	mg/kg		23	18	25	40	9
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	----	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		8.2	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T13-8_0.3-0.4	T24-4	T24-20	T24-20_0.3-0.4	T17-4
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-037	EP1913220-038	EP1913220-039	EP1913220-040	EP1913220-041
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		18.1	22.1	20.0	24.8	18.3
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	4	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	2.49	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		9	32	25	15	40
Iron	7439-89-6	50	mg/kg		22600	70800	50600	35500	34600
Manganese	7439-96-5	5	mg/kg		154	713	1480	438	1030
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		6	15	<5	6	7
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		92	1190	289	186	358
Copper	7440-50-8	5	mg/kg		35	22	27	22	18
Lead	7439-92-1	5	mg/kg		<5	8	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		54	280	163	93	402
Zinc	7440-66-6	5	mg/kg		20	22	50	28	25
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		----	<0.5	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	<1	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	8.4	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T17-4_0.05-0.15	T8-3	T8-3_0.3-0.4	T8-12	T8-12_0.3-0.4
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-042	EP1913220-043	EP1913220-044	EP1913220-045	EP1913220-046
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		32.1	17.9	25.5	37.1	29.8
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	16	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	2.67	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		68	36	29	40	20
Iron	7439-89-6	50	mg/kg		34100	60600	30800	41600	30000
Manganese	7439-96-5	5	mg/kg		473	1000	363	956	296
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		<5	6	7	6	12
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		202	590	394	385	221
Copper	7440-50-8	5	mg/kg		35	26	37	36	39
Lead	7439-92-1	5	mg/kg		<5	7	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		315	324	307	458	215
Zinc	7440-66-6	5	mg/kg		104	48	20	42	27
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		----	<0.5	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	<1	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	7.7	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP1913220	Page	: 1 of 9
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 13-Dec-2019
C-O-C number	: ----	Issue Date	: 24-Dec-2019
Sampler	: Matthew Hunt/Brandon Henry		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 49		
No. of samples analysed	: 30		



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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Michael Byrne	Laboratory Technician	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2777841)									
EP1913156-038	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	159	173	8.50	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	16	14	9.89	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	47	40	16.4	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	9	9	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	16	16	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	517	474	8.67	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	50	47	6.34	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	32100	30500	5.26	0% - 20%
EP1913220-010	T23-3_0.3-0.4	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	4	4	25.2	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	9	7	14.1	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	540	520	3.80	0% - 50%
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2777844)									
EP1913220-036	T13-8	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	172	173	0.700	0% - 20%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2777844) - continued									
EP1913220-036	T13-8	EG005T: Cobalt	7440-48-4	2	mg/kg	4	4	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	22	21	0.00	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	7	6	16.5	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	119	111	6.98	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	9	10	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	27100	28200	3.86	0% - 20%
EP1913220-046	T8-12_0.3-0.4	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	221	218	1.59	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	20	20	0.00	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	215	217	0.961	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	12	11	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	39	37	4.84	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	296	297	0.00	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	27	27	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	30000	29400	1.92	0% - 20%
EA001: pH in soil using 0.01M CaCl extract (QC Lot: 2766561)									
EP1912971-010	Anonymous	EA001: pH (CaCl2)	----	0.1	pH Unit	6.0	6.1	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2778004)									
EP1913220-001	T19-4	EA055: Moisture Content	----	0.1	%	4.8	4.6	4.10	No Limit
EP1913220-010	T23-3_0.3-0.4	EA055: Moisture Content	----	0.1	%	15.6	15.7	0.669	0% - 50%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2778005)									
EP1913220-037	T13-8_0.3-0.4	EA055: Moisture Content	----	0.1	%	18.1	19.6	8.07	0% - 50%
EP1913220-046	T8-12_0.3-0.4	EA055: Moisture Content	----	0.1	%	29.8	29.4	1.10	0% - 20%
EA075: Redox Potential (QC Lot: 2776159)									
EP1913220-011	XRF_BG	EA075: Redox Potential	----	0.1	mV	182	184	0.710	0% - 20%
		EA075: pH Redox	----	0.1	pH Unit	7.7	7.5	1.84	0% - 20%
EA075: Redox Potential (QC Lot: 2777861)									
EP1913220-001	T19-4	EA075: Redox Potential	----	0.1	mV	193	192	0.728	0% - 20%
		EA075: pH Redox	----	0.1	pH Unit	7.6	7.6	0.00	0% - 20%
ED007: Exchangeable Cations (QC Lot: 2777756)									
EP1913220-011	XRF_BG	ED007: Exchangeable Sodium Percent	----	0.1	%	1.2	1.0	16.0	0% - 50%
		ED007: Exchangeable Calcium	----	0.1	meq/100g	7.2	6.7	7.34	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	5.5	5.2	4.11	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.5	0.5	0.00	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED007: Exchangeable Cations (QC Lot: 2777756) - continued									
EP1913220-011	XRF_BG	ED007: Exchangeable Sodium	----	0.1	meq/100g	0.2	0.1	0.00	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	13.3	12.5	6.14	0% - 20%
EP1913338-021	Anonymous	ED007: Exchangeable Sodium Percent	----	0.1	%	1.8	1.7	0.00	0% - 50%
		ED007: Exchangeable Calcium	----	0.1	meq/100g	19.7	19.8	0.00	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.6	0.7	0.00	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	0.00	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	0.4	0.4	0.00	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	20.8	20.8	0.484	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2777842)									
EP1913156-038	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913220-010	T23-3_0.3-0.4	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2777843)									
EP1913220-036	T13-8	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913220-046	T8-12_0.3-0.4	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 2777758)									
EP1913220-001	T19-4	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP1913377-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2773713)									
EP1913220-001	T19-4	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
EP1913250-011	Anonymous	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743)									
EP1913220-001	T19-4	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.270	0.323	17.8	0% - 20%
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	0.032	0.034	6.33	0% - 20%
		EG020A-W: Copper	7440-50-8	0.001	mg/L	0.009	0.010	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	0.323	0.340	5.24	0% - 20%
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.494	0.558	12.2	0% - 20%
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	0.071	0.078	10.3	0% - 50%
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	11.6	13.1	12.0	0% - 20%
EP1913250-011	Anonymous	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.002	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	0.001	<0.001	0.00	No Limit

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 Work Order : EP1913220
 Client : SENVERSA PTY LTD
 Project : 17302 Bulong DSI



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743) - continued									
EP1913250-011	Anonymous	EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2776745)									
EP1913173-004	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913220-043	T8-3	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2781907)									
EP1913151-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913220-011	XRF_BG	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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.

Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
	Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High		
	<5	22 mg/kg	102	81.5	118
	<1	5 mg/kg	92.0	76.2	106
	<2	42.2 mg/kg	90.3	66.9	138
	<2	----	----	----	----
	<5	34 mg/kg	97.9	79.1	113
	<50	----	----	----	----
	<5	40 mg/kg	99.5	78.9	112
	<5	----	----	----	----
	<2	55.5 mg/kg	101	81.5	126
	<5	----	----	----	----
	<5	62 mg/kg	100	81.0	119
	<5	22 mg/kg	104	81.5	118
	<1	5 mg/kg	94.0	76.2	106
	<2	42.2 mg/kg	94.0	66.9	138
	<2	----	----	----	----
	<5	34 mg/kg	97.8	79.1	113
	<50	----	----	----	----
	<5	40 mg/kg	102	78.9	112
	<5	----	----	----	----
	<2	55.5 mg/kg	102	81.5	126
	<5	----	----	----	----
	<5	62 mg/kg	104	81.0	119
	----	4 pH Unit	100	98.8	101
	----	7 pH Unit	100	99.2	101
	<0.1	21.6 meq/100g	101	82.9	117
	<0.1	1.76 meq/100g	102	78.4	119
	<0.1	1 meq/100g	109	87.9	129
	<0.1	0.9 meq/100g	103	92.9	132
	<0.1	25.3 meq/100g	101	84.7	117
	<0.1	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777842) - continued								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	96.3	81.0	115
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777843)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	98.2	81.0	115
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2777758)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	40 mg/kg	99.8	70.0	130
				<0.5	20 mg/kg	82.1	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773713)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	91.5	74.2	106

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743)								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	108	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	104	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	103	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	101	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.5	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	95.4	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	114	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.0	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2781907)								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	102	93.0	115

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: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2777841)							
EP1913156-038	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	89.6	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2777841) - continued							
EP1913156-038	Anonymous	EG005T: Cadmium	7440-43-9	12.5 mg/kg	94.0	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	81.0	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	91.6	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	104	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	93.9	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	78.2	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	87.5	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2777844)							
EP1913220-036	T13-8	EG005T: Arsenic	7440-38-2	50 mg/kg	90.4	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	103	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	103	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	99.2	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	103	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	96.8	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	103	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	104	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777842)							
EP1913156-038	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	91.9	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777843)							
EP1913220-036	T13-8	EG035T: Mercury	7439-97-6	1 mg/kg	95.8	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2777758)							
EP1913220-001	T19-4	EG048G: Hexavalent Chromium	18540-29-9	40 mg/kg	95.1	70.0	130
EP1913220-001	T19-4	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	114	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773713)							
EP1913220-005	T23-13	EK026SF: Total Cyanide	57-12-5	20 mg/kg	95.5	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743)							
EP1913220-005	T23-13	EG020A-W: Arsenic	7440-38-2	1 mg/L	112	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	111	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	103	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	103	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	110	70.0	130



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743) - continued							
EP1913220-005	T23-13	EG020A-W: Lead	7439-92-1	1 mg/L	108	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	109	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	108	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	114	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)							
EP1913220-009	T123-3	EG035W: Mercury	7439-97-6	0.01 mg/L	100	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2781907)							
EP1913151-003	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	102	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913220	Page	: 1 of 10
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 24-Dec-2019
Sampler	: Matthew Hunt/Brandon Henry	No. of samples received	: 49
Order number	: ----	No. of samples analysed	: 30

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP1913156--038	Anonymous	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA001: pH in soil using 0.01M CaCl extract						
Soil Glass Jar - Unpreserved XRF_BG	16-Dec-2019	10-Dec-2019	6	----	----	----
Soil Glass Jar - Unpreserved T19-4, T4-3	16-Dec-2019	15-Dec-2019	1	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved XRF_BG	----	----	----	20-Dec-2019	17-Dec-2019	3
EA075: Redox Potential						
Soil Glass Jar - Unpreserved XRF_BG	19-Dec-2019	17-Dec-2019	2	----	----	----
Soil Glass Jar - Unpreserved T19-4, T4-3	23-Dec-2019	22-Dec-2019	1	----	----	----
EK026SF: Total CN by Segmented Flow Analyser						
Soil Glass Jar - Unpreserved XRF_BG	19-Dec-2019	17-Dec-2019	2	----	----	----

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	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
Container / Client Sample ID(s)							



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA001: pH in soil using 0.01M CaCl extract							
Soil Glass Jar - Unpreserved (EA001) XRF_BG	03-Dec-2019	16-Dec-2019	10-Dec-2019	✖	16-Dec-2019	16-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA001) T19-4, T4-3	08-Dec-2019	16-Dec-2019	15-Dec-2019	✖	16-Dec-2019	16-Dec-2019	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA055) T23-3_0.3-0.4	08-Dec-2019	----	----	----	20-Dec-2019	22-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA055) XRF_BG	03-Dec-2019	----	----	----	20-Dec-2019	17-Dec-2019	✖
Soil Glass Jar - Unpreserved (EA055) T19-4, T4-3, T23-13, T1-11, T123-3, T1-3_0.3-0.4 T19-4_0.3-0.4, T4-3_0.3-0.4, T23-13_0.3-0.4, T1-11_0.3-0.4, T1-3,	08-Dec-2019	----	----	----	20-Dec-2019	22-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA055) T9-T15, T9-7, T13-2, T13-8, T24-4, T24-20_0.3-0.4, T17-4_0.05-0.15, T8-3_0.3-0.4, T8-12_0.3-0.4 T9-T15_0.15-0.25, T9-7_0.3-0.4, T13-2_0.3-0.4, T13-8_0.3-0.4, T24-20, T17-4, T8-3, T8-12,	09-Dec-2019	----	----	----	20-Dec-2019	23-Dec-2019	✓
EA075: Redox Potential							
Soil Glass Jar - Unpreserved (EA075) XRF_BG	03-Dec-2019	19-Dec-2019	17-Dec-2019	✖	19-Dec-2019	19-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA075) T19-4, T4-3	08-Dec-2019	23-Dec-2019	22-Dec-2019	✖	23-Dec-2019	23-Dec-2019	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) XRF_BG	03-Dec-2019	----	----	----	19-Dec-2019	31-May-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) T19-4, T4-3	08-Dec-2019	----	----	----	19-Dec-2019	05-Jun-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) T9-7, T8-3, T24-4,	09-Dec-2019	----	----	----	19-Dec-2019	06-Jun-2020	✓



Matrix: **SOIL**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA152: Soil Particle Density								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) XRF_BG		03-Dec-2019	----	----	----	19-Dec-2019	31-May-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) T19-4,	T4-3	08-Dec-2019	----	----	----	19-Dec-2019	05-Jun-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) T9-7, T8-3	T24-4,	09-Dec-2019	----	----	----	19-Dec-2019	06-Jun-2020	✓
ED007: Exchangeable Cations								
Soil Glass Jar - Unpreserved (ED007) XRF_BG		03-Dec-2019	20-Dec-2019	31-Dec-2019	✓	20-Dec-2019	31-Dec-2019	✓
EG005(ED093)T: Total Metals by ICP-AES								
Snap Lock Bag - Friable Asbestos/PSD Bag (EG005T) T23-3_0.3-0.4		08-Dec-2019	20-Dec-2019	05-Jun-2020	✓	20-Dec-2019	05-Jun-2020	✓
Soil Glass Jar - Unpreserved (EG005T) XRF_BG		03-Dec-2019	20-Dec-2019	31-May-2020	✓	20-Dec-2019	31-May-2020	✓
Soil Glass Jar - Unpreserved (EG005T) T19-4, T4-3, T23-13, T1-11, T123-3, T1-3_0.3-0.4	T19-4_0.3-0.4, T4-3_0.3-0.4, T23-13_0.3-0.4, T1-11_0.3-0.4, T1-3,	08-Dec-2019	20-Dec-2019	05-Jun-2020	✓	20-Dec-2019	05-Jun-2020	✓
Soil Glass Jar - Unpreserved (EG005T) T9-T15, T9-7, T13-2, T13-8, T24-4, T24-20_0.3-0.4, T17-4_0.05-0.15, T8-3_0.3-0.4, T8-12_0.3-0.4	T9-T15_0.15-0.25, T9-7_0.3-0.4, T13-2_0.3-0.4, T13-8_0.3-0.4, T24-20, T17-4, T8-3, T8-12,	09-Dec-2019	20-Dec-2019	06-Jun-2020	✓	20-Dec-2019	06-Jun-2020	✓



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG035T: Total Recoverable Mercury by FIMS								
Snap Lock Bag - Friable Asbestos/PSD Bag (EG035T) T23-3_0.3-0.4	08-Dec-2019	20-Dec-2019	05-Jan-2020	✓	20-Dec-2019	05-Jan-2020	✓	
Soil Glass Jar - Unpreserved (EG035T) XRF_BG	03-Dec-2019	20-Dec-2019	31-Dec-2019	✓	20-Dec-2019	31-Dec-2019	✓	
Soil Glass Jar - Unpreserved (EG035T) T19-4, T4-3, T23-13, T1-11, T123-3, T1-3_0.3-0.4	T19-4_0.3-0.4, T4-3_0.3-0.4, T23-13_0.3-0.4, T1-11_0.3-0.4, T1-3,	08-Dec-2019	20-Dec-2019	05-Jan-2020	✓	20-Dec-2019	05-Jan-2020	✓
Soil Glass Jar - Unpreserved (EG035T) T9-T15, T9-7, T13-2, T13-8, T24-4, T24-20_0.3-0.4, T17-4_0.05-0.15, T8-3_0.3-0.4, T8-12_0.3-0.4	T9-T15_0.15-0.25, T9-7_0.3-0.4, T13-2_0.3-0.4, T13-8_0.3-0.4, T24-20, T17-4, T8-3, T8-12,	09-Dec-2019	20-Dec-2019	06-Jan-2020	✓	20-Dec-2019	06-Jan-2020	✓
EG048: Hexavalent Chromium (Alkaline Digest)								
Soil Glass Jar - Unpreserved (EG048G) XRF_BG	03-Dec-2019	20-Dec-2019	31-Dec-2019	✓	23-Dec-2019	27-Dec-2019	✓	
Soil Glass Jar - Unpreserved (EG048G) T19-4, T123-3	T23-13,	08-Dec-2019	20-Dec-2019	05-Jan-2020	✓	23-Dec-2019	27-Dec-2019	✓
Soil Glass Jar - Unpreserved (EG048G) T9-7, T8-3	T24-4,	09-Dec-2019	20-Dec-2019	06-Jan-2020	✓	23-Dec-2019	27-Dec-2019	✓
EK026SF: Total CN by Segmented Flow Analyser								
Soil Glass Jar - Unpreserved (EK026SF) XRF_BG	03-Dec-2019	19-Dec-2019	17-Dec-2019	✗	20-Dec-2019	02-Jan-2020	✓	
Soil Glass Jar - Unpreserved (EK026SF) T19-4, T123-3,	T23-13, T1-3	08-Dec-2019	19-Dec-2019	22-Dec-2019	✓	20-Dec-2019	02-Jan-2020	✓
Soil Glass Jar - Unpreserved (EK026SF) T9-7, T8-3	T24-4,	09-Dec-2019	19-Dec-2019	23-Dec-2019	✓	20-Dec-2019	02-Jan-2020	✓



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) XRF_BG	03-Dec-2019	13-Dec-2019	31-Dec-2019	✓	----	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) T19-4, T123-3, T123-3, T1-3	08-Dec-2019	13-Dec-2019	05-Jan-2020	✓	----	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) T9-7, T8-3	09-Dec-2019	13-Dec-2019	06-Jan-2020	✓	----	----	----

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG020W: Water Leachable Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) T19-4, T123-3, T1-3, T24-4,	T23-13, XRF_BG, T9-7, T8-3	13-Dec-2019	20-Dec-2019	10-Jun-2020	✓	20-Dec-2019	10-Jun-2020	✓
EG035W: Water Leachable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) T19-4, T123-3, T1-3, T24-4,	T23-13, XRF_BG, T9-7, T8-3	13-Dec-2019	----	----	----	19-Dec-2019	10-Jan-2020	✓
EG050G-W: Hexavalent Chromium - Water Leachable								
Clear Plastic Bottle - NaOH (EG050G-W) T19-4, T123-3, T1-3, T24-4,	T23-13, XRF_BG, T9-7, T8-3	13-Dec-2019	---	----	----	23-Dec-2019	10-Jan-2020	✓

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.

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

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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							



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 Control Samples (LCS) - Continued							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	14	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	14	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	14	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH in soil using a 0.01M CaCl ₂ extract	EA001	SOIL	In house: Referenced to Rayment and Lyons (2011) 4B3 (mod.) or 4B4 (mod.) 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Redox Potential	EA075	SOIL	In house: Ion selective electrode. Analysis is performed on a 1:5 soil:de-ionised water extract.
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060A. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.
pH in soil using a 0.01M CaCl2 extract	EA001-PR	SOIL	In house: Referenced to Rayment and Higginson 4B1, 10 g of soil is mixed with 50 mL of 0.01M CaCl2 and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	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 (2013) Schedule B(3)
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Deionised Water Leach	EN60-Dia	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information							Analysis Required														Comments: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals (S-02)	Total Metals by CP-AES; Se, Co, Mn, Fe (EG005T)	Clay Content by Hydrometer	Redox Potential (1:5)	pH (CaCl)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cyanide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	8 Metals (Water Leachable) (CPMS & FIMS / As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	
1	T16-1	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X	X					X	X	X	X	X	X	X	
2	T16-0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4			X											X	
3	T16-9	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X												X	
4	T16_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4								X	X	X	X	X	X	X	
5	T20-3	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X												X	
6	T20-3_0.1	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
7	T6-8	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X	X											X	
8	T6-8_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
9	T6-4	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X												X	
10	T6-4_0.15-0.25	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
11	T11-9	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X						X	X	X	X	X	X	X	
12	T11-9_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
13	T11-1	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X	X											X	
14	T11-1_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
15	QC19	Soil	11/12/2019	-	2 jars, 1 bag	3	X	X	X					X	X	X	X	X	X	X	
16	QC20	Soil	11/12/2019	-	2 jars, 1 bag	3	X	X													FWD to Eurofins
17	QC21	Water	11/12/2019	-	1N	1													X		
18	LAST SAMPLE End of TB Surface 1																				
Total						63	9	9	5	0	0	0	0	4	4	4	4	4	4	16	

Environmental Division
Perth
Work Order Reference
EP1913250



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt / Brandon Henry Signature: Date: 11/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date: 12.12.19
Of:	Time:	Date/Time:		Of:	Time: 10am
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EP1913250**

Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: blaire.coleman@senversa.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Facsimile	: +61 03 9606 0074	Facsimile	: +61-8-9406 1399
Project	: P17302 Bulong DSI	Page	: 1 of 3
Order number	: ----	Quote number	: EP2019SENV0005 (EP/382/19 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Brandon Henry, Matthew Hunt		

Dates

Date Samples Received	: 12-Dec-2019 10:00	Issue Date	: 12-Dec-2019
Client Requested Due Date	: 24-Dec-2019	Scheduled Reporting Date	: 24-Dec-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 4	Temperature	: 9.0/24.0 - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 18 / 9

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
- EA150-H conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EP1913250-017 : [11-Dec-2019] : LRSF SAMPLE - North Border

EP1913250-018 : [11-Dec-2019] : End of T13 Surface Soil

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	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - EN60-D1a Deionised Water Leach	SOIL - S-02 Metals (incl. Digestion)	SOIL - W-02W (ICPMS) Metals (Water Leachable) ICPMS & FIMS
EP1913250-001	11-Dec-2019 00:00	T16-1	✓	✓	✓	✓	✓	✓	✓
EP1913250-002	11-Dec-2019 00:00	T16-0.3-0.4		✓					
EP1913250-003	11-Dec-2019 00:00	T16-9	✓		✓			✓	
EP1913250-005	11-Dec-2019 00:00	T20-3	✓		✓	✓	✓	✓	✓
EP1913250-007	11-Dec-2019 00:00	T6-8	✓	✓	✓			✓	
EP1913250-009	11-Dec-2019 00:00	T6-4	✓		✓			✓	
EP1913250-011	11-Dec-2019 00:00	T11-9	✓		✓	✓	✓	✓	✓
EP1913250-013	11-Dec-2019 00:00	T11-1	✓	✓	✓			✓	
EP1913250-015	11-Dec-2019 00:00	QC19	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser
EP1913250-001	11-Dec-2019 00:00	T16-1		✓	✓
EP1913250-004	11-Dec-2019 00:00	T16_0.3-0.4	✓		
EP1913250-005	11-Dec-2019 00:00	T20-3		✓	✓
EP1913250-006	11-Dec-2019 00:00	T20-3_0.1	✓		
EP1913250-008	11-Dec-2019 00:00	T6-8_0.3-0.4	✓		
EP1913250-010	11-Dec-2019 00:00	T6-4_0.15-0.25	✓		
EP1913250-011	11-Dec-2019 00:00	T11-9		✓	✓
EP1913250-012	11-Dec-2019 00:00	T11-9_0.3-0.4	✓		
EP1913250-014	11-Dec-2019 00:00	T11-1_0.3-0.4	✓		
EP1913250-015	11-Dec-2019 00:00	QC19		✓	✓
EP1913250-017	11-Dec-2019 00:00	LRSF SAMPLE North B...	✓		
EP1913250-018	11-Dec-2019 00:00	End of T13 Surface S...	✓		



Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested
EP1913250-016	11-Dec-2019 00:00	QC21	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

JUSTIN LUMSDEN

- *AU Certificate of Analysis - NATA (COA)	Email	justin.lumsden@senversa.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	justin.lumsden@senversa.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	justin.lumsden@senversa.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	justin.lumsden@senversa.com.au
- Attachment - Report (SUBCO)	Email	justin.lumsden@senversa.com.au
- Chain of Custody (CoC) (COC)	Email	justin.lumsden@senversa.com.au
- EDI Format - ENMRG (ENMRG)	Email	justin.lumsden@senversa.com.au
- EDI Format - ESDAT (ESDAT)	Email	justin.lumsden@senversa.com.au
- EDI Format - XTab (XTAB)	Email	justin.lumsden@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EP1913250**
Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES TERRACE
 PERTH 6000
Telephone : +61 08 6557 8881
Project : P17302 Bulong DSI
Order number : ----
C-O-C number : ----
Sampler : Brandon Henry, Matthew Hunt
Site : ----
Quote number : EP/382/19 V2
No. of samples received : 18
No. of samples analysed : 9

Page : 1 of 5
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 10:00
Date Analysis Commenced : 13-Dec-2019
Issue Date : 27-Dec-2019 11:53



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150-H conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EA150H: Soil particle density results fell outside the scope of AS1289.3.6.3 due to high amounts of iron present. Results should be scrutinised accordingly.



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				T16-1	T20-3	T11-9	QC19	----
Client sampling date / time				11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	----
Compound	CAS Number	LOR	Unit	EP1913250-001	EP1913250-005	EP1913250-011	EP1913250-015	-----
				Result	Result	Result	Result	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	0.002	0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	0.004	<0.001	0.003	0.002	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	0.002	0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L	0.006	<0.001	<0.001	<0.001	----
Nickel	7440-02-0	0.001	mg/L	0.003	0.097	0.001	0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T16-1	T16-0.3-0.4	T16-9	T20-3	T6-8
Client sampling date / time					11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913250-001	EP1913250-002	EP1913250-003	EP1913250-005	EP1913250-007
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		1.3	----	15.5	23.4	1.9
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		5	4	----	----	8
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.91	2.89	----	----	2.58
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		25	----	24	49	50
Iron	7439-89-6	50	mg/kg		52000	----	39900	39000	39800
Manganese	7439-96-5	5	mg/kg		756	----	613	469	1520
Selenium	7782-49-2	5	mg/kg		<5	----	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		<5	----	<5	8	41
Cadmium	7440-43-9	1	mg/kg		1	----	<1	<1	1
Chromium	7440-47-3	2	mg/kg		758	----	441	386	843
Copper	7440-50-8	5	mg/kg		11	----	12	25	36
Lead	7439-92-1	5	mg/kg		7	----	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		174	----	221	648	686
Zinc	7440-66-6	5	mg/kg		20	----	20	31	19
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	----	<0.1	<0.1	<0.1
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	----	----	<1	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		7.6	----	----	7.4	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T6-4	T11-9	T11-1	QC19	----
Client sampling date / time					11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	----
Compound	CAS Number	LOR	Unit		EP1913250-009	EP1913250-011	EP1913250-013	EP1913250-015	-----
					Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		1.3	<1.0	4.7	3.4	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	----	3	5	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	----	2.60	2.66	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		39	28	27	52	----
Iron	7439-89-6	50	mg/kg		45600	36400	38800	42300	----
Manganese	7439-96-5	5	mg/kg		1220	567	633	1570	----
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	----
Arsenic	7440-38-2	5	mg/kg		6	5	7	40	----
Cadmium	7440-43-9	1	mg/kg		1	<1	<1	1	----
Chromium	7440-47-3	2	mg/kg		326	429	367	931	----
Copper	7440-50-8	5	mg/kg		36	18	32	41	----
Lead	7439-92-1	5	mg/kg		<5	<5	<5	<5	----
Nickel	7440-02-0	2	mg/kg		477	290	244	691	----
Zinc	7440-66-6	5	mg/kg		44	17	30	19	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	<1	----	<1	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	8.9	----	8.8	----

QUALITY CONTROL REPORT

Work Order	: EP1913250	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 13-Dec-2019
C-O-C number	: ----	Issue Date	: 27-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 18		
No. of samples analysed	: 9		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774147)									
EP1913248-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	13	13	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	9	9	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	28	27	0.00	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	12	13	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	16	16	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	9	10	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	39	39	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	41	40	2.74	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	13600	14100	3.33	0% - 20%
EP1913248-011	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	14	13	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	6	6	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	24	25	4.83	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	10	12	10.7	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	13	13	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	9	9	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	37	37	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	39	41	4.91	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	12900	12600	2.26	0% - 20%
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774149)									
EP1913250-015	QC19	EG005T: Cadmium	7440-43-9	1	mg/kg	1	1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	931	902	3.23	0% - 20%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774149) - continued									
EP1913250-015	QC19	EG005T: Cobalt	7440-48-4	2	mg/kg	52	51	0.00	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	691	664	4.03	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	40	39	3.16	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	41	40	2.64	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	1570	1420	10.0	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	19	18	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	42300	40200	5.17	0% - 20%
EP1913323-003	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	2	2	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	470	480	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2772669)									
EP1913250-001	T16-1	EA055: Moisture Content	----	0.1	%	1.3	1.2	11.0	No Limit
EP1913287-002	Anonymous	EA055: Moisture Content	----	0.1	%	16.1	16.5	2.04	0% - 50%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2774148)									
EP1913248-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913248-011	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2774150)									
EP1913250-015	QC19	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913323-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2773713)									
EP1913220-001	Anonymous	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
EP1913250-011	T11-9	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743)									
EP1913220-001	Anonymous	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.270	0.323	17.8	0% - 20%
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	0.032	0.034	6.33	0% - 20%



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743) - continued									
EP1913220-001	Anonymous	EG020A-W: Copper	7440-50-8	0.001	mg/L	0.009	0.010	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	0.323	0.340	5.24	0% - 20%
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.494	0.558	12.2	0% - 20%
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	0.071	0.078	10.3	0% - 50%
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	11.6	13.1	12.0	0% - 20%
EP1913250-011	T11-9	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.002	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2776745)									
EP1913173-004	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913220-043	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2782805)									
EP1913173-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913269-002	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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.

Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
	Spike	Spike Recovery (%)	Recovery Limits (%)		
Result	Concentration	LCS	Low	High	
<5	22 mg/kg	104	81.5	118	
<1	5 mg/kg	96.0	76.2	106	
<2	42.2 mg/kg	91.8	66.9	138	
<2	----	----	----	----	
<5	34 mg/kg	103	79.1	113	
<50	----	----	----	----	
<5	40 mg/kg	99.0	78.9	112	
<5	----	----	----	----	
<2	55.5 mg/kg	98.6	81.5	126	
<5	----	----	----	----	
<5	62 mg/kg	101	81.0	119	
<5	22 mg/kg	104	81.5	118	
<1	5 mg/kg	99.0	76.2	106	
<2	42.2 mg/kg	98.1	66.9	138	
<2	----	----	----	----	
<5	34 mg/kg	105	79.1	113	
<50	----	----	----	----	
<5	40 mg/kg	103	78.9	112	
<5	----	----	----	----	
<2	55.5 mg/kg	104	81.5	126	
<5	----	----	----	----	
<5	62 mg/kg	103	81.0	119	
<0.1	2.154 mg/kg	104	81.0	115	
<0.1	2.154 mg/kg	109	81.0	115	
<1	40 mg/kg	91.5	74.2	106	
Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
	Spike	Spike Recovery (%)	Recovery Limits (%)		
Result	Concentration	LCS	Low	High	



Sub-Matrix: **WATER**

Method: Compound				Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
CAS Number	LOR	Unit						
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743) - continued								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	108	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	104	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	103	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	101	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.5	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	95.4	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	114	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.0	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	101	93.0	115

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: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774147)							
EP1913248-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	101	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	100	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	100.0	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	101	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	102	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	103	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	101	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	98.3	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149)							
EP1913250-015	QC19	EG005T: Arsenic	7440-38-2	50 mg/kg	74.5	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	92.4	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149) - continued							
EP1913250-015	QC19	EG005T: Cobalt	7440-48-4	50 mg/kg	87.4	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	100.0	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	96.5	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	# Not Determined	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	84.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774148)							
EP1913248-001	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	92.0	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774150)							
EP1913250-015	QC19	EG035T: Mercury	7439-97-6	1 mg/kg	98.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773713)							
EP1913220-005	Anonymous	EK026SF: Total Cyanide	57-12-5	20 mg/kg	95.5	70.0	130

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743)							
EP1913220-005	Anonymous	EG020A-W: Arsenic	7440-38-2	1 mg/L	112	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	111	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	103	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	103	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	110	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	108	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	109	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	108	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	114	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)							
EP1913220-009	Anonymous	EG035W: Mercury	7439-97-6	0.01 mg/L	100	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)							
EP1913173-003	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	104	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913250	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 27-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt	No. of samples received	: 18
Order number	: ----	No. of samples analysed	: 9

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	QC19	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	QC19	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	QC19	Nickel	7440-02-0	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

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.

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
T16-1, T20-3, T6-4, T11-1, T16-9, T6-8, T11-9, QC19	11-Dec-2019	----	----	----	18-Dec-2019	25-Dec-2019	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H)							
QC19	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓
Snap Lock Bag: Separate bag received (EA150H)							
T16-1, T6-8, T16-0.3-0.4, T11-1	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓
EA152: Soil Particle Density							
Snap Lock Bag (EA152)							
QC19	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓
Snap Lock Bag: Separate bag received (EA152)							
T16-1, T6-8, T16-0.3-0.4, T11-1	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓

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

Matrix: WATER			Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.				
Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020W: Water Leachable Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) T16-1, T20-3, T11-9, QC19	13-Dec-2019	20-Dec-2019	10-Jun-2020	✔	20-Dec-2019	10-Jun-2020	✔
EG035W: Water Leachable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) T16-1, T20-3, T11-9, QC19	13-Dec-2019	----	----	----	19-Dec-2019	10-Jan-2020	✔
EG050G-W: Hexavalent Chromium - Water Leachable							
Clear Plastic Bottle - NaOH (EG050G-W) T16-1, T20-3, T11-9, QC19	13-Dec-2019	----	----	----	23-Dec-2019	10-Jan-2020	✔

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.

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

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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							

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 Work Order : EP1913250
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



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							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazine. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.



<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	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 (2013) Schedule B(3)
Deionised Water Leach	EN60-D1a	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)



Senversa Pty Ltd
www.senversa.com.au
ABN 89 132 231 380

Chain of Custody Documentation

Laboratory: ALS WA
Address: 28 Rigali Way, Wangara WA 6065
Contact: Lauren Blagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/mobile:	+61 409 296 017

Sample Information					Container Information	
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles
1	T5-T8	soil	9/12/2019			4
2	T5-6_0.3-0.4	soil	9/12/2019			4
3	T10-8	soil	9/12/2019			4
4	T10-8_0.3-0.4	soil	9/12/2019			4
5	T10-17	soil	9/12/2019			4
6	T10-17_0.3-0.4	soil	9/12/2019			4
				</		

Environmental Division
Perth
Work Order Reference
EP1913252



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:	Sampler Name: Matthew Hunt / Brandon Henry	Signature:	Date: 11/12/2019
---	--	------------	------------------

Relinquished By:	Method of Shipment (if applicable):	Received by: <i>Phannon</i>
Name/Signature:	Carrier / Reference #:	Name/Signature:
Date:	Date/Time:	Date: 16/12/19
Name/Signature:	Carrier / Reference #:	Time: 4:33pm
Date:	Date/Time:	
Name/Signature:	Carrier / Reference #:	
Date:	Date/Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic;
V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's Iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____



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ABN 89 132 231 380

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Chain of Custody Documentation

Job Number: P17302		Purchase Order:																		
Project Name: Bulong DSI		Quote No: EP-382-19 (V2)																		
Sampled By: Matthew Hunt / Brandon Henry		Turn Around Time: Standard																		
Project Manager: Blaire Coleman		Page: of																		
Email Report To: blaire.coleman@senversa.com.au		Phone/Mobile: +61 409 296 017																		
Sample Information					Container Information		Analysis Required												Comments: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.	
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	1:5 Leach	Total Metals by ICP-AES: Fe	Redox Potential (1:5)	pH (CaCl)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Clay Content by Hydrometer	Deionised Water Leach	8 Metals (Water Leachable) CPMS & FIMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	Total Cyanide by Segmented Flow Analyser		HOLD
1	T5-6	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	
2	T5-6_0.3-0.4	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	
3	T10-8	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	
4	T10-8_0.3-0.4	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	
5	T10-17	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	
6	T10-17_0.3-0.4	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	
Total							24	6	6	6	6	6	6	6	6	6	6	6	0	

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt / Brandon Henry Signature: Date: 10/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date: 12/12/19	
Of:	Time:	Date/Time:	Of:	Time: 1000	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913252

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Brandon Henry, Matthew Hunt</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 12-Dec-2019 10:00	Issue Date : 17-Dec-2019
Client Requested Due : 30-Dec-2019	Scheduled Reporting Date : 30-Dec-2019
Date	

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 4	Temperature : 9.0/24.0 - Ice present
Receipt Detail :	No. of samples received / analysed : 6 / 3

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
- PSD analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- **PSD analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - EN60-Dia Deionised Water Leach	SOIL - S-02 & Metals (incl. Digestion)
EP1913252-001	09-Dec-2019 00:00	T5-T6		✓	✓	✓	✓		✓
EP1913252-002	09-Dec-2019 00:00	T5-6_0.3-0.4	✓						
EP1913252-003	09-Dec-2019 00:00	T10-8		✓		✓	✓	✓	✓
EP1913252-004	09-Dec-2019 00:00	T10-8_0.3-0.4	✓						
EP1913252-005	09-Dec-2019 00:00	T10-17		✓		✓	✓		✓
EP1913252-006	09-Dec-2019 00:00	T10-17_0.3-0.4	✓						

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - W-02W (ICPMS) & Metals (Water Leachable) ICPMS & FIMS
EP1913252-003	09-Dec-2019 00:00	T10-8	✓	✓	✓

Proactive Holding Time Report

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



Requested Deliverables

Blaire Coleman

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Attachment - Report (SUBCO)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au

JUSTIN LUMSDEN

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- Attachment - Report (SUBCO)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email	supplieraccounts@senversa.com.au
-------	----------------------------------

CERTIFICATE OF ANALYSIS

Work Order : **EP1913252**
Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES TERRACE
 PERTH 6000
Telephone : +61 08 6557 8881
Project : P17302 Bulong DSI
Order number : ----
C-O-C number : ----
Sampler : Brandon Henry, Matthew Hunt
Site : ----
Quote number : EP/382/19 V2
No. of samples received : 6
No. of samples analysed : 3

Page : 1 of 4
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 10:00
Date Analysis Commenced : 18-Dec-2019
Issue Date : 30-Dec-2019 15:57



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- PSD analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.



Analytical Results

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

Client sample ID

				T10-8	----	----	----	----
Client sampling date / time				09-Dec-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP1913252-003	-----	-----	-----	-----
Result				----	----	----	----	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.002	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.003	----	----	----	----
Cobalt	7440-48-4	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	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.08	----	----	----	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T5-T6	T10-8	T10-17	----	----
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		EP1913252-001	EP1913252-003	EP1913252-005	-----	-----
					Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		23.3	23.4	27.4	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		1	----	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.56	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		46	23	47	----	----
Iron	7439-89-6	50	mg/kg		42900	46200	64800	----	----
Manganese	7439-96-5	5	mg/kg		1270	685	948	----	----
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	----	----
Arsenic	7440-38-2	5	mg/kg		6	6	7	----	----
Cadmium	7440-43-9	1	mg/kg		<1	1	2	----	----
Chromium	7440-47-3	2	mg/kg		359	404	607	----	----
Copper	7440-50-8	5	mg/kg		26	23	24	----	----
Lead	7439-92-1	5	mg/kg		<5	<5	<5	----	----
Nickel	7440-02-0	2	mg/kg		520	268	476	----	----
Zinc	7440-66-6	5	mg/kg		36	14	45	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	<1	<1	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	9.0	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP1913252	Page	: 1 of 6
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 18-Dec-2019
C-O-C number	: ----	Issue Date	: 30-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 6		
No. of samples analysed	: 3		



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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774149)									
EP1913250-015	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	1	1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	931	902	3.23	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	52	51	0.00	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	691	664	4.03	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	40	39	3.16	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	41	40	2.64	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	1570	1420	10.0	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	19	18	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	42300	40200	5.17	0% - 20%
EP1913323-003	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	2	2	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	470	480	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2785204)									
EP1913252-001	T5-T6	EA055: Moisture Content	----	0.1	%	23.3	23.2	0.00	0% - 20%
EP1913486-006	Anonymous	EA055: Moisture Content	----	0.1	%	3.8	4.0	6.11	No Limit

Page : 3 of 6
 Work Order : EP1913252
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2774150)									
EP1913250-015	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913323-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2773721)									
EP1913252-001	T5-T6	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2779442)									
EP1913252-003	T10-8	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.004	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	0.08	0.06	25.9	No Limit
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2779455)									
EP1913409-005	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913434-007	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2782805)									
EP1913173-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913269-002	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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 Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	22 mg/kg	104	81.5	118
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	5 mg/kg	99.0	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	42.2 mg/kg	98.1	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	----	----	----	----
EG005T: Copper	7440-50-8	5	mg/kg	<5	34 mg/kg	105	79.1	113
EG005T: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	103	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.5 mg/kg	104	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	62 mg/kg	103	81.0	119
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774150)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	109	81.0	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773721)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	89.9	74.2	106

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	109	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.4	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	100	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	99.8	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.0	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	97.9	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	100	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.2	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)								



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit		Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805) - continued								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	101	93.0	115

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: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149)							
EP1913250-015	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	74.5	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	92.4	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	87.4	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	100.0	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	96.5	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	# Not Determined	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	84.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774150)							
EP1913250-015	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	98.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773721)							
EP1913252-003	T10-8	EK026SF: Total Cyanide	57-12-5	20 mg/kg	83.3	70.0	130

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)							
EP1913434-001	Anonymous	EG020A-W: Arsenic	7440-38-2	1 mg/L	127	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	117	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	96.9	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	109	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	106	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	106	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	111	70.0	130



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442) - continued							
EP1913434-001	Anonymous	EG020A-W: Zinc	7440-66-6	1 mg/L	124	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)							
EP1913434-002	Anonymous	EG035W: Mercury	7439-97-6	0.01 mg/L	99.6	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)							
EP1913173-003	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	104	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913252	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 30-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt	No. of samples received	: 6
Order number	: ----	No. of samples analysed	: 3

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	Anonymous	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	Anonymous	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	Anonymous	Nickel	7440-02-0	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved							
T5-T6, T10-17	T10-8,	----	----	----	24-Dec-2019	23-Dec-2019	1

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		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
T5-T6, T10-17	T10-8,	09-Dec-2019	----	----	----	24-Dec-2019	23-Dec-2019	✖
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H)								
T5-T6		09-Dec-2019	----	----	----	24-Dec-2019	06-Jun-2020	✔



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA152: Soil Particle Density							
Snap Lock Bag (EA152) T5-T6	09-Dec-2019	----	----	----	24-Dec-2019	06-Jun-2020	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) T5-T6, T10-17	09-Dec-2019	18-Dec-2019	06-Jun-2020	✓	19-Dec-2019	06-Jun-2020	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) T5-T6, T10-17	09-Dec-2019	18-Dec-2019	06-Jan-2020	✓	19-Dec-2019	06-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser							
Soil Glass Jar - Unpreserved (EK026SF) T5-T6, T10-17	09-Dec-2019	18-Dec-2019	23-Dec-2019	✓	27-Dec-2019	01-Jan-2020	✓
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) T10-8	09-Dec-2019	19-Dec-2019	06-Jan-2020	✓	----	----	----

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020W: Water Leachable Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) T10-8	19-Dec-2019	23-Dec-2019	16-Jun-2020	✓	23-Dec-2019	16-Jun-2020	✓
EG035W: Water Leachable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) T10-8	19-Dec-2019	----	----	----	20-Dec-2019	16-Jan-2020	✓
EG050G-W: Hexavalent Chromium - Water Leachable							
Clear Plastic Bottle - NaOH (EG050G-W) T10-8	19-Dec-2019	----	----	----	23-Dec-2019	16-Jan-2020	✓

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.

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

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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							



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							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	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
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazine. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.



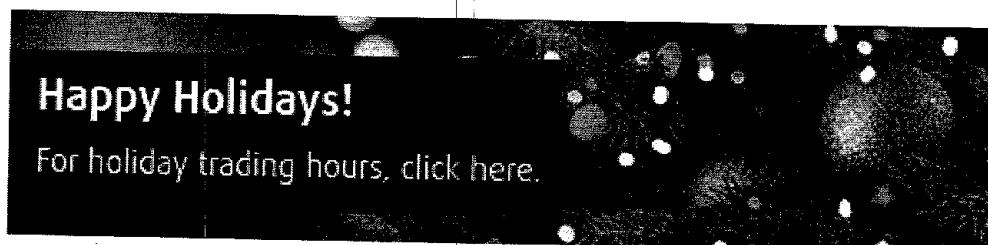
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)
Deionised Water Leach	EN60-D1a	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Rhiannon Chenoweth

From: ALS Enviro Perth
Sent: Wednesday, 8 January 2020 11:36 AM
To: Samples Perth
Subject: FW: [EXTERNAL] - 17302 - DMIRS, Bulong, DSI
Attachments: EP1913220_COC (1).pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Please see the additional analysis request for EP1913220.



Kind Regards,

Rhiannon Steere

Client Services Officer, Environmental - Perth
Western Australia



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EnviroMail™ 124 – PFOS Analysis to Freshwater Species Protection Lvl 99%

From: Brandon Henry [mailto:Brandon.Henry@senversa.com.au]
Sent: Wednesday, 8 January 2020 11:17 AM
To: ALS Enviro Perth <ALSEnviro.Perth@ALSGlobal.com>
Cc: Blaire Coleman <blaire.coleman@senversa.com.au>
Subject: [EXTERNAL] - 17302 - DMIRS, Bulong, DSI

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

Hi,

Can I please get soil sample QC09 (COC attached) analysed for Metals (8) & Total Metals by ICP-AES; Se, Co, Mn, Fe (EG005T) with standard turn around time.

Please send results to myself and Blaire Coleman (CC'd to this email).

Kind regards,

Brandon Henry

Graduate Environmental Scientist



Senversa Pty Ltd

Ground Floor, 190 Flinders Street, Adelaide SA 5000

m: +61 417 822 624 | e: Brandon.Henry@senversa.com.au

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ABN 89 132 231 380

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Bagioni / Client Services Coordinator
Phone: 08 9406 1301

Chain of Custody Documentation

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaine Coleman	Page:	of
Email Report To:	blaine.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information					Container Information										Analysis Required										Comments: e.g. Highly contaminated sample; hazardous materials present, trace LORe etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals (S-02)	Total Metals by ICP-AES; Se, Co, Mn, Fe (E5005T)	Clay Content by Hydrometer	Redox Potential (1-5)	pH (C-CD)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cyanide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	9 Metals (Water Leachable) ICPMS & FIMS As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD					
1	S19T4_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x	x	x	x	x		x	x	x	x	x	x	x	Relabel T19-4				
2	S19T4_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x												x	Relabel T19-4_0.3-0.4				
3	S3T4_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x	x	x	x								x		Relabel T4-3				
4	S3T4_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x		Relabel T4-3_0.3-0.4				
5	S13T23_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x				x		x	x	x	x	x	x	x	Relabel T23-13				
6	S13T23_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x		Relabel T23-13_0.3-0.4				
7	S11T1_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x		Relabel T1-11				
8	S11T1_0.3-0.35	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x		Relabel 1-11_0.3-0.4				
9	S3T23_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x				x		x	x	x	x	x	x	x	Relabel T123-3				
10	S3T23_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x		Relabel T23-3_0.3-0.4				

Environmental Division
Perth
Work Order Reference
EP1913220

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt/Brandon Henry Signature: Date:

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;

sonversa
www.sonversa.com.au
ARN 89 132 231 380

Laboratory: ALS WA
Address: 25 Riggall Way, Wangara WA 2055
Contact: Luron Segoni / Client Services Coordinator
Phone: 08 9406 1301

Chain of Custody Documentation

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DS1	Quote No:	EP-362-19 (V3)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@sonversa.com.au	Phone/Mobile:	+61 403 296 017

Sample Information							Analysis Required																
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals (SCD)	Total Metals by ICP-AES: As, Co, Mn, Fe (EC0003T)	Clay Content by Hydrometer	Redox Potential (1:5)	pH (CaCl2)	Total Hexavalent Chromium (Alkaline digestion) by Decolor Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cymide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	8 Metals (Water Leachable) ICPMS & FILMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Fe	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	Remarks: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.		
11	XRF_BG	Soil	3/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
12	MW1_0.05-0.15	Soil	3/12/2019	-	1 jar	1																	
13	MW1_1.0-1.1	Soil	3/12/2019	-	1 jar	1																	
14	MW1_2.0-2.1	Soil	3/12/2019	-	1 jar	1																	
15	MW1_3.0-3.1	Soil	3/12/2019	-	1 jar	1																	
16	MW1_4.0-4.1	Soil	3/12/2019	-	1 jar	1																	
17	MW2_0.05-0.15	Soil	3/12/2019	-	1 jar	1																	
18	MW2_0.5-0.8	Soil	3/12/2019	-	1 jar	1																	
19	MW2_1.0-1.1	Soil	3/12/2019	-	1 jar	1																	
20	MW2_2.0-2.1	Soil	3/12/2019	-	1 jar	1																	
21	MW2_3.0-3.1	Soil	3/12/2019	-	1 jar	1																	
22	MW2_4.0-4.1	Soil	3/12/2019	-	1 jar	1																	
23	MW2_5.0-5.1	Soil	3/12/2019	-	1 jar	1																	
24	MW2_6.0-6.1	Soil	3/12/2019	-	1 jar	1																	
25	MW2_8.4-9.5	Soil	3/12/2019	-	1 jar	1																	
26	MW4_0.05-0.15	Soil	5/12/2019	-	1 jar	1																	
27	MW5_0.05-0.15	Soil	6/12/2019	-	1 jar	1																	
28	MW3_0.05-0.15	Soil	6/12/2019	-	1 jar	1																	
29	S3T1_0.05-0.15	Soil	8/12/2019	-	2 jars, 2 bags	4	X	X						X	X	X	X	X	X		Relabel T1-3		
30	S3T1_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	X	X						X	X	X	X	X	X		Relabel T1-3 0.3-0.4		

Sampler: I attest that proper field sampling procedures in accordance with Sonversa standard procedures and/or project. Sampler Name: Matthew Hunt/Brandon Henry Signature: Date: 8/12/2019

Relinquished By:	Date:	Method of Shipment (if applicable):	Received by:	Date:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:
Of:	Time:	Date/Time:	Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO3) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium Hydroxide Preserved Plastic;
V = VOA/Viol Hydrochloric Acid (HCl) Preserved; VS = VOA/Viol Sulphuric Preserved; USA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Specimen Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; UA = Unpreserved Amber Glass; LUGLO's Iodine preserved white plastic bottle; SW = sulfuric acid preserved wide mouth glass jar

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EP2000242**

Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: blaire.coleman@senversa.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Facsimile	: +61 03 9606 0074	Facsimile	: +61-8-9406 1399
Project	: 17302 Bulong DSI	Page	: 1 of 2
Order number	: ----	Quote number	: EP2019SENV0005 (EP/382/19 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 12-Dec-2019 08:00	Issue Date	: 09-Jan-2020
Client Requested Due Date	: 16-Jan-2020	Scheduled Reporting Date	: 16-Jan-2020

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - S-02 8 Metals (incl. Digestion)
EP2000242-001	08-Dec-2019 00:00	QC09	✓	✓	✓

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: SOIL

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
EA055: Moisture Content								
QC09	Soil Glass Jar - Unpreserved		----	22-Dec-2019	12-Dec-2019	✓	08-Jan-2020	✗
EG035T: Total Mercury by FIMS								
QC09	Soil Glass Jar - Unpreserved		05-Jan-2020	05-Jan-2020	12-Dec-2019	✓	08-Jan-2020	✗

Requested Deliverables

Blaire Coleman

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

Brandon Henry

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

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EP2000242**
Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES TERRACE
 PERTH 6000
Telephone : +61 08 6557 8881
Project : 17302 Bulong DSI
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : EP/382/19 V2
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 2
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 08:00
Date Analysis Commenced : 10-Jan-2020
Issue Date : 15-Jan-2020 17:37



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

- EG005T: Poor matrix spike recovery was obtained for arsenic on sample EP2000208-002 due to possible matrix interference. Results have been confirmed by re-extraction and re-analysis.

Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				QC09	----	----	----	----
Client sampling date / time				08-Dec-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2000242-001	-----	-----	-----	-----
Result				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	5.2	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Cobalt	7440-48-4	2	mg/kg	20	----	----	----	----
Iron	7439-89-6	50	mg/kg	41800	----	----	----	----
Manganese	7439-96-5	5	mg/kg	420	----	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
Arsenic	7440-38-2	5	mg/kg	5	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	691	----	----	----	----
Copper	7440-50-8	5	mg/kg	25	----	----	----	----
Lead	7439-92-1	5	mg/kg	<5	----	----	----	----
Nickel	7440-02-0	2	mg/kg	170	----	----	----	----
Zinc	7440-66-6	5	mg/kg	33	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP2000242	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 10-Jan-2020
C-O-C number	: ----	Issue Date	: 15-Jan-2020
Sampler	: ----		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 1		
No. of samples analysed	: 1		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2802740)									
EP2000208-002	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	82	84	2.11	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	4	4	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	7	7	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	13	13	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	21	20	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	9	9	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
EG005T: Iron	7439-89-6	50	mg/kg	50000	50600	1.16	0% - 20%		
EP2000208-042	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	31	29	8.01	0% - 50%
		EG005T: Cobalt	7440-48-4	2	mg/kg	5	5	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	6	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	10	9	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	9	8	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	97	76	24.9	0% - 50%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	5	0.00	No Limit
EG005T: Iron	7439-89-6	50	mg/kg	19400	18300	5.71	0% - 20%		
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2802751)									
EP2000235-001	Anonymous	EA055: Moisture Content	----	0.1	%	0.1	0.2	0.00	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2802741)									
EP2000208-002	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP2000208-042	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2802740)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	22 mg/kg	107	81.5	118
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	5 mg/kg	93.0	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	42.2 mg/kg	86.2	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	----	----	----	----
EG005T: Copper	7440-50-8	5	mg/kg	<5	34 mg/kg	111	79.1	113
EG005T: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	102	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.5 mg/kg	94.9	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	62 mg/kg	103	81.0	119
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2802741)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	88.0	81.0	115

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: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2802740)							
EP2000208-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	# 54.2	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	98.5	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	108	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	98.7	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	106	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	103	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	102	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	98.6	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	97.9	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2802741)							
EP2000208-002	Anonymous	EG035T: Mercurv	7439-97-6	1 mg/kg	74.4	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP2000242	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 15-Jan-2020
Sampler	: ----	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP2000208--002	Anonymous	Arsenic	7440-38-2	54.2 %	70.0-130%	Recovery less than lower data quality objective

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved QC09	----	----	----	10-Jan-2020	22-Dec-2019	19
EG035T: Total Recoverable Mercury by FIMS						
Soil Glass Jar - Unpreserved QC09	13-Jan-2020	05-Jan-2020	8	14-Jan-2020	05-Jan-2020	9

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	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) QC09	08-Dec-2019	----	----	----	10-Jan-2020	22-Dec-2019	✘
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) QC09	08-Dec-2019	13-Jan-2020	05-Jun-2020	✔	13-Jan-2020	05-Jun-2020	✔
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) QC09	08-Dec-2019	13-Jan-2020	05-Jan-2020	✘	14-Jan-2020	05-Jan-2020	✘



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)							
Moisture Content	EA055	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	7.14	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
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Chain of Custody Documentation

Senversa Pty Ltd
www.senversa.com.au
ABN 89 132 231 380

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6066
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Brandon Henry	Turn Around	Standard
Project Manager:	Blair Coleman	Page:	of
Email Report To:	re.coleman@senversa.com	Phone/Mob	+61 409 296 017

[illegible]

Environmental Division
Perth
Work Order Reference
EP2002272



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard	Sampler Na Brandon Henry	Signature:	Date: 24/02/2020
--	--------------------------	------------	------------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	SP	5.3.2006
Of:	Time:	Date/Time:	Of:	ALU	1645
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		
Of:	Time:	Date/Time:	Of:		
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		
Of:	Time:	Date/Time:	Of:		

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Chain of Custody Documentation

Laboratory: - ALSWA
Address: - 26 Rigali Way, Wangara WA
Contact: Lauren - Biagioni
Phone: 98 - 94061301

Job Number: P17302	Purchase Order:
Project Name: Bulong DMRS DSI	Quote No:
Sampled By: Brandon Henry	Turn Around Time: Standard
Project Manager: Blaire Coleman	Page: of
Email Report To: Blaire.coleman@senversa.com.au #N/A	Phone/Mobile: +61 409 296 017 #N/A

[illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:	Sampler Name: <u>Brandon L</u>	Signature: <u>[Signature]</u>	Date: <u>24/2/20</u>
---	--------------------------------	-------------------------------	----------------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Natalie Duncan

From: Natalie Duncan
Sent: Wednesday, 26 February 2020 11:50 AM
To: blaire.coleman@sensversa.com.au
Cc: Samples Perth; Lauren Biagioni
Subject: P17302 Bulong PSI
Attachments: 26022020114228-0001.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Blaire,

We have just received the attached COC via Toll.

We unfortunately only received the satchel containing the soil samples and are missing the 'jugs' (toll connote number 8994917939). Are you able to follow this up through toll?

Do you require analysis on these soil samples? If so, can you please send through an updated COC or analysis request.

We will retain all samples in our cold room for the meantime.

ALS Environmental Perth is closed on Monday the 2nd of March for Labor Day public holiday

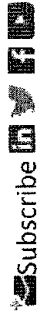
Kind Regards,

Natalie Duncan
Sample Receipt Supervisor
Wangara – Environmental

T +61 8 9406 1301
D +61 8 9406 1351

natalie.duncan@alsglobal.com

26 Rigali Way,
Wangara WA 6065
AUSTRALIA



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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP2002272

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Brandon Henry</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V3)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
--	--

Dates

Date Samples Received : 03-Mar-2020 16:40	Issue Date : 04-Mar-2020
Client Requested Due : 12-Mar-2020	Scheduled Reporting Date : 12-Mar-2020
Date	

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 1	Temperature : 24.5
Receipt Detail :	No. of samples received / analysed : 3 / 3

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
- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- **Clay Content analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - EA075 Redox Potential (1:5)	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG048G Total Hexavalent Chromium (Alkaline digestion)	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - S-02 8 Metals (incl. Digestion)
EP2002272-001	24-Feb-2020 00:00	QC22		✓		✓			✓
EP2002272-002	24-Feb-2020 00:00	BG2	✓	✓	✓	✓	✓	✓	✓
EP2002272-003	24-Feb-2020 00:00	BG3	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - ED008 Def Exchangeable Cations with pre-treatment -
EP2002272-002	24-Feb-2020 00:00	BG2	✓	✓
EP2002272-003	24-Feb-2020 00:00	BG3	✓	✓

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: **SOIL**

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

Method	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
Client Sample ID(s)				Date	Evaluation	Date	Evaluation
EA001: pH in soil using a 0.01M CaCl ₂ extract							
BG2	Soil Glass Jar - Unpreserved	02-Mar-2020	02-Mar-2020	03-Mar-2020	✗	----	----
BG3	Soil Glass Jar - Unpreserved	02-Mar-2020	02-Mar-2020	03-Mar-2020	✗	----	----



Requested Deliverables

Blaire Coleman

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Attachment - Report (SUBCO)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email	supplieraccounts@senversa.com.au
-------	----------------------------------

CERTIFICATE OF ANALYSIS

Work Order : **EP2002272**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **Brandon Henry**
Site : **----**
Quote number : **EP/382/19 V3**
No. of samples received : **3**
No. of samples analysed : **3**

Page : 1 of 4
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 03-Mar-2020 16:40
Date Analysis Commenced : 05-Mar-2020
Issue Date : 13-Mar-2020 22:41



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Stephanie Tilson	Instrument Chemist	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EG048G (Hexavalent Chromium): Poor Hexavalent Chromium spike recoveries possibly due to sample matrix effects. Confirmed by re-extraction and re-analysis.
- EG048G (Hexavalent Chromium): LOR for sample EP2002272-002 raised due to possible sample matrix interference.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H^+ + Al^{3+}).

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	QC22	BG2	BG3	----	----
Client sampling date / time				24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----	----	
Compound	CAS Number	LOR	Unit	EP2002272-001	EP2002272-002	EP2002272-003	-----	-----	
				Result	Result	Result	----	----	
EA001: pH in soil using 0.01M CaCl extract									
pH (CaCl2)	----	0.1	pH Unit	----	7.4	7.5	----	----	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%	9.0	9.2	6.1	----	----	
EA075: Redox Potential									
Redox Potential	----	0.1	mV	----	190	188	----	----	
pH Redox	----	0.1	pH Unit	----	8.3	8.4	----	----	
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%	----	11	13	----	----	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	2.58	2.59	----	----	
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g	----	13.2	5.7	----	----	
Exchangeable Magnesium	----	0.1	meq/100g	----	2.0	1.7	----	----	
Exchangeable Potassium	----	0.1	meq/100g	----	1.0	0.5	----	----	
Exchangeable Sodium	----	0.1	meq/100g	----	0.1	<0.1	----	----	
Cation Exchange Capacity	----	0.1	meq/100g	----	21.5	13.3	----	----	
Exchangeable Sodium Percent	----	0.1	%	----	0.6	1.1	----	----	
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg	16	15	24	----	----	
Iron	7439-89-6	50	mg/kg	45000	40700	52600	----	----	
Manganese	7439-96-5	5	mg/kg	908	821	2120	----	----	
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	----	----	
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	----	----	
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	----	
Chromium	7440-47-3	2	mg/kg	214	210	152	----	----	
Copper	7440-50-8	5	mg/kg	33	26	28	----	----	
Lead	7439-92-1	5	mg/kg	<5	<5	<5	----	----	
Nickel	7440-02-0	2	mg/kg	81	77	70	----	----	
Zinc	7440-66-6	5	mg/kg	44	43	61	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	----	
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg	----	<2.5	<0.5	----	----	
EK026SF: Total CN by Segmented Flow Analyser									



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	QC22	BG2	BG3	----	----
Client sampling date / time					24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2002272-001	EP2002272-002	EP2002272-003	-----	-----
					Result	Result	Result	----	----
EK026SF: Total CN by Segmented Flow Analyser - Continued									
Total Cyanide	57-12-5	1	mg/kg		----	<1	<1	----	----

QUALITY CONTROL REPORT

Work Order	: EP2002272	Page	: 1 of 5
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 03-Mar-2020
Order number	: ----	Date Analysis Commenced	: 05-Mar-2020
C-O-C number	: ----	Issue Date	: 13-Mar-2020
Sampler	: Brandon Henry		
Site	: ----		
Quote number	: EP/382/19 V3		
No. of samples received	: 3		
No. of samples analysed	: 3		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Stephanie Tilson	Instrument Chemist	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2894993)									
EP2002272-001	QC22	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	214	228	6.06	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	16	15	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	81	80	0.00	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	33	29	10.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	908	887	2.32	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	44	42	4.49	No Limit
EG005T: Iron	7439-89-6	50	mg/kg	45000	45400	0.939	0% - 20%		
EA001: pH in soil using 0.01M CaCl extract (QC Lot: 2894986)									
EP2002272-002	BG2	EA001: pH (CaCl2)	----	0.1	pH Unit	7.4	7.5	1.34	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2895081)									
EP2002272-001	QC22	EA055: Moisture Content	----	0.1	%	9.0	8.9	1.52	No Limit
EP2002317-007	Anonymous	EA055: Moisture Content	----	0.1	%	21.5	21.6	0.00	0% - 20%
EA075: Redox Potential (QC Lot: 2895006)									
EP2002272-002	BG2	EA075: Redox Potential	----	0.1	mV	190	190	0.158	0% - 20%
		EA075: pH Redox	----	0.1	pH Unit	8.3	8.3	0.00	0% - 20%
ED007: Exchangeable Cations (QC Lot: 2902230)									
EP2002272-002	BG2	ED007: Exchangeable Sodium Percent	----	0.1	%	0.6	0.6	0.00	No Limit
		ED007: Exchangeable Calcium	----	0.1	meq/100g	13.2	12.5	5.88	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	2.0	1.8	6.15	0% - 50%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	1.0	0.9	0.00	No Limit

Page : 3 of 5
 Work Order : EP2002272
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED007: Exchangeable Cations (QC Lot: 2902230) - continued									
EP2002272-002	BG2	ED007: Exchangeable Sodium	----	0.1	meq/100g	0.1	<0.1	0.00	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	21.5	20.6	4.42	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2894994)									
EP2002272-001	QC22	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 2895009)									
EP2002272-002	BG2	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<2.5	<2.5	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2895003)									
EP2002272-002	BG2	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2894993)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	22 mg/kg	103	81.5	118
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	5 mg/kg	91.0	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	42.2 mg/kg	89.2	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	----	----	----	----
EG005T: Copper	7440-50-8	5	mg/kg	<5	34 mg/kg	92.0	79.1	113
EG005T: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	95.1	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.5 mg/kg	96.4	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	62 mg/kg	104	81.0	119
EA001: pH in soil using 0.01M CaCl extract (QCLot: 2894986)								
EA001: pH (CaCl2)	----	----	pH Unit	----	4 pH Unit	101	98.8	101
				----	7 pH Unit	100	99.2	101
ED007: Exchangeable Cations (QCLot: 2902230)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	21.6 meq/100g	109	82.9	117
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.76 meq/100g	99.4	78.4	119
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	1 meq/100g	108	87.9	129
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.9 meq/100g	110	92.9	132
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	25.3 meq/100g	108	84.7	117
ED007: Exchangeable Sodium Percent	----	0.1	%	<0.1	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2894994)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	94.2	81.0	115
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2895009)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	40 mg/kg	76.6	70.0	130
				<0.5	20 mg/kg	96.6	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2895003)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	92.3	74.2	106

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: **SOIL**

Matrix Spike (MS) Report



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2894993)							
EP2002272-001	QC22	EG005T: Arsenic	7440-38-2	50 mg/kg	84.2	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	99.3	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	97.3	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	97.1	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	100	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	97.7	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	98.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2894994)							
EP2002272-001	QC22	EG035T: Mercury	7439-97-6	1 mg/kg	85.7	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2895009)							
EP2002272-002	BG2	EG048G: Hexavalent Chromium	18540-29-9	40 mg/kg	# 24.9	70.0	130
EP2002272-002	BG2	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	71.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2895003)							
EP2002272-003	BG3	EK026SF: Total Cyanide	57-12-5	20 mg/kg	91.3	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP2002272	Page	: 1 of 6
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 03-Mar-2020
Site	: ----	Issue Date	: 13-Mar-2020
Sampler	: Brandon Henry	No. of samples received	: 3
Order number	: ----	No. of samples analysed	: 3

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP2002272--001	QC22	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP2002272--001	QC22	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG048: Hexavalent Chromium (Alkaline Digest)	EP2002272--002	BG2	Hexavalent Chromium	18540-29-9	24.9 %	70.0-130%	Recovery less than lower data quality objective

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA001: pH in soil using 0.01M CaCl extract						
Soil Glass Jar - Unpreserved BG2,	BG3	06-Mar-2020	02-Mar-2020	4	----	----

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	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA001: pH in soil using 0.01M CaCl extract							
Soil Glass Jar - Unpreserved (EA001) BG2, BG3	24-Feb-2020	06-Mar-2020	02-Mar-2020	✖	06-Mar-2020	06-Mar-2020	✔
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) QC22, BG3	24-Feb-2020	----	----	----	05-Mar-2020	09-Mar-2020	✔
EA075: Redox Potential							
Soil Glass Jar - Unpreserved (EA075) BG2, BG3	24-Feb-2020	06-Mar-2020	09-Mar-2020	✔	06-Mar-2020	06-Mar-2020	✔



Matrix: **SOIL**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Soil Classification based on Particle Size								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) BG2,	BG3	24-Feb-2020	----	----	----	12-Mar-2020	22-Aug-2020	✓
EA152: Soil Particle Density								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) BG2,	BG3	24-Feb-2020	----	----	----	12-Mar-2020	22-Aug-2020	✓
ED007: Exchangeable Cations								
Soil Glass Jar - Unpreserved (ED007) BG2,	BG3	24-Feb-2020	10-Mar-2020	23-Mar-2020	✓	10-Mar-2020	23-Mar-2020	✓
EG005(ED093)T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T) QC22, BG3	BG2,	24-Feb-2020	05-Mar-2020	22-Aug-2020	✓	06-Mar-2020	22-Aug-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T) QC22, BG3	BG2,	24-Feb-2020	05-Mar-2020	23-Mar-2020	✓	06-Mar-2020	23-Mar-2020	✓
EG048: Hexavalent Chromium (Alkaline Digest)								
Soil Glass Jar - Unpreserved (EG048G) BG2,	BG3	24-Feb-2020	05-Mar-2020	23-Mar-2020	✓	06-Mar-2020	12-Mar-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
Soil Glass Jar - Unpreserved (EK026SF) BG2,	BG3	24-Feb-2020	09-Mar-2020	09-Mar-2020	✓	10-Mar-2020	23-Mar-2020	✓



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)							
Exchangeable Cations	ED007	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Redox Potential	EA075	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Exchangeable Cations	ED007	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Exchangeable Cations	ED007	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	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 in soil using a 0.01M CaCl ₂ extract	EA001	SOIL	In house: Referenced to Rayment and Lyons (2011) 4B3 (mod.) or 4B4 (mod.) 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Redox Potential	EA075	SOIL	In house: Ion selective electrode. Analysis is performed on a 1:5 soil:de-ionised water extract.
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060A. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.



Preparation Methods	Method	Matrix	Method Descriptions
pH in soil using a 0.01M CaCl ₂ extract	EA001-PR	SOIL	In house: Referenced to Rayment and Higginson 4B1, 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH ₄ Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Robert Johnston

To: Blaire Coleman
Subject: RE: Bulong DSI (17302) - samples received without a COC

From: Blaire Coleman [<mailto:blaire.coleman@senversa.com.au>]
Sent: Wednesday, 18 December 2019 8:53 AM
To: Robert Johnston
Cc: Justin Lumsden
Subject: FW: Bulong DSI (17302) - samples received without a COC

My apologies Rob! I didn't realise that this email hadn't gone through to you on Monday. Please see attached, and let me or Justin know if you have any queries.

Cheers,
Blaire

Blaire Coleman
Associate Geoscientist

From: Georgia Hefron <Georgia.Hefron@senversa.com.au>
Sent: Monday, 16 December 2019 4:59 PM
To: Blaire Coleman <blaire.coleman@senversa.com.au>
Subject: FW: Bulong DSI (17302) - samples received without a COC

Just check 😊

Hi Rob,

Please see attached COC for the below QC samples.

Thanks,

Georgia Hefron
Project Environmental Scientist



Senversa Pty Ltd
Level 17, 140 St Georges Terrace, Perth WA 6000

m: +61 403 309 654 | e: georgia.hefron@senversa.com.au
t: +61 8 6324 0200 | w: www.senversa.com.au

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Please consider the environment before printing this email. Senversa is a carbon neutral company.

Rob Johnston 18/12/19 Eurofins 694415



Date/Time: 18/12/19 8:53
Chilled: Yes/No
Temp: 17.5
12.5
13.1
Correction: +3.5
Final Temp: 17.9°C

From: EnviroSampleWA@eurofins.com <EnviroSampleWA@eurofins.com>

Sent: Friday, 13 December 2019 3:28 PM

To: Blaire Coleman <blaire.coleman@sensversa.com.au>

Subject: Bulong DSI (17302) - samples received without a COC

Hi Blaire,

We have received samples QC05, QC08, QC10, QC12 and QC20 for this project, but without a COC (sample dates 3-11/12). Can you please provide us a COC?

Kind Regards,
Rob

Eurofins | Environment Testing

Unit 2, 91 Leach Highway

KEWDALE WA 6105

Australia

Phone : +61 8 9251 9692

Email : EnviroSampleWA@eurofins.com

Rob Johnston 18/12/19 Eurofin 694415

Laboratory: Eurofins WA
Address: 2/61 Leach Hwy, Kewdale WA 6105
Contact: Rob Johnson / Analytical Services Manager
Phone: 08 9251 9692

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

[illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name:	Matthew Hunt / Brandon Henry
----------------------	---------------------------------

Signature: _____

Date: 11/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Val Hydrochloric Acid (HCl) Preserved; VSA = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugo's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Melbourne

6 Monterey Road
Dandenong South Vic 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney

Unit F3, Building F
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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane

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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth

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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521

e.mail : EnviroSales@eurofins.com

web : www.eurofins.com.au

Sample Receipt Advice

Company name: **Senversa Pty Ltd WA**
Contact name: **Blaire Coleman**
Project name: **BULONG DSI**
Project ID: **P17302**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Dec 18, 2019 8:53 AM**
Eurofins reference: **694415**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☒ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- N/A Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Robert Johnston on Phone : or by e.mail: RobertJohnston@eurofins.com

Results will be delivered electronically via e.mail to Blaire Coleman - Blaire.Coleman@senversa.com.au.

Senversa Pty Ltd WA
Level 17, 140 St Georges Terrace
Perth
WA 6000



NATA Accredited
Accreditation Number 1261
Site Number 23736

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

Attention: **Blaire Coleman**

Report **694415-S**
 Project name **BULONG DSI**
 Project ID **P17302**
 Received Date **Dec 18, 2019**

Client Sample ID			QC05	QC10	QC12	QC20
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			P19-De26029	P19-De26031	P19-De26032	P19-De26033
Date Sampled			Dec 03, 2019	Dec 03, 2019	Dec 03, 2019	Dec 03, 2019
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	2	mg/kg	6.8	15	14	41
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	420	1100	870	1600
Cobalt	5	mg/kg	20	22	25	110
Copper	5	mg/kg	25	27	33	51
Iron	20	mg/kg	48000	80000	63000	57000
Lead	5	mg/kg	< 5	8.7	5.0	< 5
Manganese	5	mg/kg	180	450	400	8800
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	180	190	180	800
Selenium	2	mg/kg	< 2	< 2	< 2	< 2
Zinc	5	mg/kg	70	37	58	21
% Moisture	1	%	24	1.9	5.5	5.2

Client Sample ID			QC02
Sample Matrix			Soil
Eurofins Sample No.			P19-De26034
Date Sampled			Dec 03, 2019
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic	2	mg/kg	16
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	1400
Cobalt	5	mg/kg	58
Copper	5	mg/kg	28
Iron	20	mg/kg	80000
Lead	5	mg/kg	8.9
Manganese	5	mg/kg	940
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	750
Selenium	2	mg/kg	< 2
Zinc	5	mg/kg	52
% Moisture	1	%	25

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Heavy Metals - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Perth	Dec 18, 2019	180 Days
Mercury - Method: USEPA 7470/1 Mercury	Perth	Dec 18, 2019	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Perth	Dec 18, 2019	14 Days

Australia

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Site # 1254 & 14271

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NATA # 1261 Site # 18217

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NATA # 1261 Site # 20794

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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN – 50 005 085 521

web : www.eurofins.com.au

e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000
Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail							Moisture Set																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

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

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

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

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

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

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Method Blank								
Heavy Metals								
Arsenic			mg/kg	< 2		2	Pass	
Cadmium			mg/kg	< 0.4		0.4	Pass	
Chromium			mg/kg	< 5		5	Pass	
Cobalt			mg/kg	< 5		5	Pass	
Copper			mg/kg	< 5		5	Pass	
Iron			mg/kg	< 20		20	Pass	
Lead			mg/kg	< 5		5	Pass	
Manganese			mg/kg	< 5		5	Pass	
Mercury			mg/kg	< 0.1		0.1	Pass	
Nickel			mg/kg	< 5		5	Pass	
Selenium			mg/kg	< 2		2	Pass	
Zinc			mg/kg	< 5		5	Pass	
LCS - % Recovery								
Heavy Metals								
Arsenic			%	94		80-120	Pass	
Cadmium			%	94		80-120	Pass	
Chromium			%	94		80-120	Pass	
Cobalt			%	95		80-120	Pass	
Copper			%	86		80-120	Pass	
Iron			%	94		80-120	Pass	
Lead			%	96		80-120	Pass	
Manganese			%	92		80-120	Pass	
Mercury			%	91		70-130	Pass	
Nickel			%	92		80-120	Pass	
Selenium			%	95		80-120	Pass	
Zinc			%	92		80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
Heavy Metals				Result 1				
Cadmium	P19-De25877	NCP	%	101		75-125	Pass	
Chromium	P19-De25877	NCP	%	99		75-125	Pass	
Cobalt	P19-De25877	NCP	%	101		75-125	Pass	
Copper	P19-De25877	NCP	%	96		75-125	Pass	
Iron	P19-De27620	NCP	%	93		75-125	Pass	
Lead	P19-De25877	NCP	%	108		75-125	Pass	
Mercury	P19-De25877	NCP	%	94		70-130	Pass	
Nickel	P19-De25877	NCP	%	99		75-125	Pass	
Zinc	P19-De25877	NCP	%	85		75-125	Pass	
Spike - % Recovery								
Heavy Metals				Result 1				
Manganese	P19-De27620	NCP	%	98		75-125	Pass	
Spike - % Recovery								
Heavy Metals				Result 1				
Arsenic	P19-De27620	NCP	%	100		75-125	Pass	
Selenium	P19-De27620	NCP	%	101		75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	P19-De26033	CP	mg/kg	41	41	1.0	30%	Pass	
Cadmium	P19-De26033	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	P19-De26033	CP	mg/kg	1600	1600	5.0	30%	Pass	
Cobalt	P19-De26033	CP	mg/kg	110	110	1.0	30%	Pass	
Copper	P19-De26033	CP	mg/kg	51	42	18	30%	Pass	
Iron	P19-De26033	CP	mg/kg	57000	57000	1.0	30%	Pass	
Lead	P19-De26033	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Manganese	P19-De26033	CP	mg/kg	8800	8900	1.0	30%	Pass	
Mercury	P19-De26033	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	P19-De26033	CP	mg/kg	800	780	2.0	30%	Pass	
Selenium	P19-De26033	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Zinc	P19-De26033	CP	mg/kg	21	21	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	P19-De26033	CP	%	5.2	5.1	2.0	30%	Pass	

Comments
Sample Integrity

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

Authorised By

Robert Johnston	Analytical Services Manager
Elden Garrett	Senior Analyst-Metal (WA)



Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please [click here](#).

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

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
 Perth
 WA 6000

Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

[illegible]

Sample Receipt Advice

Company name: **Senversa Pty Ltd WA**
Contact name: **Blaire Coleman**
Project name: **BULONG DSI**
Project ID: **P17302**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Mar 11, 2020 11:21 AM**
Eurofins reference: **707123**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☐ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- ☐ Split sample sent to requested external lab.
- ☐ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Robert Johnston on Phone : or by e.mail: RobertJohnston@eurofins.com

Results will be delivered electronically via e.mail to Blaire Coleman - Blaire.Coleman@senversa.com.au.

Senversa Pty Ltd WA
Level 17, 140 St Georges Terrace
Perth
WA 6000



NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Attention: **Blaire Coleman**

Report **707123-S**
 Project name **BULONG DSI**
 Project ID **P17302**
 Received Date **Mar 11, 2020**

Client Sample ID			QC23
Sample Matrix			Soil
Eurofins Sample No.			S20-Ma15326
Date Sampled			Feb 24, 2020
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic	2	mg/kg	6.5
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	360
Cobalt	5	mg/kg	19
Copper	5	mg/kg	40
Iron	20	mg/kg	35000
Lead	5	mg/kg	8.5
Manganese	5	mg/kg	1000
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	120
Selenium	2	mg/kg	< 2
Zinc	5	mg/kg	60
% Moisture	1	%	8.3

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Metals M8	Sydney	Mar 17, 2020	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals	Sydney	Mar 17, 2020	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Sydney	Mar 11, 2020	14 Days
- Method: LTM-GEN-7080 Moisture			

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

New Zealand

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Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN – 50 005 085 521

web : www.eurofins.com.au

e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000

Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 707123
Phone: 0437 472 990
Fax:

Received: Mar 11, 2020 11:21 AM
Due: Mar 18, 2020
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Cobalt	Iron	Manganese	Selenium	Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271											
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	QC23	Feb 24, 2020		Soil	S20-Ma15326	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

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

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

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

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

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

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Heavy Metals									
Arsenic			mg/kg	< 2			2	Pass	
Cadmium			mg/kg	< 0.4			0.4	Pass	
Chromium			mg/kg	< 5			5	Pass	
Cobalt			mg/kg	< 5			5	Pass	
Copper			mg/kg	< 5			5	Pass	
Iron			mg/kg	< 20			20	Pass	
Lead			mg/kg	< 5			5	Pass	
Manganese			mg/kg	< 5			5	Pass	
Mercury			mg/kg	< 0.1			0.1	Pass	
Nickel			mg/kg	< 5			5	Pass	
Selenium			mg/kg	< 2			2	Pass	
Zinc			mg/kg	< 5			5	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic			%	109			70-130	Pass	
Cadmium			%	88			70-130	Pass	
Chromium			%	110			70-130	Pass	
Cobalt			%	108			70-130	Pass	
Copper			%	108			70-130	Pass	
Iron			%	112			70-130	Pass	
Lead			%	108			70-130	Pass	
Manganese			%	107			70-130	Pass	
Mercury			%	106			70-130	Pass	
Nickel			%	109			70-130	Pass	
Selenium			%	100			70-130	Pass	
Zinc			%	104			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S20-Ma18126	NCP	%	117			70-130	Pass	
Cadmium	S20-Ma18126	NCP	%	108			70-130	Pass	
Chromium	S20-Ma18126	NCP	%	119			70-130	Pass	
Cobalt	S20-Ma18126	NCP	%	111			70-130	Pass	
Copper	S20-Ma18126	NCP	%	107			70-130	Pass	
Lead	S20-Ma18126	NCP	%	111			70-130	Pass	
Manganese	S20-Ma14270	NCP	%	124			70-130	Pass	
Mercury	S20-Ma18126	NCP	%	118			70-130	Pass	
Nickel	S20-Ma18126	NCP	%	115			70-130	Pass	
Selenium	S20-Ma18126	NCP	%	103			70-130	Pass	
Zinc	S20-Ma18126	NCP	%	118			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S20-Ma19565	NCP	mg/kg	3.0	2.3	27	30%	Pass	
Cadmium	S20-Ma19565	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S20-Ma19565	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Cobalt	S20-Ma19565	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Copper	S20-Ma19565	NCP	mg/kg	7.0	7.4	6.0	30%	Pass	
Iron	S20-Ma23546	NCP	mg/kg	43000	48000	12	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	S20-Ma19565	NCP	mg/kg	43	50	17	30%	Pass	
Manganese	S20-Ma19565	NCP	mg/kg	96	110	18	30%	Pass	
Mercury	S20-Ma19565	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S20-Ma19565	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Selenium	S20-Ma19565	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Zinc	S20-Ma19565	NCP	mg/kg	190	170	9.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S20-Ma15491	NCP	%	22	23	3.0	30%	Pass	

Comments

Sample Integrity

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

Authorised By

Robert Johnston	Analytical Services Manager
Gabriele Cordero	Senior Analyst-Metal (NSW)



Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please [click here](#).

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Australia

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Site # 1254 & 14271

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Rolleston, Christchurch 7675
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ABN – 50 005 085 521

web : www.eurofins.com.au

e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000

Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 707123
Phone: 0437 472 990
Fax:

Received: Mar 11, 2020 11:21 AM
Due: Mar 18, 2020
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Cobalt	Iron	Manganese	Selenium	Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271											
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	QC23	Feb 24, 2020		Soil	S20-Ma15326	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Sample Information							Analysis Required										Comments: e.g. Highly contaminated sample, hazardous materials present; trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	EA038-AVS: SEM: Acid Volatile Sulphides (AVS) and Simultaneously Extractable Metals (SEM)	EG020-SD: Total Metals in Sediments by ICPMS (NODG): As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn	EG005-SD: Total Metals in Sediments by ICPAES (NODG): Fe	EG035-SD: Mercury in Sediments by FIMS (NODG-required Level of Reporting)	EG020-SDH: 1M HCl Extractable Se in Sediments by ICPMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn	EG005-SDH: 1M HCl Extractable Metals: Fe	EG035-SDH: 1M HCl Extractable Mercury in Sediments by FIMS	EP003: Total Organic Carbon (TOC) in Soil	EA150/HEA152: Particle Sizing with Hydrometer + Soil Particle Density	EG048G: Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	
1	PW1	Sediment	2/12/2019	-	7 bags	0	X	X	X	X	X	X	X	X	X	X	Metals Total: As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn Total metals by ICPMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn, Fe FWD to Eurofins
2	PW2	Sediment	2/12/2019	-	7 bags	0											
3	PW3	Sediment	2/12/2019	-	7 bags	0											
4	PW4	Sediment	2/12/2019	-	7 bags	0											
5	PW5	Sediment	2/12/2019	-	7 bags	0											
6	PW6	Sediment	2/12/2019	-	7 bags	0											
7	QC01	Sediment	2/12/2019	-	7 bags	0											
8	QC02	Sediment	2/12/2019	-	7 bags	0											
	QC03	Water	2/12/2019	-	1 water	1											
Total						1	0	0	0	0	0	0	0	0	0	0	0

Environmental Division
Perth
Work Order Reference
EP1912834



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt / Brandon Henry Signature: [Signature] Date: 2/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature: <u>Matt Hunt</u>	Date: <u>3/12</u>	Carrier / Reference #:		Name/Signature: <u>NS</u>	Date: <u>4/12/19</u>
Of: <u>Senversa</u>	Time: <u>10:00</u>	Date/Time:		Of: <u>NS</u>	Time: <u>10:45</u>
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EP1912834**

Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: blaire.coleman@senversa.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Facsimile	: +61 03 9606 0074	Facsimile	: +61-8-9406 1399
Project	: P17302 Bulong DSI	Page	: 1 of 5
Order number	: ----	Quote number	: EP2019SENV0005 (EP/382/19 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Brandon Henry, MATTHEW HUNT		

Dates

Date Samples Received	: 04-Dec-2019 08:45	Issue Date	: 04-Dec-2019
Client Requested Due Date	: 19-Dec-2019	Scheduled Reporting Date	: 19-Dec-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 4	Temperature	: 6.0 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 8 / 8

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
- TOC, AVS/SEM, Pore water conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
1M HCl Extractable Metals : EG005-SEM_1		
PW1	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW2	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW3	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW4	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW5	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW6	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
QC01	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
Acid Volatile Sulfides (AVS) : EA038-SEM		
PW1	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW2	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW3	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW4	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW5	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW6	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
QC01	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
Ferrous Iron by Discrete Analyser - Unfiltered : EG051GUF		
PW1	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW2	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW3	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW4	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW5	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW6	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
QC01	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
Hexavalent Chromium by Alkaline Digestion and DA Finish : EG048G		
PW1	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW2	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW3	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW4	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW5	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW6	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
QC01	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
Major Cations - Total : ED093T		
PW1	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW2	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW3	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered



Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Major Cations - Total : ED093T		
PW4	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW5	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW6	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
QC01	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered

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	Client sampling date / time	Client sample ID	SOIL - EG005-SD Total Iron and Aluminium in Sediments by	SOIL - EG005-SDH 1M HCl Extractable Metals	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG020-SDH 1M HCl Extractable Se in Sediments by ICPMS	SOIL - EG035-SD Mercury in Sediments by FIMS (NODG-required)	SOIL - EG035-SDH 1M HCl Extractable Mercury in Sediments by	SOIL - EG048G Total Hexavalent Chromium (Alkaline digestion)
EP1912834-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓	✓	✓	✓
EP1912834-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓	✓	✓	✓
EP1912834-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓	✓	✓	✓
EP1912834-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓	✓	✓	✓
EP1912834-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓	✓	✓	✓
EP1912834-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓	✓	✓	✓
EP1912834-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA005P pH (PCT)	SOIL - EA038-AVS_SEM Acid Volatile Sulphides (AVS) and Simultaneously	SOIL - EA055-103 Moisture Content	SOIL - EA065 Total Hardness as CaCO3	SOIL - EA150H/EA152 Particle Sizing with Hydrometer + Soil Particle	SOIL - EN82 Porewater Extraction	SOIL - EP003 Total Organic Carbon (TOC) in Soil
EP1912834-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓	✓	✓	✓
EP1912834-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓	✓	✓	✓
EP1912834-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓	✓	✓	✓
EP1912834-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓	✓	✓	✓
EP1912834-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓	✓	✓	✓
EP1912834-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓	✓	✓	✓
EP1912834-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓	✓	✓	✓



Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EG035T-LL Total Mercury - Low Level	SOIL - EG051GUF Ferrous Iron by Discrete Analyser - Unfiltered	SOIL - EG093-T Total Metals by ORC - Ultra Trace in Saline	SOIL - NT-01T Total Major Cations (Ca, Mg, Na, K)	SOIL - NT-02 Major Anions (Chloride, Sulphate, Alkalinity)	SOIL - NT-07 Total Nitrogen + NO2 + NO3 + NH3
EP1912834-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓	✓	✓
EP1912834-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓	✓	✓
EP1912834-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓	✓	✓
EP1912834-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓	✓	✓
EP1912834-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓	✓	✓
EP1912834-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓	✓	✓
EP1912834-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - W-02T 8 metals (Total)
EP1912834-008	02-Dec-2019 00:00	QC03	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020T Total Metals by ICP/MS (including digestion)
EP1912834-008	02-Dec-2019 00:00	QC03	✓



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

Matrix: SOIL

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
EA038-SEM: Acid Volatile Sulfides (AVS)								
PW1	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW2	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW3	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW4	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW5	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW6	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
QC01	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
EG005-SEM_1: 1M HCl Extractable Metals								
PW1	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW2	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW3	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW4	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW5	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW6	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
QC01	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	

Requested Deliverables

Blaire Coleman

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

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EP1912834**
Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES TERRACE
 PERTH 6000
Telephone : +61 08 6557 8881
Project : P17302 Bulong DSI
Order number : ----
C-O-C number : ----
Sampler : Brandon Henry, MATTHEW HUNT
Site : ----
Quote number : EP/382/19 V2
No. of samples received : 8
No. of samples analysed : 8

Page : 1 of 9
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 04-Dec-2019 08:45
Date Analysis Commenced : 05-Dec-2019
Issue Date : 19-Dec-2019 22:31



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Carsten Emrich	Client Services	Brisbane Inorganics, Stafford, QLD
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- TOC, AVS/SEM, Pore water conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EA150H: Samples 004 and 005 were pretreated to remove 90% of soluble solids. Results have been corrected for salinity and consequently, NATA endorsement does not apply to clay/silt results
- EG020-SD: Poor precision was obtained for chromium, nickel on sample EP1912834-001 due to possible sample heterogeneity. Results have been confirmed by re-extraction and re-analysis.
- EG005-SD: EP1912834-1 shows poor duplicate precision for iron due to possible sample heterogeneity. Results confirmed by re-digestion and re-analysis.



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1912834-001	EP1912834-002	EP1912834-003	EP1912834-004	EP1912834-005
				Result	Result	Result	Result	Result
EA038 / EG005 (ED093): Simultaneously Extracted Metals								
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	1.0	mg/kg	<1.0	1.4	3.6	4.5	5.5
Lead	7439-92-1	1.0	mg/kg	<1.0	1.7	1.2	1.8	2.1
Nickel	7440-02-0	1.0	mg/kg	4.1	14.3	196	165	296
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg	1.9	2.2	3.1	3.8	3.9
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals								
Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	0.4	0.5	<0.3	0.4	1.0
Cadmium	7440-43-9	0.01	mmol/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mmol/kg	<0.01	0.02	0.06	0.07	0.09
Lead	7439-92-1	0.01	mmol/kg	<0.01	<0.01	<0.01	<0.01	0.01
Nickel	7440-02-0	0.01	mmol/kg	0.07	0.24	3.34	2.82	5.05
Silver	7440-22-4	0.01	mmol/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.01	mmol/kg	0.03	0.03	0.05	0.06	0.06
Sum of SEM (Cd, Cu, Pb, Ni, Ag, Zn)	----	0.01	mmol/kg	0.10	0.31	3.45	2.96	5.21
SEM - AVS	----	0.01	mmol/kg	<0.01	<0.01	3.45	2.54	4.21
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	15.9	28.1	26.3	23.9	24.6
EA150: Particle Sizing								
+75µm	----	1	%	8	23	22	15	20
+150µm	----	1	%	5	7	12	4	7
+300µm	----	1	%	4	3	7	2	3
+425µm	----	1	%	4	2	5	1	2
+600µm	----	1	%	3	2	4	<1	1
+1180µm	----	1	%	<1	<1	3	<1	<1
+2.36mm	----	1	%	<1	<1	2	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	8	4	<1	7	15
Silt (2-60 µm)	----	1	%	72	57	60	60	46

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1912834-001	EP1912834-002	EP1912834-003	EP1912834-004	EP1912834-005	
				Result	Result	Result	Result	Result	
EA150: Soil Classification based on Particle Size - Continued									
Sand (0.06-2.00 mm)	----	1	%	20	39	38	33	39	
Gravel (>2mm)	----	1	%	<1	<1	2	<1	<1	
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.57	2.76	2.76	2.75	2.45	
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Iron	7439-89-6	50	mg/kg	21400	54700	30400	44200	46000	
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Iron	7439-89-6	50	mg/kg	250	1360	2700	1960	1830	
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg	6.32	6.22	5.67	9.35	8.42	
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Chromium	7440-47-3	1.0	mg/kg	222	628	286	420	383	
Copper	7440-50-8	1.0	mg/kg	5.6	19.6	18.3	24.3	29.0	
Cobalt	7440-48-4	0.5	mg/kg	7.4	29.9	46.7	54.0	59.3	
Lead	7439-92-1	1.0	mg/kg	3.7	6.4	4.3	5.5	5.2	
Manganese	7439-96-5	10	mg/kg	136	469	492	1340	1030	
Nickel	7440-02-0	1.0	mg/kg	82.6	289	576	742	863	
Selenium	7782-49-2	0.1	mg/kg	0.2	0.2	0.2	0.3	0.2	
Zinc	7440-66-6	1.0	mg/kg	9.2	60.4	26.3	39.3	48.8	
EG020-SDH: 1M HCl Extractable metals by ICPMS									
Arsenic	7440-38-2	1.0	mg/kg	<1.0	<1.0	1.2	<1.0	1.2	
Cadmium	7440-43-9	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	
Chromium	7440-47-3	1.0	mg/kg	5.5	11.3	18.9	18.2	15.9	
Cobalt	7440-48-4	0.5	mg/kg	1.3	6.6	20.8	14.3	21.1	
Copper	7440-50-8	1.0	mg/kg	1.1	3.8	5.8	5.9	5.8	
Lead	7439-92-1	1.0	mg/kg	1.3	2.5	1.8	2.3	1.7	
Manganese	7439-96-5	10	mg/kg	43	135	303	348	288	
Nickel	7440-02-0	1.0	mg/kg	9.1	73.0	268	203	348	
Zinc	7440-66-6	1.0	mg/kg	2.1	4.2	5.3	5.6	4.1	
Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	
EG035T: Total Recoverable Mercury by FIMS									



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW1	PW2	PW3	PW4	PW5
Client sampling date / time					02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1912834-001	EP1912834-002	EP1912834-003	EP1912834-004	EP1912834-005
					Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS - Continued									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
EN82: Porewater Extraction									
Volume	----	1	mL		10	34	13	<1	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.10	0.15	1.02	0.22	0.43



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				PW6	QC01	----	----	----
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP1912834-006	EP1912834-007	-----	-----	-----
				Result	Result	----	----	----
EA038 / EG005 (ED093): Simultaneously Extracted Metals								
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	----	----	----
Copper	7440-50-8	1.0	mg/kg	2.1	1.2	----	----	----
Lead	7439-92-1	1.0	mg/kg	2.0	<1.0	----	----	----
Nickel	7440-02-0	1.0	mg/kg	5.0	39.5	----	----	----
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	----	----	----
Zinc	7440-66-6	1.0	mg/kg	2.6	1.8	----	----	----
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals								
Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	0.5	0.4	----	----	----
Cadmium	7440-43-9	0.01	mmol/kg	<0.01	<0.01	----	----	----
Copper	7440-50-8	0.01	mmol/kg	0.03	0.02	----	----	----
Lead	7439-92-1	0.01	mmol/kg	<0.01	<0.01	----	----	----
Nickel	7440-02-0	0.01	mmol/kg	0.08	0.67	----	----	----
Silver	7440-22-4	0.01	mmol/kg	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.01	mmol/kg	0.04	0.03	----	----	----
Sum of SEM (Cd, Cu, Pb, Ni, Ag, Zn)	----	0.01	mmol/kg	0.17	0.72	----	----	----
SEM - AVS	----	0.01	mmol/kg	<0.01	0.31	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	19.6	17.0	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	76	21	----	----	----
+150µm	----	1	%	48	6	----	----	----
+300µm	----	1	%	13	3	----	----	----
+425µm	----	1	%	8	2	----	----	----
+600µm	----	1	%	5	1	----	----	----
+1180µm	----	1	%	2	<1	----	----	----
+2.36mm	----	1	%	<1	<1	----	----	----
+4.75mm	----	1	%	<1	<1	----	----	----
+9.5mm	----	1	%	<1	<1	----	----	----
+19.0mm	----	1	%	<1	<1	----	----	----
+37.5mm	----	1	%	<1	<1	----	----	----
+75.0mm	----	1	%	<1	<1	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	4	<1	----	----	----
Silt (2-60 µm)	----	1	%	1	53	----	----	----

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW6	QC01	----	----	----
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EP1912834-006	EP1912834-007	-----	-----	-----	
				Result	Result	----	----	----	
EA150: Soil Classification based on Particle Size - Continued									
Sand (0.06-2.00 mm)	----	1	%	94	47	----	----	----	
Gravel (>2mm)	----	1	%	1	<1	----	----	----	
Cobbles (>6cm)	----	1	%	<1	<1	----	----	----	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.80	2.81	----	----	----	
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Iron	7439-89-6	50	mg/kg	56600	29700	----	----	----	
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Iron	7439-89-6	50	mg/kg	420	1120	----	----	----	
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg	2.63	4.47	----	----	----	
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	----	----	----	
Chromium	7440-47-3	1.0	mg/kg	520	335	----	----	----	
Copper	7440-50-8	1.0	mg/kg	14.0	11.7	----	----	----	
Cobalt	7440-48-4	0.5	mg/kg	13.2	24.2	----	----	----	
Lead	7439-92-1	1.0	mg/kg	7.0	5.6	----	----	----	
Manganese	7439-96-5	10	mg/kg	402	495	----	----	----	
Nickel	7440-02-0	1.0	mg/kg	89.4	244	----	----	----	
Selenium	7782-49-2	0.1	mg/kg	0.1	0.1	----	----	----	
Zinc	7440-66-6	1.0	mg/kg	32.7	28.5	----	----	----	
EG020-SDH: 1M HCl Extractable metals by ICPMS									
Arsenic	7440-38-2	1.0	mg/kg	<1.0	<1.0	----	----	----	
Cadmium	7440-43-9	0.10	mg/kg	<0.10	<0.10	----	----	----	
Chromium	7440-47-3	1.0	mg/kg	2.2	10.8	----	----	----	
Cobalt	7440-48-4	0.5	mg/kg	2.2	6.3	----	----	----	
Copper	7440-50-8	1.0	mg/kg	2.3	3.1	----	----	----	
Lead	7439-92-1	1.0	mg/kg	1.5	1.7	----	----	----	
Manganese	7439-96-5	10	mg/kg	127	138	----	----	----	
Nickel	7440-02-0	1.0	mg/kg	6.8	78.7	----	----	----	
Zinc	7440-66-6	1.0	mg/kg	2.0	3.3	----	----	----	
Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	----	----	----	
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW6	QC01	----	----	----
Client sampling date / time					02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1912834-006	EP1912834-007	-----	-----	-----
				Result	Result		----	----	----
EG035T: Total Recoverable Mercury by FIMS - Continued									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	----	----	----
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	<0.5	----	----	----
EN82: Porewater Extraction									
Volume	----	1	mL		----	30	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.14	0.18	----	----	----



Analytical Results

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

Client sample ID

				QC03	----	----	----	----
Client sampling date / time				02-Dec-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP1912834-008	-----	-----	-----	-----
				Result	----	----	----	----
EG020T: Total Metals by ICP-MS								
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	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----

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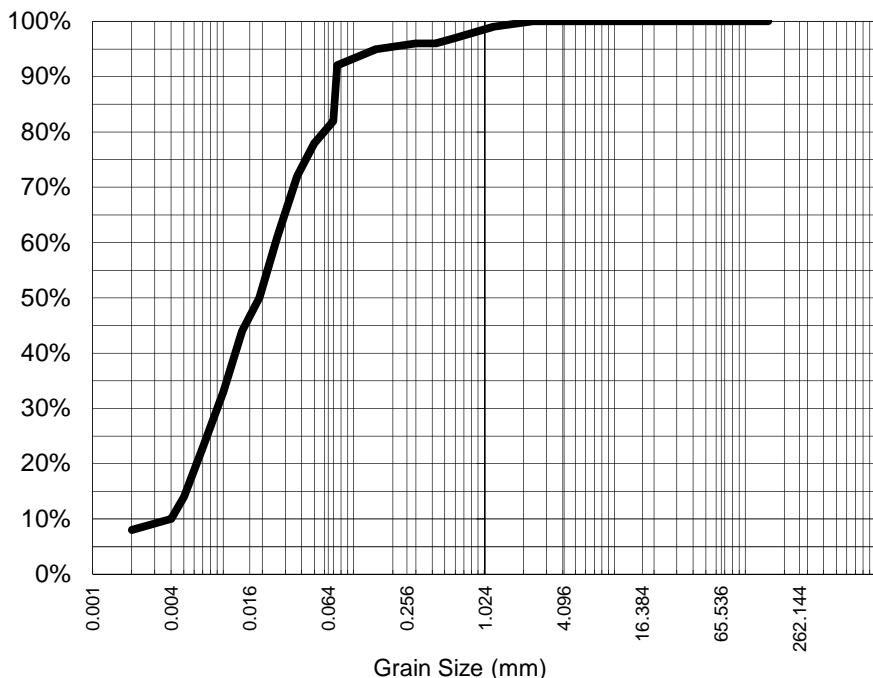
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fax 02 4968 0349
samples.newcastle@alsenviro.com

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Newcastle, NSW



CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-001 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW1

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	97%
0.425	96%
0.300	96%
0.150	95%
0.075	92%
Particle Size (microns)	
50	78%
37	72%
26	61%
19	50%
14	44%
10	33%
7	23%
5	14%
2	8%

Median Particle Size (mm)*	0.019
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.57

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

NATA Accreditation: 825 Site: Newcastle
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Technical Manager Air
Authorised Signatory

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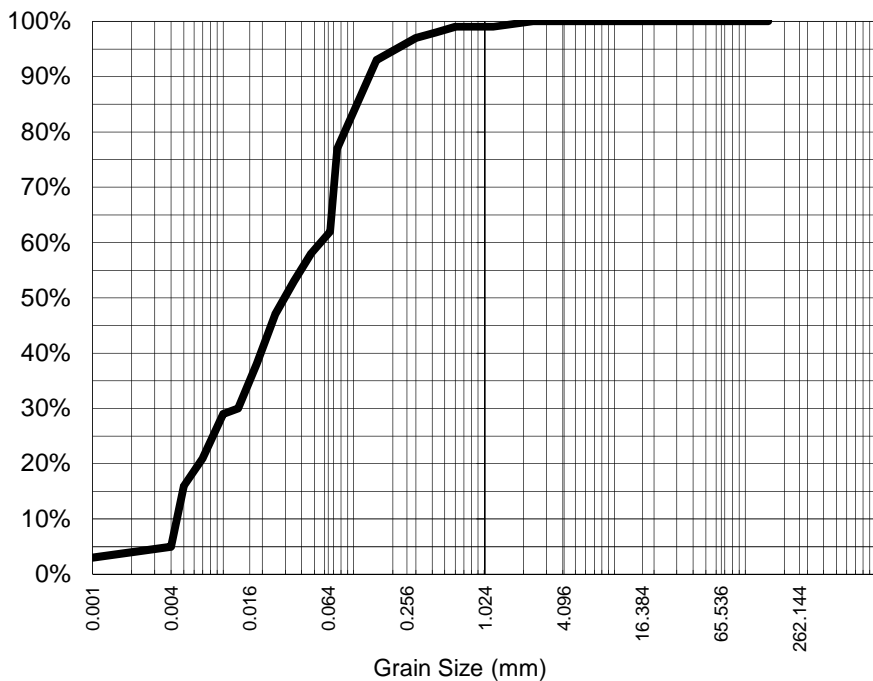
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COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-002 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW2

Particle Size Distribution



Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	97%
0.150	93%
0.075	77%
Particle Size (microns)	
47	58%
35	53%
25	47%
18	38%
13	30%
10	29%
7	21%
5	16%
1	3%

Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.030
----------------------------	-------

Sample Comments:

Analysed: 10-Dec-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, CLAY

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.76

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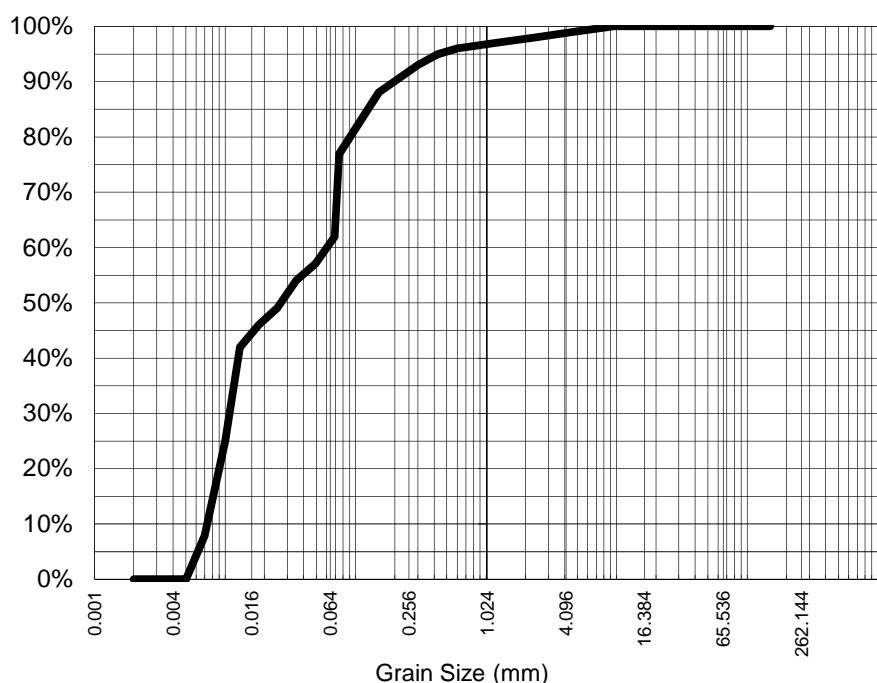
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COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-003 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW3

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	97%
0.600	96%
0.425	95%
0.300	93%
0.150	88%
0.075	77%
Particle Size (microns)	
49	57%
35	54%
25	49%
18	46%
13	42%
10	25%
7	8%
5	0%

Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.027
----------------------------	-------

Sample Comments:

Analysed: 10-Dec-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, CLAY

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.76

NATA Accreditation: 825 **Site:** Newcastle

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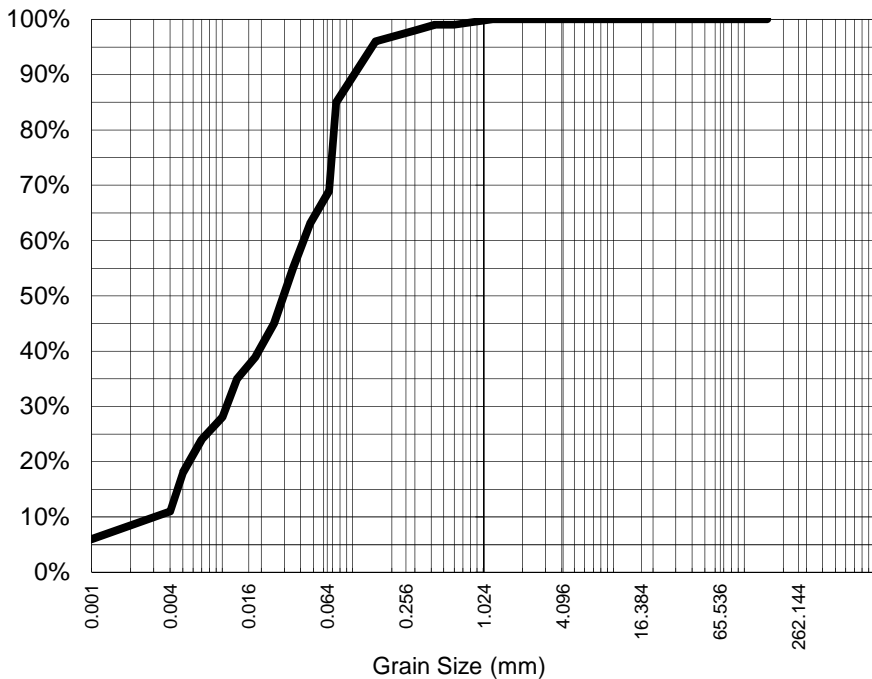
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COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-004 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW4

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	98%
0.150	96%
0.075	85%
Particle Size (microns)	
47	63%
35	55%
25	45%
18	39%
13	35%
10	28%
7	24%
5	18%
1	6%

Median Particle Size (mm)*	0.030
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.75

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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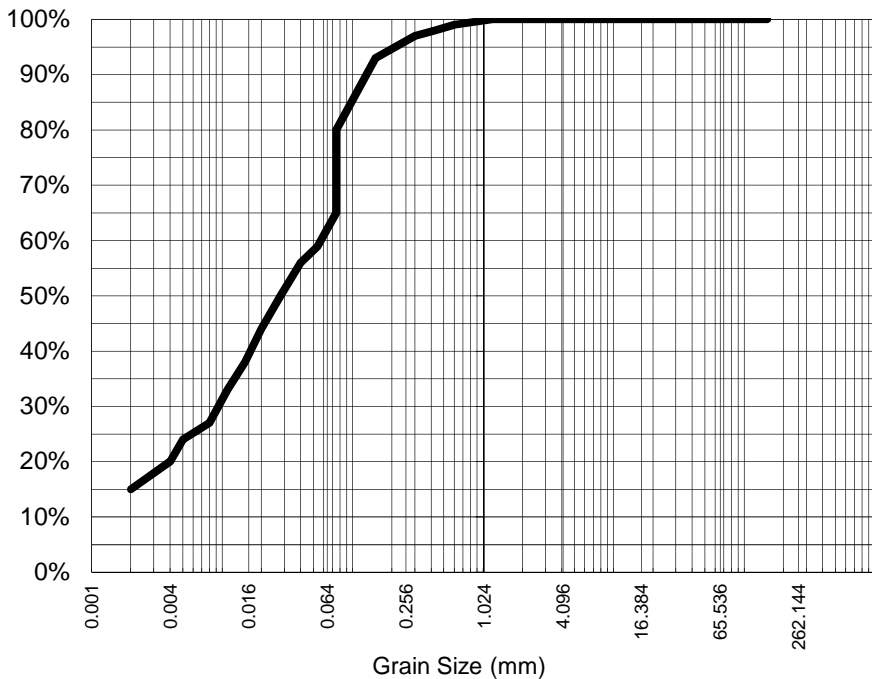
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CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-005 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW5

Particle Size Distribution



Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	98%
0.300	97%
0.150	93%
0.075	80%
Particle Size (microns)	
54	59%
40	56%
28	50%
20	44%
15	38%
11	33%
8	27%
5	24%
2	15%

Analysis Notes

The sample was pretreated to remove 90% of soluble solids and results have been corrected for salinity. Consequently, NATA endorsement does not apply to clay/silt results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.028
----------------------------	-------

Sample Comments:

Loss on Pretreatment 30%

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.45

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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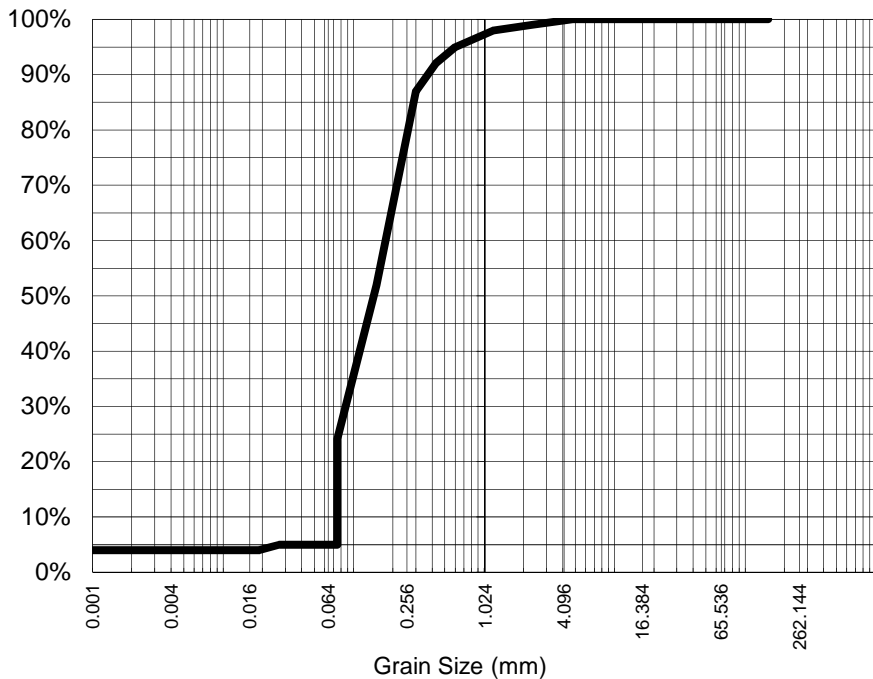
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CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-006 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW6

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	92%
0.300	87%
0.150	52%
0.075	24%
Particle Size (microns)	
55	5%
39	5%
27	5%
19	4%
14	4%
10	4%
7	4%
5	4%
1	4%

Analysis Notes

The sample was pretreated to remove 90% of soluble solids and results have been corrected for salinity. Consequently, NATA endorsement does not apply to clay/silt results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.145
----------------------------	-------

Sample Comments:

Loss on Pretreatment 26%

Sample Description: FINES, SAND, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.8

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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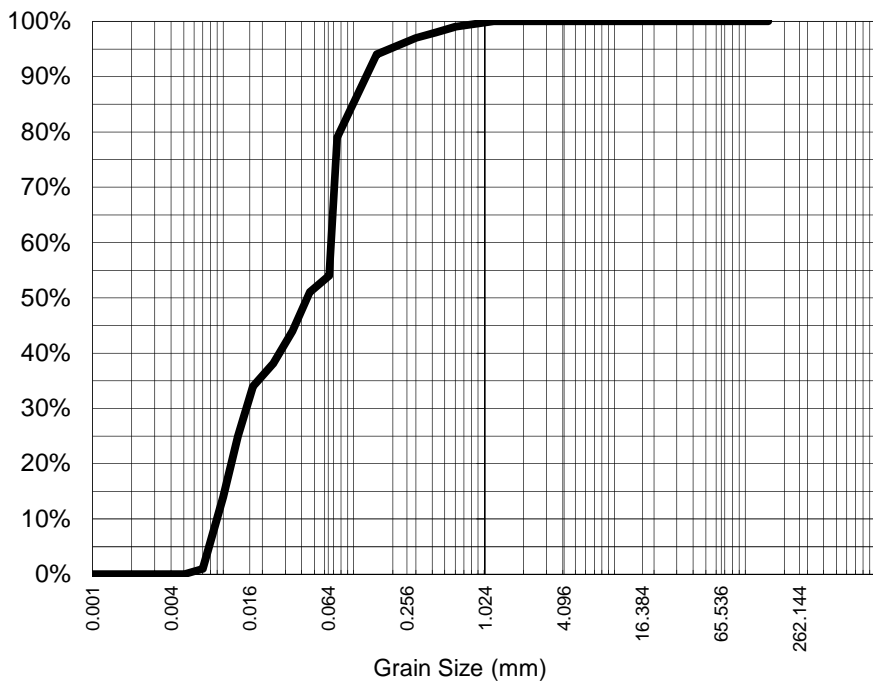
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CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-007 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** QC01

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	98%
0.300	97%
0.150	94%
0.075	79%
Particle Size (microns)	
46	51%
34	44%
24	38%
17	34%
13	25%
10	14%
7	1%
5	0%

Median Particle Size (mm)*	0.044
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.81

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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Technical Manager Air
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QUALITY CONTROL REPORT

Work Order	: EP1912834	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Order number	: ----	Date Analysis Commenced	: 05-Dec-2019
C-O-C number	: ----	Issue Date	: 19-Dec-2019
Sampler	: Brandon Henry, MATTHEW HUNT		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 8		
No. of samples analysed	: 8		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Carsten Emrich	Client Services	Brisbane Inorganics, Stafford, QLD
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA038 / EG005 (ED093): Simultaneously Extracted Metals (QC Lot: 2770323)									
EP1912834-001	PW1	EG005-SEM_1: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005-SEM_1: Copper	7440-50-8	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SEM_1: Lead	7439-92-1	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SEM_1: Nickel	7440-02-0	1	mg/kg	4.1	3.8	7.32	No Limit
		EG005-SEM_1: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SEM_1: Zinc	7440-66-6	1	mg/kg	1.9	1.6	20.4	No Limit
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals (QC Lot: 2759063)									
EP1912834-001	PW1	EA038-SEM: Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	0.4	0.5	0.00	No Limit
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QC Lot: 2766587)									
EP1912834-001	PW1	EG005-SD: Iron	7439-89-6	50	mg/kg	21400	# 16200	27.7	0% - 20%
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QC Lot: 2751125)									
EP1912834-001	PW1	EG005-SDH: Iron	7439-89-6	50	mg/kg	250	160	41.2	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 2766585)									
EP1912834-001	PW1	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2760236)									
EP1912834-001	PW1	EA055: Moisture Content	----	0.1	%	15.9	16.0	0.00	0% - 20%
EP1912951-006	Anonymous	EA055: Moisture Content	----	0.1	%	5.1	5.0	0.00	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2766586)									
EP1912834-001	PW1	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.2	0.2	0.00	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	7.4	5.5	29.7	0% - 50%
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	6.32	2.91	73.9	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	222	# 127	54.8	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	5.6	2.6	72.5	No Limit

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 Work Order : EP1912834
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2766586) - continued									
EP1912834-001	PW1	EG020-SD: Lead	7439-92-1	1	mg/kg	3.7	2.6	35.4	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	82.6	# 63.1	26.8	0% - 20%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	9.2	4.2	74.2	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	136	108	23.6	0% - 50%
EG020-SDH: 1M HCl Extractable metals by ICPMS (QC Lot: 2751126)									
EP1912834-001	PW1	EG020-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
		EG020-SDH: Cobalt	7440-48-4	0.5	mg/kg	1.3	0.9	37.0	No Limit
		EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EG020-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG020-SDH: Chromium	7440-47-3	1	mg/kg	5.5	3.9	34.7	No Limit
		EG020-SDH: Copper	7440-50-8	1	mg/kg	1.1	<1.0	13.4	No Limit
		EG020-SDH: Lead	7439-92-1	1	mg/kg	1.3	<1.0	27.3	No Limit
		EG020-SDH: Nickel	7440-02-0	1	mg/kg	9.1	6.2	38.6	No Limit
		EG020-SDH: Zinc	7440-66-6	1	mg/kg	2.1	1.4	37.2	No Limit
EG020-SDH: Manganese	7439-96-5	10	mg/kg	43	29	40.6	No Limit		
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 2751127)									
EP1912834-001	PW1	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 2757232)									
EP1912834-001	PW1	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP1913031-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2763279)									
EP1912834-007	QC01	EP003: Total Organic Carbon	----	0.02	%	0.18	0.16	11.2	No Limit
EB1932960-001	Anonymous	EP003: Total Organic Carbon	----	0.02	%	33.6	35.3	4.98	0% - 20%
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 2745761)									
EP1912846-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0138	0.0137	0.903	0% - 20%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.012	0.013	10.1	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	1.28	1.30	1.66	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.338	0.345	1.77	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.301	0.311	3.14	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.018	0.020	6.62	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.942	0.991	5.16	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	10.2	9.78	4.19	0% - 20%
		EP1912820-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001
EG020A-T: Arsenic	7440-38-2	0.001		mg/L	<0.001	<0.001	0.00	No Limit	

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 Work Order : EP1912834
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 2745761) - continued									
EP1912820-001	Anonymous	EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.057	0.056	1.93	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.425	0.416	2.17	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.023	0.022	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.22	0.19	12.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2745807)									
EP1912820-013	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA038 / EG005 (ED093): Simultaneously Extracted Metals (QCLot: 2770323)								
EG005-SEM_1: Cadmium	7440-43-9	0.1	mg/kg	<0.1	1.563 mg/kg	96.0	70.0	130
EG005-SEM_1: Copper	7440-50-8	1	mg/kg	<1.0	44.944 mg/kg	103	70.0	130
EG005-SEM_1: Lead	7439-92-1	1	mg/kg	<1.0	70.538 mg/kg	102	77.0	130
EG005-SEM_1: Nickel	7440-02-0	1	mg/kg	<1.0	13.026 mg/kg	109	70.0	123
EG005-SEM_1: Silver	7440-22-4	1	mg/kg	<1.0	0.521 mg/kg	92.1	70.0	130
EG005-SEM_1: Zinc	7440-66-6	1	mg/kg	<1.0	88.509 mg/kg	108	70.0	130
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals (QCLot: 2759063)								
EA038-SEM: Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	<0.3	22.553 mmol/kg	100	70.0	130
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QCLot: 2766587)								
EG005-SD: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 2751125)								
EG005-SDH: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2766585)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	2.154 mg/kg	117	80.0	120
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2766586)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	21.62091 mg/kg	107	74.0	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	4.6838 mg/kg	102	97.0	113
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	33.904 mg/kg	133	72.0	152
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	33.782 mg/kg	96.8	76.0	116
EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	----	----	----	----
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	40.33169 mg/kg	97.9	74.0	124
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	----	----	----	----
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	51.10088 mg/kg	116	81.0	135
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	61.70999 mg/kg	118	81.0	143
EG020-SDH: 1M HCl Extractable metals by ICPMS (QCLot: 2751126)								
EG020-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.10	----	----	----	----
EG020-SDH: Chromium	7440-47-3	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Cobalt	7440-48-4	0.5	mg/kg	<0.5	----	----	----	----
EG020-SDH: Copper	7440-50-8	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Lead	7439-92-1	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Manganese	7439-96-5	10	mg/kg	<10	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SDH: 1M HCl Extractable metals by ICPMS (QCLot: 2751126) - continued								
EG020-SDH: Nickel	7440-02-0	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	----	----	----	----
EG020-SDH: Zinc	7440-66-6	1	mg/kg	<1.0	----	----	----	----
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 2751127)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	1.34 mg/kg	125	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2757232)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	40 mg/kg	95.0	70.0	130
				<0.5	20 mg/kg	115	70.0	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2763279)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	28.3 %	105	70.0	130
				<0.02	0.48 %	106	70.0	130

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2745761)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	109	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	98.7	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	103	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	100	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.9	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	103	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.4	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	99.1	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	109	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	105	87.1	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2745807)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.2	85.1	115

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: SOIL				Matrix Spike (MS) Report			
				Spike	Spike Recovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2766585)							
EP1912834-002	PW2	EG035T-LL: Mercury	7439-97-6	1 mg/kg	84.0	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLOT: 2766586)							
EP1912834-002	PW2	EG020-SD: Arsenic	7440-38-2	50 mg/kg	83.1	70.0	130
		EG020-SD: Cadmium	7440-43-9	12.5 mg/kg	102	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	93.7	70.0	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	92.8	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	# Not Determined	70.0	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	79.6	70.0	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLOT: 2751127)							
EP1912834-002	PW2	EG035-SDH: Mercury	7439-97-6	0.5 mg/kg	96.9	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLOT: 2757232)							
EP1912834-001	PW1	EG048G: Hexavalent Chromium	18540-29-9	40 mg/kg	97.6	70.0	130
EP1912834-001	PW1	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	92.7	70.0	130

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2745761)							
EP1912812-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	127	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	113	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	105	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	108	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	110	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	106	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	103	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	112	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	130	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2745807)							
EP1912820-012	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	103	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1912834	Page	: 1 of 10
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Site	: ----	Issue Date	: 19-Dec-2019
Sampler	: Brandon Henry, MATTHEW HUNT	No. of samples received	: 8
Order number	: ----	No. of samples analysed	: 8

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EG005(ED093)-SD: Total Metals in Sediments by ICP-A	EP1912834--001	PW1	Iron	7439-89-6	27.7 %	0% - 20%	RPD exceeds LOR based limits
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--001	PW1	Chromium	7440-47-3	54.8 %	0% - 20%	RPD exceeds LOR based limits
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--001	PW1	Nickel	7440-02-0	26.8 %	0% - 20%	RPD exceeds LOR based limits
Matrix Spike (MS) Recoveries							
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--002	PW2	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--002	PW2	Nickel	7440-02-0	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA038 / EG005 (ED093): Simultaneously Extracted Metals							
Snap Lock Bag - frozen on receipt at ALS							
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	17-Dec-2019	03-Dec-2019	14	----	----	----
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals							
Snap Lock Bag - frozen on receipt at ALS							
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	----	----	----	11-Dec-2019	03-Dec-2019	8

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Control Samples (LCS)					
1M HCl Extractable Metals	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Total Fe and Al in Sediments by ICPAES	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard



Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Evaluation	Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction			Date analysed	Due for analysis	Evaluation
EA038 / EG005 (ED093): Simultaneously Extracted Metals								
Snap Lock Bag - frozen on receipt at ALS (EG005-SEM_1)								
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	02-Dec-2019	17-Dec-2019	03-Dec-2019	✖	17-Dec-2019	16-Mar-2020	✔
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals								
Snap Lock Bag - frozen on receipt at ALS (EA038-SEM)								
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	02-Dec-2019	----	----	----	11-Dec-2019	03-Dec-2019	✖
EA055: Moisture Content (Dried @ 105-110°C)								
Snap Lock Bag (EA055)								
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	02-Dec-2019	----	----	----	12-Dec-2019	16-Dec-2019	✔
EA150: Particle Sizing								
Snap Lock Bag: Separate bag received (EA150H)								
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	02-Dec-2019	----	----	----	12-Dec-2019	30-May-2020	✔
EA150: Soil Classification based on Particle Size								
Snap Lock Bag: Separate bag received (EA150H)								
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	02-Dec-2019	----	----	----	12-Dec-2019	30-May-2020	✔

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA152: Soil Particle Density								
Snap Lock Bag: Separate bag received (EA152)		02-Dec-2019	----	----	----	12-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Snap Lock Bag (EG005-SD)		02-Dec-2019	16-Dec-2019	30-May-2020	✓	16-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Snap Lock Bag (EG005-SDH)		02-Dec-2019	18-Dec-2019	30-May-2020	✓	18-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG020-SD: Total Metals in Sediments by ICPMS								
Snap Lock Bag (EG020-SD)		02-Dec-2019	16-Dec-2019	30-May-2020	✓	16-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG020-SDH: 1M HCl Extractable metals by ICPMS								
Snap Lock Bag (EG020-SDH)		02-Dec-2019	18-Dec-2019	30-May-2020	✓	18-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Snap Lock Bag (EG035-SDH)		02-Dec-2019	18-Dec-2019	30-Dec-2019	✓	18-Dec-2019	30-Dec-2019	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG035T: Total Recoverable Mercury by FIMS								
Snap Lock Bag (EG035T-LL)		02-Dec-2019	16-Dec-2019	30-Dec-2019	✓	17-Dec-2019	30-Dec-2019	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							

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 Work Order : EP1912834
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG048: Hexavalent Chromium (Alkaline Digest)								
Snap Lock Bag (EG048G) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	02-Dec-2019	11-Dec-2019	30-Dec-2019	✓	12-Dec-2019	18-Dec-2019	✓	
EN82: Porewater Extraction								
Non-Volatile Leach: 14 day HT(e.g. SV organics) (EN82) PW1, PW3, QC01 PW2, PW4,	02-Dec-2019	09-Dec-2019	16-Dec-2019	✓	----	----	----	
Non-Volatile Leach: 14 day HT(e.g. SV organics) (EN82) PW5, PW6	02-Dec-2019	11-Dec-2019	16-Dec-2019	✓	----	----	----	
EP003: Total Organic Carbon (TOC) in Soil								
Snap Lock Bag (EP003) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	02-Dec-2019	13-Dec-2019	30-Dec-2019	✓	13-Dec-2019	30-Dec-2019	✓	

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) QC03	02-Dec-2019	05-Dec-2019	30-May-2020	✓	05-Dec-2019	30-May-2020	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC03	02-Dec-2019	----	----	----	05-Dec-2019	30-Dec-2019	✓



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)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SEM_1	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Acid Volatile Sulfides (AVS)	EA038-SEM	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	10	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	0	7	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SEM_1	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Acid Volatile Sulfides (AVS)	EA038-SEM	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SEM_1	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Acid Volatile Sulfides (AVS)	EA038-SEM	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	0	7	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard



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	
Matrix Spikes (MS) - Continued							
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	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	
Laboratory Duplicates (DUP)							
Total Mercury by FIMS	EG035T	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	16	6.25	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
Acid Volatile Sulfides (AVS)	EA038-SEM	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. AVS is defined as the fraction of sulfides extracted from sediments by cold digestion using HCl. The remaining solution is then run on the ICP to determine concentration of various metals and SEM is calculated as sum of Cd, Cu, Ni, Pb, Zn in mmol/kg.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Total Fe and Al in Sediments by ICPAES	EG005-SD	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NODG
1M HCl Extractable Metals	EG005-SDH	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined via ICPAES following weak acid extraction. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NAGD. ALS is not NATA accredited for the analysis of Barium, Boron, Molybdenum and Strontium by this method.
1M HCl Extractable Metals	EG005-SEM 1	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. AVS is defined as the fraction of sulfides extracted from sediments by cold digestion using HCl. The remaining solution is then run on the ICP to determine concentration of various metals and SEM is calculated as sum of Cd, Cu, Ni, Pb, Zn in mmol/kg.
Simultaneously Extractable Metals (SEM)	EG005-SEM 2	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. AVS is defined as the fraction of sulfides extracted from sediments by cold digestion using HCl. The remaining solution is then run on the ICP to determine concentration of various metals and SEM is calculated as sum of Cd, Cu, Ni, Pb, Zn in mmol/kg.
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	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. Analyte list and LORs per NODG.
1M HCl Extractable Metals by ICPMS	EG020-SDH	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020. Metals are determined via ICPMS following weak acid extraction. 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. Analyte list and LORs per NAGD. ALS is not NATA accredited for the analysis of Tin, Uranium, Barium, Boron and Strontium by this method.



Analytical Methods	Method	Matrix	Method Descriptions
1M HCl Extractable Mercury by FIMS	EG035-SDH	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B. Mercury is determined via FIMS following weak acid extraction. FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060A. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red 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.
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house: Referenced to In house, Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
1M HCl Extraction for Metals in Sediments (1 hour)	EN71-SEM	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. 2g of as received sample is leached at room temperature for 1 hour in 1N hydrochloric acid.
Porewater Extraction	EN82	SOIL	Extraction of porewater from sediment samples using centrifuge.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#

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Work Order : EP1912834
Client : SENVERSA PTY LTD
Project : P17302 Bulong DSI



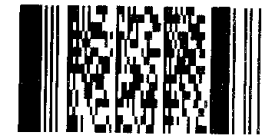
Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Sample Information							Container Information							Analysis Required										Comments: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	1:5 Leach	deionised water leach	8 Metals (Water Leachable) ICPMS & FIMS :As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate													
1	PW1	sediment	2/12/2019		7 bags		X	X	X	X	X													
2	PW2	sediment	2/12/2019		7 bags		X	X	X	X	X													
3	PW3	sediment	2/12/2019		7 bags		X	X	X	X	X													
4	PW4	sediment	2/12/2019		7 bags		X	X	X	X	X													
5	PW5	sediment	2/12/2019		7 bags		X	X	X	X	X													
6	PW6	sediment	2/12/2019		7 bags		X	X	X	X	X													
7	QC01	sediment	2/12/2019		7 bags		X	X	X	X	X													
Total							7	7	7	7	7													

Environmental Division
Perth
Work Order Reference
EP1913434



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Signature: Date:

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Additional Leachate Analysis _ ALS

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9400 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@servsa.com.au	Phone/Mobile:	+61 409 286 017

[illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name: Matthew Hunt /
Brandon Henry

Signature: _____

Dat

2/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature: <u>Matt Hunt</u>	Date: <u>3/12</u>	Carrier / Reference #:	Name/Signature: <u>ny</u>	Date: <u>4/12/19</u>	
Of: <u>Service</u>	Time: <u>FBC</u>	Date/Time:	Of: <u>ny</u>	Time: <u>8:48</u>	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Fomulohydro Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Rptiles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L = Lugol's Iodine preserved white plastic bottle; SW = sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

M17302 COC 2.12.19 Sediment

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913434

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler :</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 2</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 04-Dec-2019 08:45	Issue Date : 17-Dec-2019
Client Requested Due Date : 24-Dec-2019	Scheduled Reporting Date : 24-Dec-2019

Delivery Details

Mode of Delivery : Samples On Hand	Security Seal : Not Available
No. of coolers/boxes : ----	Temperature : ----
Receipt Detail :	No. of samples received / analysed : 7 / 7

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - EN60-Dia Deionised Water Leach	SOIL - W-02W (ICPMS) 8 Metals (Water Leachable) ICPMS & FIMS
EP1913434-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓
EP1913434-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓
EP1913434-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓
EP1913434-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓
EP1913434-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓
EP1913434-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓
EP1913434-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EP1913434**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **----**
Site : **----**
Quote number : **EP/382/19 V2**
No. of samples received : **7**
No. of samples analysed : **7**

Page : 1 of 6
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 04-Dec-2019 08:45
Date Analysis Commenced : 19-Dec-2019
Issue Date : 27-Dec-2019 11:51



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913434-001	EP1913434-002	EP1913434-003	EP1913434-004	EP1913434-005
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.002	0.003	0.002	0.002
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
Cobalt	7440-48-4	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	0.002	0.001	0.002
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	<0.001	0.016	0.002	0.009	0.005
Nickel	7440-02-0	0.001	mg/L	<0.001	0.010	0.051	0.036	0.031
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	<0.005	0.008	<0.005	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				PW6	QC01	----	----	----
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP1913434-006	EP1913434-007	-----	-----	-----
				Result	Result	----	----	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	<0.001	0.024	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	0.006	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	0.011	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	----	----	----



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Client sample ID

				PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913434-001	EP1913434-002	EP1913434-003	EP1913434-004	EP1913434-005
				Result	Result	Result	Result	Result
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	6.2	6.1	6.3	6.4	6.4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	PW6	QC01	----	----	----
Client sampling date / time					02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1913434-006	EP1913434-007	-----	-----	-----
					Result	Result	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		8.4	7.7	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP1913434	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Order number	: ----	Date Analysis Commenced	: 19-Dec-2019
C-O-C number	: ----	Issue Date	: 27-Dec-2019
Sampler	: ----		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 7		
No. of samples analysed	: 7		



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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2779442)									
EP1913252-003	Anonymous	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.004	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EG020A-W: Iron	7439-89-6	0.05	mg/L	0.08	0.06	25.9	No Limit		
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2779455)									
EP1913409-005	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913434-007	QC01	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2782806)									
EP1913280-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913434-002	PW2	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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 Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	109	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.4	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	100	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	99.8	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.0	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	97.9	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	100	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.2	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782806)								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	102	93.0	115

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)							
EP1913434-001	PW1	EG020A-W: Arsenic	7440-38-2	1 mg/L	127	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	117	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	96.9	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	109	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	106	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	106	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	111	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	124	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)							



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455) - continued							
EP1913434-002	PW2	EG035W: Mercury	7439-97-6	0.01 mg/L	99.6	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782806)							
EP1913280-002	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	102	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913434	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Site	: ----	Issue Date	: 27-Dec-2019
Sampler	: ----	No. of samples received	: 7
Order number	: ----	No. of samples analysed	: 7

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a)		02-Dec-2019	19-Dec-2019	30-Dec-2019	✔	----	----
PW1,	PW2,						
PW3,	PW4,						
PW5,	PW6,						
QC01							

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020W: Water Leachable Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	19-Dec-2019	23-Dec-2019	16-Jun-2020	✓	23-Dec-2019	16-Jun-2020	✓
EG035W: Water Leachable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	19-Dec-2019	----	----	----	20-Dec-2019	16-Jan-2020	✓
EG050G-W: Hexavalent Chromium - Water Leachable							
Clear Plastic Bottle - NaOH (EG050G-W) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	19-Dec-2019	----	----	----	23-Dec-2019	16-Jan-2020	✓



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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	15	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	11	18.18	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	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
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	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 (2013) Schedule B(3)
Deionised Water Leach	EN60-D1a	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigoli Way, Wangara, WA 8065
Contact: Lauren Blagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information				Container Information			Analysis Required										Comments: e.g. Highly contaminated sample, hazardous materials present, trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	Total Hardness as CaCO3	pH (PCT)	Total Nitrogen + NO2 + NO3 + NH3	Dissolved Mercury - Low Level	Cs, Mg, Na, K, Cl, SO4, Alkalinity	Total Cyanide by Segmented Flow Anal	8 metals (Total): As, Cd, Cr, Cu, Pb, Ni, Fe	Total Metals by ICP/MS: Se, Co, Mn, F, B			
1	MW1	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
2	MW2	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
3	MW3	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
4	MW4	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
5	MW5	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
6	QC15	Water	3/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
7	QC16	Water	8/12/2019	-	1N	1	X	X	X	X	X	X	*	*			
Total						25	7	7	7	7	7	7	7	7			

*please forward NMI bottles to NMI for metals analysis

Environmental Division
Perth
Work Order Reference
EP1913212



Telephone : + 61-6-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project	Sampler Name:	Matthew Hunt/ Brandon Henry	Signature:	Date:	2/12/2019
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Relinquished By:	Date:	Method of Shipment (if applicable):	Received by:	Date:
Name/Signature:	Time:	Carrier / Reference #:	Name/Signature:	Time:
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:
Of:	Time:	Date/Time:	Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; SH1 = Sodium thiosulfate preserved plastic;
V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EP1913212**

Amendment : **1**

Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES
TERRACE
PERTH 6000**

Laboratory : **Environmental Division Perth**
Contact : **Lauren Biagioni**
Address : **26 Rigali Way Wangara WA Australia
6065**

E-mail : **blaire.coleman@senversa.com.au**
Telephone : **+61 08 6557 8881**
Facsimile : **+61 03 9606 0074**

E-mail : **Lauren.biagioni@alsglobal.com**
Telephone : **08 9406 1307**
Facsimile : **+61-8-9406 1399**

Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Site : **----**
Sampler : **Matthew Hunt/Brandon Henry**

Page : **1 of 3**
Quote number : **EP2019SENV0005 (EP/382/19 V3)**
QC Level : **NEPM 2013 B3 & ALS QC Standard**

Dates

Date Samples Received : **12-Dec-2019 08:00**
Client Requested Due Date : **19-Dec-2019**

Issue Date : **02-Apr-2020**
Scheduled Reporting Date : **19-Dec-2019**

Delivery Details

Mode of Delivery : **Carrier**
No. of coolers/boxes : **8**
Receipt Detail :

Security Seal : **Not Available**
Temperature : **20.2 - Ice present**
No. of samples received / analysed : **7 / 7**

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

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

- No sample container / preservation non-compliance exists.

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.

Matrix: WATER

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER pH (PCT)	WATER Total Hg	WATER Dissolved	WATER Total Me	WATER Total Cy	WATER Ca, Mg	WATER Total Ni
EP1913212-001	09-Dec-2019 00:00	MW1	✓	✓	✓		✓	✓	✓
EP1913212-002	09-Dec-2019 00:00	MW2	✓	✓	✓		✓	✓	✓
EP1913212-003	09-Dec-2019 00:00	MW3	✓	✓	✓		✓	✓	✓
EP1913212-004	09-Dec-2019 00:00	MW4	✓	✓	✓		✓	✓	✓
EP1913212-005	09-Dec-2019 00:00	MW5	✓	✓	✓		✓	✓	✓
EP1913212-006	10-Dec-2019 00:00	QC15	✓	✓		✓	✓	✓	✓
EP1913212-007	10-Dec-2019 00:00	QC16				✓			

Matrix: WATER

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER Total Metals	WATER 8 metals
EP1913212-007	10-Dec-2019 00:00	QC16	✓	✓

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

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

Method	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA005-P: pH by PC Titrator							
MW1	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW2	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW3	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW4	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW5	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
QC15	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
EK057G: Nitrite as N by Discrete Analyser							

Issue Date : 02-Apr-2020
 Page : 3 of 3
 Work Order : EP1913212 Amendment 1
 Client : SENVERSA PTY LTD



MW1	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW2	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW3	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW4	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW5	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----

Requested Deliverables

Blaire Coleman

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

Email blaire.coleman@senversa.com.au
 Email blaire.coleman@senversa.com.au
 Email blaire.coleman@senversa.com.au
 Email blaire.coleman@senversa.com.au
 Email blaire.coleman@senversa.com.au
 Email blaire.coleman@senversa.com.au
 Email blaire.coleman@senversa.com.au
 Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.au
 u

CERTIFICATE OF ANALYSIS

Work Order : EP1913212 Amendment : 1 Client : SENVERSA PTY LTD Contact : Blaire Coleman Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000 Telephone : +61 08 6557 8881 Project : P17302 Bulong DSI Order number : ---- C-O-C number : ---- Sampler : Matthew Hunt/Brandon Henry Site : ---- Quote number : EP/382/19 V3 No. of samples received : 7 No. of samples analysed : 7	Page : 1 of 6 Laboratory : Environmental Division Perth Contact : Lauren Biagioni Address : 26 Rigali Way Wangara WA Australia 6065 Telephone : 08 9406 1307 Date Samples Received : 12-Dec-2019 08:00 Date Analysis Commenced : 12-Dec-2019 Issue Date : 02-Apr-2020 15:36
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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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Amendment (02/04/2020): This report has been amended and re-released to alter the sampling dates. All analysis results are as per the previous report.
- EK028SF; LOR raised for cyanide on particular samples due to possible sample matrix interference.
- EG035F-LL (Dissolved Mercury): LOR raised for EP1913212-1, 2, 3 and 4 due to high TDS content.
- EK061G/EK067G (TKN/TP): LOR for sample EP1913212-001 raised due to the high amount of TDS present.
- EK061G/EK067G (TKN/TP): LOR for sample EP1913212-006 raised due to the high amount of NOx present.
- It is recognised that Total Kjeldahl Nitrogen (EK061G) is less than Ammonia (EK055G) for sample EP1913212-004. However, the difference is within experimental variation of the methods.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Ionic balances were calculated using: major anions - chloride, alkalinity, sulfate and NOx; and major cations - calcium, magnesium, potassium and sodium for #6.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW1	MW2	MW3	MW4	MW5
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913212-001	EP1913212-002	EP1913212-003	EP1913212-004	EP1913212-005
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.18	7.27	7.14	6.83	7.15
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		18200	13100	18000	31700	9780
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		114	158	121	242	770
Total Alkalinity as CaCO3	----	1	mg/L		114	158	121	242	770
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		5580	4130	5240	18400	3990
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		60000	36100	48300	60000	21200
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		926	694	559	865	340
Magnesium	7439-95-4	1	mg/L		3860	2760	4040	7180	2170
Sodium	7440-23-5	1	mg/L		39600	23200	30800	42100	14500
Potassium	7440-09-7	1	mg/L		310	115	153	345	134
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L		<0.00020	<0.00008	<0.00008	<0.00008	<0.00004
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.040	<0.040	<0.040	<0.040	<0.040
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.11	0.11	0.18	276	0.22
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	0.05	0.10	0.99	0.07
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.40	2.55	5.97	39.7	1.57
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.40	2.60	6.07	40.7	1.64
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.5	0.8	1.5	264	0.6
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		<0.5	3.4	7.6	305	2.2



Analytical Results

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

Client sample ID

				MW1	MW2	MW3	MW4	MW5
Client sampling date / time				09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913212-001	EP1913212-002	EP1913212-003	EP1913212-004	EP1913212-005
				Result	Result	Result	Result	Result
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	1810	1110	1470	2080	696
∅ Total Cations	----	0.01	meq/L	2090	1270	1700	2470	830
∅ Ionic Balance	----	0.01	%	7.26	6.99	7.24	8.64	8.73

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC15	QC16	----	----	----
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EP1913212-006	EP1913212-007	-----	-----	-----	
				Result	Result	----	----	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	6.75	----	----	----	----	
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L	16	----	----	----	----	
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	5	----	----	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	5	----	----	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	----	----	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	40	----	----	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----	
Magnesium	7439-95-4	1	mg/L	4	----	----	----	----	
Sodium	7440-23-5	1	mg/L	40	----	----	----	----	
Potassium	7440-09-7	1	mg/L	1	----	----	----	----	
EG020T: Total Metals by ICP-MS									
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	----	----	----	
Cobalt	7440-48-4	0.001	mg/L	----	<0.001	----	----	----	
Nickel	7440-02-0	0.001	mg/L	----	<0.001	----	----	----	
Lead	7439-92-1	0.001	mg/L	----	<0.001	----	----	----	
Zinc	7440-66-6	0.005	mg/L	----	<0.005	----	----	----	
Manganese	7439-96-5	0.001	mg/L	----	<0.001	----	----	----	
Selenium	7782-49-2	0.01	mg/L	----	<0.01	----	----	----	
Iron	7439-89-6	0.05	mg/L	----	<0.05	----	----	----	
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L	<0.00004	----	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	----	<0.0001	----	----	----	
EK026SF: Total CN by Segmented Flow Analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC15	QC16	----	----	----
Client sampling date / time					10-Dec-2019 00:00	10-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1913212-006	EP1913212-007	-----	-----	-----
					Result	Result	----	----	----
EK026SF: Total CN by Segmented Flow Analyser - Continued									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.02	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		6.61	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		6.61	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.5	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		6.6	----	----	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		1.87	----	----	----	----
∅ Total Cations	----	0.01	meq/L		2.09	----	----	----	----
∅ Ionic Balance	----	0.01	%		5.75	----	----	----	----

QUALITY CONTROL REPORT

Work Order : **EP1913212**

Page : 1 of 7

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Perth

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 26 Rigali Way Wangara WA Australia 6065

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 12-Dec-2019

Order number : ----

Date Analysis Commenced : 12-Dec-2019

C-O-C number : ----

Issue Date : 02-Apr-2020

Sampler : Matthew Hunt/Brandon Henry

Site : ----

Quote number : EP/382/19 V3

No. of samples received : 7

No. of samples analysed : 7



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. 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

Canhuang Ke

Inorganics Supervisor

Perth Inorganics, Wangara, WA

Chris Lemaitre

Laboratory Manager (Perth)

Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Titrator (QC Lot: 2776014)									
EP1913212-002	MW2	EA005-P: pH Value	----	0.01	pH Unit	7.27	7.27	0.00	0% - 20%
EP1913213-005	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.69	6.68	0.150	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2776015)									
EP1913212-002	MW2	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	158	158	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	158	158	0.00	0% - 20%
EP1913213-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	16	16	0.00	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	16	0.00	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2762197)									
EP1913212-002	MW2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4130	3650	12.4	0% - 20%
EP1913213-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10500	10200	3.23	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2762198)									
EP1913212-002	MW2	ED045G: Chloride	16887-00-6	1	mg/L	36100	37200	2.99	0% - 20%
EP1913213-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	116000	114000	1.68	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2763610)									
EP1913212-001	MW1	ED093F: Calcium	7440-70-2	1	mg/L	926	955	3.06	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	3860	4020	4.03	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	39600	41000	3.47	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	310	327	5.53	0% - 20%
EP1913213-005	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	1290	1250	3.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	8340	8140	2.44	0% - 20%



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 2763610) - continued									
EP1913213-005	Anonymous	ED093F: Sodium	7440-23-5	1	mg/L	90500	88400	2.37	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	418	408	2.26	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 2771255)									
EP1913212-007	QC16	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EP1913322-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.876	0.886	1.15	0% - 20%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.011	0.010	13.1	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.310	0.316	1.68	0% - 20%
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.471	0.474	0.622	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	3.06	3.09	1.02	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	6.05	6.38	5.36	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.028	0.030	5.07	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	82.1	84.5	2.89	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	0.06	0.06	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.25	<0.25	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2764162)									
EP1912987-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EP1913161-005	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Mercury by FIMS (QC Lot: 2764312)									
EP1913212-006	QC15	EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2771249)									
EP1913213-009	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913322-003	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2764069)									
EP1913212-001	MW1	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EP1913213-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762211)									
EP1913212-002	MW2	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.11	0.10	14.1	0% - 50%
EP1913213-005	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	51.6	50.1	3.03	0% - 20%

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 Work Order : EP1913212 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196)									
EP1913212-002	MW2	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.05	0.05	0.00	No Limit
EP1913213-005	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2762212)									
EP1913212-002	MW2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.60	2.57	1.14	0% - 20%
EP1913213-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	31.7	32.5	2.62	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768184)									
EP1913195-012	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	392	404	2.98	0% - 20%
EP1913322-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	4.4	4.4	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 2776014)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98.5	102
				----	7 pH Unit	100	98.5	102
ED037P: Alkalinity by PC Titrator (QCLot: 2776015)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	103	81.2	126
				<1	200 mg/L	97.7	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.2	87.7	113
				<1	100 mg/L	102	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.6	87.9	114
				<1	1000 mg/L	97.3	87.9	114
ED093F: Dissolved Major Cations (QCLot: 2763610)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.6	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	105	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	105	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	106	89.7	108
EG020T: Total Metals by ICP-MS (QCLot: 2771255)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.3	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.0	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	96.5	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.7	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.3	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	103	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	89.9	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.3	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	97.0	87.1	120
EG035F: Dissolved Mercury by FIMS (QCLot: 2764162)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	103	87.6	115



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG035T: Total Mercury by FIMS (QCLot: 2764312)								
EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	99.1	89.0	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.7	85.1	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	105	75.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	95.8	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.5	93.7	108
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768184)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	80.3	75.8	100

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)							
EP1913212-001	MW1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)							
EP1913212-001	MW1	ED045G: Chloride	16887-00-6	1000 mg/L	# Not Determined	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 2771255)							
EP1913213-006	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	99.7	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	109	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	108	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	103	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	107	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	110	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	109	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	105	70.0	130

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 Work Order : EP1913212 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 2764162)							
EP1913160-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.01 mg/L	113	70.0	130
EG035T: Total Mercury by FIMS (QCLot: 2764312)							
EP1913212-007	QC16	EG035T-LL: Mercury	7439-97-6	0.01 mg/L	118	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)							
EP1913284-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	97.4	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)							
EP1913212-002	MW2	EK026SF: Total Cyanide	57-12-5	2 mg/L	96.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)							
EP1913212-001	MW1	EK055G: Ammonia as N	7664-41-7	1 mg/L	129	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)							
EP1913212-001	MW1	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	96.5	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)							
EP1913212-001	MW1	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	79.3	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768184)							
EP1913195-012	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	# Not Determined	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913212	Page	: 1 of 8
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 02-Apr-2020
Sampler	: Matthew Hunt/Brandon Henry	No. of samples received	: 7
Order number	: ----	No. of samples analysed	: 7

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EP1913212--001	MW1	Sulfate as SO4 - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	EP1913212--001	MW1	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser	EP1913195--012	Anonymous	Total Kjeldahl Nitrogen as N	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural MW1, MW3, MW5 MW2, MW4,	----	----	----	19-Dec-2019	09-Dec-2019	10
Clear Plastic Bottle - Natural QC15	----	----	----	19-Dec-2019	10-Dec-2019	9
EK057G: Nitrite as N by Discrete Analyser						
Clear Plastic Bottle - Natural MW1, MW3, MW5 MW2, MW4,	----	----	----	12-Dec-2019	11-Dec-2019	1

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation



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) MW1, MW3, MW5 MW2, MW4,	09-Dec-2019	----	----	----	19-Dec-2019	09-Dec-2019	✘
Clear Plastic Bottle - Natural (EA005-P) QC15	10-Dec-2019	----	----	----	19-Dec-2019	10-Dec-2019	✘
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) MW1, MW3, MW5 MW2, MW4,	09-Dec-2019	----	----	----	19-Dec-2019	23-Dec-2019	✔
Clear Plastic Bottle - Natural (ED037-P) QC15	10-Dec-2019	----	----	----	19-Dec-2019	24-Dec-2019	✔
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) MW1, MW3, MW5 MW2, MW4,	09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✔
Clear Plastic Bottle - Natural (ED041G) QC15	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) MW1, MW3, MW5 MW2, MW4,	09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✔
Clear Plastic Bottle - Natural (ED045G) QC15	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) MW1, MW3, MW5 MW2, MW4,	09-Dec-2019	----	----	----	17-Dec-2019	06-Jan-2020	✔
Clear Plastic Bottle - Natural (ED093F) QC15	10-Dec-2019	----	----	----	17-Dec-2019	17-Dec-2019	✔
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) QC16	10-Dec-2019	17-Dec-2019	07-Jun-2020	✔	17-Dec-2019	07-Jun-2020	✔
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F-LL) MW1, MW3, MW5 MW2, MW4,	09-Dec-2019	----	----	----	13-Dec-2019	06-Jan-2020	✔



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035T: Total Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T-LL) QC15		10-Dec-2019	----	----	----	13-Dec-2019	07-Jan-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC16		10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
White Plastic Bottle-NaOH (EK026SF) MW1, MW2, MW3, MW4, MW5		09-Dec-2019	----	----	----	13-Dec-2019	23-Dec-2019	✓
White Plastic Bottle-NaOH (EK026SF) QC15		10-Dec-2019	----	----	----	13-Dec-2019	24-Dec-2019	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) MW1, MW2, MW3, MW4, MW5		09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) QC15		10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) MW1, MW2, MW3, MW4, MW5		09-Dec-2019	----	----	----	12-Dec-2019	11-Dec-2019	✗
Clear Plastic Bottle - Natural (EK057G) QC15		10-Dec-2019	----	----	----	12-Dec-2019	12-Dec-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) MW1, MW2, MW3, MW4, MW5		09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) QC15		10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) MW1, MW2, MW3, MW4, MW5		09-Dec-2019	18-Dec-2019	06-Jan-2020	✓	18-Dec-2019	06-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) QC15		10-Dec-2019	18-Dec-2019	07-Jan-2020	✓	18-Dec-2019	07-Jan-2020	✓



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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Alkalinity by PC Titrator	ED037-P	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	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	
Method Blanks (MB) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 by PC 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 (2013) Schedule B(3)
Hardness as CaCO ₃	EA065	WATER	In house: Referenced to APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS - Low Level	EG035T-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO ₂ - B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO _x) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Combined oxidised Nitrogen (NO ₂ +NO ₃) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO ₃ -. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) Schedule B(3)



Senversa Pty Ltd
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ABN 89 132 231 380

Chain of Custody Documentation

Laboratory: ALS WA
Address: 28 Rigall Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Sample Information							Container Information							Analysis Required									
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	Total Hardness as CaCO3	pH (PCT)	Total Nitrogen + NO2 + NO3 + NH3	Dissolved Mercury - Low Level	Ca, Mg, Na, K, Cl, SO4, Alkalinity	Total Cyanide by Segmented Flow Analyser	8 metals (Total): As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Total Metals by ICP/MS: Se, Co, Mn, Fe	Comments: e.g. Highly contaminated sample, hazardous materials present, trace LORs etc.								
1	BMH01	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
2	BMH02A	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
3	BMH04	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
4	BMH08	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
5	BMH11A	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
6	QC06	Water	8/12/2019	-	1N	1	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
7	QC07	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
	QC08	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		FWD to Eurofins							
8	QC13	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
9	QC14	Water	8/12/2019	-	1N	1	X	X	X	X	X	X	*	*		*Fwd to NMI for metals analysis							
Total:						34	10	10	10	10	10	10											

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name: Matthew Hunt/ Brandon Henry Signature:

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L = Lugol's Iodine preserved white plastic bottle; SW = sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Environmental Division
Perth
Work Order Reference
EP1913213



Telephone : + 61-8-9406 1301

2/12/2019

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913213

Amendment : 1

Client : **SENVERSA PTY LTD**
 Contact : Blaire Coleman
 Address : LEVEL 25, 108 ST GEORGES
 TERRACE
 PERTH 6000

Laboratory : Environmental Division Perth
 Contact : Lauren Biagioni
 Address : 26 Rigali Way Wangara WA Australia
 6065

E-mail : blaire.coleman@senversa.com.au
 Telephone : +61 08 6557 8881
 Facsimile : +61 03 9606 0074

E-mail : Lauren.biagioni@alsglobal.com
 Telephone : 08 9406 1307
 Facsimile : +61-8-9406 1399

Project : P17302 Bulong DSI
 Order number : ----
 C-O-C number : ----
 Site : ----
 Sampler : Matthew Hunt/Brandon Henry

Page : 1 of 3
 Quote number : EP2019SENV0005 (EP/382/19 V3)
 QC Level : NEPM 2013 B3 & ALS QC Standard

Dates

Date Samples Received : 12-Dec-2019 08:00
 Client Requested Due : 19-Dec-2019
 Date

Issue Date : 02-Apr-2020
 Scheduled Reporting Date : **19-Dec-2019**

Delivery Details

Mode of Delivery : Carrier
 No. of coolers/boxes : 8
 Receipt Detail :

Security Seal : Not Available
 Temperature : 20.2 - Ice present
 No. of samples received / analysed : 9 / 9

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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	Client sampling date / time	Client sample ID	WATER - EA005P pH (PCT)	WATER - EA065 Total Hardness as CaCO3	WATER - EG035F-LL Dissolved Mercury - Low Level	WATER - EG035T-LL Total Mercury - Low Level	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-07 Total Nitrogen + NO2 + NO3 + NH3
EP1913213-001	08-Dec-2019 00:00	BMH01	✓	✓	✓		✓	✓	✓
EP1913213-002	08-Dec-2019 00:00	BMH02A	✓	✓	✓		✓	✓	✓
EP1913213-003	08-Dec-2019 00:00	BMH04	✓	✓	✓		✓	✓	✓
EP1913213-004	08-Dec-2019 00:00	BMH08	✓	✓	✓		✓	✓	✓
EP1913213-005	08-Dec-2019 00:00	BMH11A	✓	✓	✓		✓	✓	✓
EP1913213-006	10-Dec-2019 00:00	QC06				✓			
EP1913213-007	10-Dec-2019 00:00	QC07	✓	✓	✓	✓	✓	✓	✓
EP1913213-008	10-Dec-2019 00:00	QC13	✓	✓		✓	✓	✓	✓
EP1913213-009	10-Dec-2019 00:00	QC14				✓			

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020T Total Metals by ICP/MS (including digestion)	WATER - W-02T 8 metals (Total)
EP1913213-006	10-Dec-2019 00:00	QC06	✓	✓
EP1913213-009	10-Dec-2019 00:00	QC14	✓	✓

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		Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
Client Sample ID(s)		Container					
EA005-P: pH by PC Titrator							
BMH01	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
BMH02A	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
BMH04	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
BMH08	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----

Issue Date : 02-Apr-2020
Page : 3 of 3
Work Order : EP1913213 Amendment 1
Client : SENVERSA PTY LTD



BMH11A	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
QC07	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
QC13	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
EK057G: Nitrite as N by Discrete Analyser							
BMH01	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH02A	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH04	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH08	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH11A	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----

Requested Deliverables

Blaire Coleman

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

Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.au

CERTIFICATE OF ANALYSIS

Work Order	: EP1913213	Page	: 1 of 6
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019 08:00
Order number	: ----	Date Analysis Commenced	: 12-Dec-2019
C-O-C number	: ----	Issue Date	: 02-Apr-2020 16:13
Sampler	: Matthew Hunt/Brandon Henry		
Site	: ----		
Quote number	: EP/382/19 V3		
No. of samples received	: 9		
No. of samples analysed	: 9		



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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Amendment (02/04/2020): This report has been amended and re-released to alter the sampling dates. All analysis results are as per the previous report.
- EK028SF; LOR raised for cyanide on particular samples due to possible sample matrix interference.
- EG35F-LL (Dissolved Mercury): LOR was raised for sample #1, 2, 3, 4, 5 and 7 due to high TDS content.
- Ionic Balance out of acceptable limits for sample #2, #3, #4, #5 and #7 due to analytes not quantified in this report. Major anions (ED041/45G) and major cations (ED093F) confirmed by re-preparation and re-analysis.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	BMH01	BMH02A	BMH04	BMH08	BMH11A
Client sampling date / time					08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913213-001	EP1913213-002	EP1913213-003	EP1913213-004	EP1913213-005
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		5.76	6.63	7.12	7.01	6.69
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		17500	46200	22900	32200	37600
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		2	194	34	38	16
Total Alkalinity as CaCO3	----	1	mg/L		2	194	34	38	16
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		5320	26300	4750	6520	10500
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		47400	65600	57000	91700	116000
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		1210	694	1140	959	1290
Magnesium	7439-95-4	1	mg/L		3510	10800	4870	7240	8340
Sodium	7440-23-5	1	mg/L		32300	49700	39500	74300	90500
Potassium	7440-09-7	1	mg/L		104	247	104	344	418
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.040	<0.040	<0.040	<0.040	<0.040
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.15	1100	0.47	0.15	51.6
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	0.31	<0.01	<0.01	0.02
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.45	17.1	17.4	13.8	31.7
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.45	17.4	17.4	13.8	31.7
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.4	1140	4.0	1.4	52.9
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.8	1160	21.4	15.2	84.6



Analytical Results

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

Client sample ID

				BMH01	BMH02A	BMH04	BMH08	BMH11A
Client sampling date / time				08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913213-001	EP1913213-002	EP1913213-003	EP1913213-004	EP1913213-005
				Result	Result	Result	Result	Result
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	1450	2400	1710	2720	3490
∅ Total Cations	----	0.01	meq/L	1760	3090	2180	3880	4700
∅ Ionic Balance	----	0.01	%	9.64	12.6	12.1	17.6	14.7

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC06	QC07	QC13	QC14	----
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	----	
Compound	CAS Number	LOR	Unit	EP1913213-006	EP1913213-007	EP1913213-008	EP1913213-009	-----	
				Result	Result	Result	Result	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	----	6.67	5.89	----	----	
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L	----	46200	<1	----	----	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	<1	<1	----	----	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	<1	<1	----	----	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	199	<1	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	----	199	<1	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	27400	<1	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	----	66200	<1	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	----	692	<1	----	----	
Magnesium	7439-95-4	1	mg/L	----	10800	<1	----	----	
Sodium	7440-23-5	1	mg/L	----	50600	<1	----	----	
Potassium	7440-09-7	1	mg/L	----	256	<1	----	----	
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	<0.001	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	<0.0001	----	
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	<0.001	----	
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	<0.001	----	
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	<0.001	----	
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	<0.001	----	
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	<0.001	----	
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	<0.005	----	
Manganese	7439-96-5	0.001	mg/L	<0.001	----	----	<0.001	----	
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	<0.01	----	
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	<0.05	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L	----	<0.00020	----	----	----	
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L	----	----	<0.00004	----	----	
EG035T: Total Recoverable Mercury by FIMS									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC06	QC07	QC13	QC14	----
Client sampling date / time					10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	----
Compound	CAS Number	LOR	Unit		EP1913213-006	EP1913213-007	EP1913213-008	EP1913213-009	-----
					Result	Result	Result	Result	----
EG035T: Total Recoverable Mercury by FIMS - Continued									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	<0.0001	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		----	<0.040	<0.004	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	1060	<0.01	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		----	0.22	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	16.9	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	17.1	<0.01	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	1120	<0.1	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		----	1140	<0.1	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		----	2440	<0.01	----	----
∅ Total Cations	----	0.01	meq/L		----	3130	<0.01	----	----
∅ Ionic Balance	----	0.01	%		----	12.4	----	----	----

QUALITY CONTROL REPORT

Work Order : **EP1913213**

Page : 1 of 7

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Perth

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 26 Rigali Way Wangara WA Australia 6065

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 12-Dec-2019

Order number : ----

Date Analysis Commenced : 12-Dec-2019

C-O-C number : ----

Issue Date : 02-Apr-2020

Sampler : Matthew Hunt/Brandon Henry

Site : ----

Quote number : EP/382/19 V3

No. of samples received : 9

No. of samples analysed : 9



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. 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

Canhuang Ke

Inorganics Supervisor

Perth Inorganics, Wangara, WA

Chris Lemaitre

Laboratory Manager (Perth)

Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Titrator (QC Lot: 2776014)									
EP1913212-002	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.27	7.27	0.00	0% - 20%
EP1913213-005	BMH11A	EA005-P: pH Value	----	0.01	pH Unit	6.69	6.68	0.150	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2776015)									
EP1913212-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	158	158	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	158	158	0.00	0% - 20%
EP1913213-005	BMH11A	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	16	16	0.00	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	16	0.00	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2762197)									
EP1913212-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4130	3650	12.4	0% - 20%
EP1913213-005	BMH11A	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10500	10200	3.23	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2762198)									
EP1913212-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	36100	37200	2.99	0% - 20%
EP1913213-005	BMH11A	ED045G: Chloride	16887-00-6	1	mg/L	116000	114000	1.68	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2763610)									
EP1913212-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	926	955	3.06	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	3860	4020	4.03	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	39600	41000	3.47	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	310	327	5.53	0% - 20%
EP1913213-005	BMH11A	ED093F: Calcium	7440-70-2	1	mg/L	1290	1250	3.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	8340	8140	2.44	0% - 20%

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 2763610) - continued									
EP1913213-005	BMH11A	ED093F: Sodium	7440-23-5	1	mg/L	90500	88400	2.37	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	418	408	2.26	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 2771255)									
EP1913212-007	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913322-001	Anonymous	EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.876	0.886	1.15	0% - 20%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.011	0.010	13.1	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.310	0.316	1.68	0% - 20%
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.471	0.474	0.622	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	3.06	3.09	1.02	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	6.05	6.38	5.36	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.028	0.030	5.07	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	82.1	84.5	2.89	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	0.06	0.06	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.25	<0.25	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2764163)									
EP1913213-001	BMH01	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00020	<0.00020	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2767899)									
EP1913265-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EP1913265-007	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Mercury by FIMS (QC Lot: 2764312)									
EP1913212-006	Anonymous	EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2771249)									
EP1913213-009	QC14	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913322-003	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2764069)									
EP1913212-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EP1913213-005	BMH11A	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762211)									

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 Work Order : EP1913213 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762211) - continued									
EP1913212-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.11	0.10	14.1	0% - 50%
EP1913213-005	BMH11A	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	51.6	50.1	3.03	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196)									
EP1913212-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.05	0.05	0.00	No Limit
EP1913213-005	BMH11A	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2762212)									
EP1913212-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.60	2.57	1.14	0% - 20%
EP1913213-005	BMH11A	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	31.7	32.5	2.62	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768204)									
EP1913230-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.9	97.6	No Limit
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.4	0.2	36.2	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA005P: pH by PC Titrator (QCLot: 2776014)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98.5	102
				----	7 pH Unit	100	98.5	102
ED037P: Alkalinity by PC Titrator (QCLot: 2776015)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	103	81.2	126
				<1	200 mg/L	97.7	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.2	87.7	113
				<1	100 mg/L	102	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.6	87.9	114
				<1	1000 mg/L	97.3	87.9	114
ED093F: Dissolved Major Cations (QCLot: 2763610)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.6	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	105	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	105	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	106	89.7	108
EG020T: Total Metals by ICP-MS (QCLot: 2771255)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.3	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.0	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	96.5	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.7	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.3	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	103	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	89.9	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.3	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	97.0	87.1	120
EG035F: Dissolved Mercury by FIMS (QCLot: 2764163)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	98.2	87.6	115



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	101	87.6	115
EG035T: Total Mercury by FIMS (QCLot: 2764312)								
EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	99.1	89.0	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.7	85.1	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	105	75.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	95.8	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.5	93.7	108
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	84.7	75.8	100

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)							
EP1913212-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)							
EP1913212-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	# Not Determined	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 2771255)							
EP1913213-006	QC06	EG020A-T: Arsenic	7440-38-2	1 mg/L	99.7	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	109	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	108	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	103	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	107	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	110	70.0	130



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2771255) - continued							
EP1913213-006	QC06	EG020A-T: Nickel	7440-02-0	1 mg/L	109	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	105	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2764163)							
EP1913213-002	BMH02A	EG035F-LL: Mercury	7439-97-6	0.05 mg/L	84.9	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)							
EP1913265-002	Anonymous	EG035F-LL: Mercury	7439-97-6	0.01 mg/L	105	70.0	130
EG035T: Total Mercury by FIMS (QCLot: 2764312)							
EP1913212-007	Anonymous	EG035T-LL: Mercury	7439-97-6	0.01 mg/L	118	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)							
EP1913284-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	97.4	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)							
EP1913212-002	Anonymous	EK026SF: Total Cyanide	57-12-5	2 mg/L	96.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)							
EP1913212-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	129	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)							
EP1913212-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	96.5	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)							
EP1913212-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	79.3	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)							
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	79.5	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913213	Page	: 1 of 9
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 02-Apr-2020
Sampler	: Matthew Hunt/Brandon Henry	No. of samples received	: 9
Order number	: ----	No. of samples analysed	: 9

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : 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							
ED041G: Sulfate (Turbidimetric) as SO ₄ 2- by DA	EP1913212--001	Anonymous	Sulfate as SO ₄ - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	EP1913212--001	Anonymous	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
BMH01, BMH04, BMH11A	BMH02A, BMH08,	----	----	----	19-Dec-2019	08-Dec-2019	11
Clear Plastic Bottle - Natural							
QC07,	QC13	----	----	----	19-Dec-2019	10-Dec-2019	9
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
BMH01, BMH04, BMH11A	BMH02A, BMH08,	----	----	----	12-Dec-2019	10-Dec-2019	2

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	19-Dec-2019	08-Dec-2019	✘
Clear Plastic Bottle - Natural (EA005-P) QC07,	QC13	10-Dec-2019	----	----	----	19-Dec-2019	10-Dec-2019	✘
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	19-Dec-2019	22-Dec-2019	✔
Clear Plastic Bottle - Natural (ED037-P) QC07,	QC13	10-Dec-2019	----	----	----	19-Dec-2019	24-Dec-2019	✔
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✔
Clear Plastic Bottle - Natural (ED041G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✔
Clear Plastic Bottle - Natural (ED045G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	17-Dec-2019	05-Jan-2020	✔
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) QC07		10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✔
Clear Plastic Bottle - Natural (ED093F) QC13		10-Dec-2019	----	----	----	17-Dec-2019	17-Dec-2019	✔
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) QC06,	QC14	10-Dec-2019	17-Dec-2019	07-Jun-2020	✔	17-Dec-2019	07-Jun-2020	✔



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F-LL) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	13-Dec-2019	05-Jan-2020	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F-LL) QC07		10-Dec-2019	----	----	----	16-Dec-2019	07-Jan-2020	✓
EG035T: Total Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T-LL) QC13		10-Dec-2019	----	----	----	13-Dec-2019	07-Jan-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC06,	QC14	10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
White Plastic Bottle-NaOH (EK026SF) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	13-Dec-2019	22-Dec-2019	✓
White Plastic Bottle-NaOH (EK026SF) QC07,	QC13	10-Dec-2019	----	----	----	13-Dec-2019	24-Dec-2019	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	10-Dec-2019	✗
Clear Plastic Bottle - Natural (EK057G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	12-Dec-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓



Matrix: WATER

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			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)		08-Dec-2019	19-Dec-2019	05-Jan-2020	✔	19-Dec-2019	05-Jan-2020	✔
BMH01,	BMH02A,							
BMH04,	BMH08,							
BMH11A								
Clear Plastic Bottle - Sulfuric Acid (EK061G)		10-Dec-2019	19-Dec-2019	07-Jan-2020	✔	19-Dec-2019	07-Jan-2020	✔
QC07,	QC13							



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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	3	22	13.64	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	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	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	22	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	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	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Alkalinity by PC Titrator	ED037-P	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	22	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	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	
Method Blanks (MB) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	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	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	22	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	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	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 by PC 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 (2013) Schedule B(3)
Hardness as CaCO ₃	EA065	WATER	In house: Referenced to APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS - Low Level	EG035T-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO ₂ - B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO _x) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Combined oxidised Nitrogen (NO ₂ +NO ₃) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO ₃ -. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) Schedule B(3)

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Blagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@servesa.com.au	Phone/Mobile:	+61 409 295 017

[illegible][illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name:	Matthew Hunt / Brandon Henry
----------------------	---------------------------------

Signature: _____

Date: 10/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913247

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Brandon Henry, MATTHEW HUNT</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 12-Dec-2019 10:00	Issue Date : 12-Dec-2019
Client Requested Due Date : 19-Dec-2019	Scheduled Reporting Date : 19-Dec-2019

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 4	Temperature : 9.0 - Ice present
Receipt Detail :	No. of samples received / analysed : 5 / 5

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
- Some sample IDs do not match the COC; these bottle IDs are written as the sample description.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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	Client sampling date / time	Client sample ID	WATER - EA005P pH (PCT)	WATER - EA065 Total Hardness as CaCO3	WATER - EG035F-LL Dissolved Mercury - Low Level	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-07 Total Nitrogen + NO2 + NO3 + NH3	WATER - W-02T 8 metals (Total)
EP1913247-001	10-Dec-2019 00:00	BMH06 BMH06A	✓	✓	✓	✓	✓	✓	
EP1913247-002	10-Dec-2019 00:00	BMH09	✓	✓	✓	✓	✓	✓	
EP1913247-003	10-Dec-2019 00:00	BMH12A	✓	✓	✓	✓	✓	✓	
EP1913247-004	10-Dec-2019 00:00	QC17 QC16	✓	✓	✓	✓	✓	✓	
EP1913247-005	10-Dec-2019 00:00	QC18 QC17							✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020T Total Metals by ICP/MS (including digestion)
EP1913247-005	10-Dec-2019 00:00	QC18 QC17	✓

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	Due for extraction	Due for analysis	Samples Received		Instructions Received	
Client Sample ID(s)	Container		Date	Evaluation	Date	Evaluation
EA005-P: pH by PC Titrator						
BMH06	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----
BMH09	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----
BMH12A	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----
QC17	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----



Requested Deliverables

Blaire Coleman

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

Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au

JUSTIN LUMSDEN

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : EP1913247 Amendment : 1 Client : SENVERSA PTY LTD Contact : Blaire Coleman Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000 Telephone : +61 08 6557 8881 Project : P17302 Bulong DSI Order number : ---- C-O-C number : ---- Sampler : Brandon Henry, MATTHEW HUNT Site : ---- Quote number : EP/382/19 V3 No. of samples received : 5 No. of samples analysed : 5	Page : 1 of 4 Laboratory : Environmental Division Perth Contact : Lauren Biagioni Address : 26 Rigali Way Wangara WA Australia 6065 Telephone : 08 9406 1307 Date Samples Received : 12-Dec-2019 10:00 Date Analysis Commenced : 12-Dec-2019 Issue Date : 02-Apr-2020 16:15
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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. 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
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Some sample IDs do not match the COC; these bottle IDs are written as the sample description.
- EK028SF; LOR raised for cyanide on particular samples due to possible sample matrix interference.
- (EG035F-LL): LOR for EP1913247-1 to 3 was raised due to high salinity.
- Ionic Balance out of acceptable limits for sample #2 due to analytes not quantified in this report. Major anions (ED041/45G) and major cations (ED093F) have been confirmed by re-preparation and re-analysis.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				BMH06 BMH06A	BMH09	BMH12A	QC17 QC16	QC18 QC17
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913247-001	EP1913247-002	EP1913247-003	EP1913247-004	EP1913247-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.53	6.73	6.91	5.78	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	46200	61400	35200	<1	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	12	139	44	<1	----
Total Alkalinity as CaCO3	----	1	mg/L	12	139	44	<1	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5670	42700	12400	<1	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	118000	71600	105000	<1	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	1500	663	809	<1	----
Magnesium	7439-95-4	1	mg/L	10300	14500	8070	<1	----
Sodium	7440-23-5	1	mg/L	73500	57700	66700	<1	----
Potassium	7440-09-7	1	mg/L	184	450	255	<1	----
EG020T: Total Metals by ICP-MS								
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
Cobalt	7440-48-4	0.001	mg/L	----	----	----	----	<0.001
Nickel	7440-02-0	0.001	mg/L	----	----	----	----	<0.001
Lead	7439-92-1	0.001	mg/L	----	----	----	----	<0.001
Zinc	7440-66-6	0.005	mg/L	----	----	----	----	<0.005
Manganese	7439-96-5	0.001	mg/L	----	----	----	----	<0.001
Selenium	7782-49-2	0.01	mg/L	----	----	----	----	<0.01
Iron	7439-89-6	0.05	mg/L	----	----	----	----	<0.05
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00020	<0.00020	<0.00020	<0.00004	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	----	----	----	<0.0001



Analytical Results

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

Client sample ID

				BMH06 BMH06A	BMH09	BMH12A	QC17 QC16	QC18 QC17
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913247-001	EP1913247-002	EP1913247-003	EP1913247-004	EP1913247-005
				Result	Result	Result	Result	Result
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	<0.040	<0.004	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	13.2	1870	216	<0.01	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.58	5.33	<0.01	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	185	19.5	22.6	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	185	20.1	27.9	<0.01	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	422	2060	237	<0.1	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	607	2080	265	<0.1	----
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	3450	2910	3220	<0.01	----
∅ Total Cations	----	0.01	meq/L	4120	3750	3610	<0.01	----
∅ Ionic Balance	----	0.01	%	8.95	12.6	5.73	----	----

QUALITY CONTROL REPORT

Work Order : **EP1913247**

Page : 1 of 7

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Perth

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 26 Rigali Way Wangara WA Australia 6065

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 12-Dec-2019

Order number : ----

Date Analysis Commenced : 12-Dec-2019

C-O-C number : ----

Issue Date : 02-Apr-2020

Sampler : Brandon Henry, MATTHEW HUNT

Site : ----

Quote number : EP/382/19 V3

No. of samples received : 5

No. of samples analysed : 5



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. 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

Canhuang Ke

Inorganics Supervisor

Perth Inorganics, Wangara, WA

Chris Lemaitre

Laboratory Manager (Perth)

Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Titrator (QC Lot: 2776014)									
EP1913212-002	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.27	7.27	0.00	0% - 20%
EP1913213-005	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.69	6.68	0.150	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2776015)									
EP1913212-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	158	158	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	158	158	0.00	0% - 20%
EP1913213-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	16	16	0.00	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	16	0.00	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2762197)									
EP1913212-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4130	3650	12.4	0% - 20%
EP1913213-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10500	10200	3.23	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2762198)									
EP1913212-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	36100	37200	2.99	0% - 20%
EP1913213-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	116000	114000	1.68	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2763618)									
EP1913232-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	20	20	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	5	5	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	148	151	2.07	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	5	5	0.00	No Limit
EP1913247-003	BMH12A	ED093F: Calcium	7440-70-2	1	mg/L	809	832	2.88	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	8070	8320	3.12	0% - 20%



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 2763618) - continued									
EP1913247-003	BMH12A	ED093F: Sodium	7440-23-5	1	mg/L	66700	68800	3.04	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	255	268	5.26	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 2767585)									
EP1913124-013	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EP1913175-009	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.082	0.089	7.95	0% - 50%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.05	<0.05	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2767899)									
EP1913265-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EP1913265-007	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2767708)									
EP1913124-012	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913262-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2764069)									
EP1913212-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EP1913213-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762406)									
EP1913247-002	BMH09	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	1870	2000	6.83	0% - 20%
EP1913253-005	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.06	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196)									
EP1913212-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.05	0.05	0.00	No Limit

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 Work Order : EP1913247 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196) - continued									
EP1913213-005	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2762407)									
EP1913247-002	BMH09	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	20.1	19.6	2.72	0% - 20%
EP1913253-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768204)									
EP1913230-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.9	97.6	No Limit
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.4	0.2	36.2	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768205)									
EP1913260-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.7	0.6	19.5	No Limit
EP1913260-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.8	0.8	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 2776014)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98.5	102
				----	7 pH Unit	100	98.5	102
ED037P: Alkalinity by PC Titrator (QCLot: 2776015)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	103	81.2	126
				<1	200 mg/L	97.7	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.2	87.7	113
				<1	100 mg/L	102	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.6	87.9	114
				<1	1000 mg/L	97.3	87.9	114
ED093F: Dissolved Major Cations (QCLot: 2763618)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	97.8	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	97.0	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	101	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	102	89.7	108
EG020T: Total Metals by ICP-MS (QCLot: 2767585)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	103	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	111	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	106	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	104	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	104	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	104	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	102	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	98.6	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	111	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	110	87.1	120
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	101	87.6	115



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2767708)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.5	85.1	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	105	75.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762406)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	99.8	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.5	93.7	108
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762407)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.0	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	84.7	75.8	100
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768205)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	78.4	75.8	100

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)							
EP1913212-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)							
EP1913212-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	# Not Determined	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 2767585)							
EP1913124-014	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	106	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	116	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	103	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	100	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	110	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	107	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	112	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	110	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	112	70.0	130



Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)							
EP1913265-002	Anonymous	EG035F-LL: Mercury	7439-97-6	0.01 mg/L	105	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2767708)							
EP1913175-011	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	94.1	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)							
EP1913212-002	Anonymous	EK026SF: Total Cyanide	57-12-5	2 mg/L	96.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762406)							
EP1913247-001	BMH06 BMH06A	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)							
EP1913212-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	96.5	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762407)							
EP1913247-001	BMH06 BMH06A	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)							
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	79.5	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768205)							
EP1913260-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	79.7	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913247	Page	: 1 of 8
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 02-Apr-2020
Sampler	: Brandon Henry, MATTHEW HUNT	No. of samples received	: 5
Order number	: ----	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : 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							
ED041G: Sulfate (Turbidimetric) as SO ₄ 2- by DA	EP1913212--001	Anonymous	Sulfate as SO ₄ - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	EP1913212--001	Anonymous	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK055G: Ammonia as N by Discrete Analyser	EP1913247--001	BMH06 BMH06A	Ammonia as N	7664-41-7	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK059G: Nitrite plus Nitrate as N (NO _x) by Discrete Ar	EP1913247--001	BMH06 BMH06A	Nitrite + Nitrate as N	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	----	----	----	19-Dec-2019	10-Dec-2019	9

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	19-Dec-2019	10-Dec-2019	✖



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) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	19-Dec-2019	24-Dec-2019	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
ED093F: Dissolved Major Cations								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✓
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) QC18 - QC17		10-Dec-2019	16-Dec-2019	07-Jun-2020	✓	16-Dec-2019	07-Jun-2020	✓
EG035F: Dissolved Mercury by FIMS								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-LL) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	16-Dec-2019	07-Jan-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC18 - QC17		10-Dec-2019	----	----	----	16-Dec-2019	07-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
White Plastic Bottle-NaOH (EK026SF) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	13-Dec-2019	24-Dec-2019	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	12-Dec-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓



Matrix: WATER

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		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)								
BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	19-Dec-2019	07-Jan-2020	✔	19-Dec-2019	07-Jan-2020	✔



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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	16	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	33	12.12	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	19	10.53	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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	6.06	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	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)							
Alkalinity by PC Titrator	ED037-P	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	16	6.25	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	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	
Method Blanks (MB) - Continued							
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	6.06	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	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)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	6.06	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	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 by PC 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 (2013) Schedule B(3)
Hardness as CaCO ₃	EA065	WATER	In house: Referenced to APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) 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 (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) Schedule B(3)

Robert Johnston

To: Blaire Coleman
Subject: RE: Bulong DSI (17302) - samples received without a COC

From: Blaire Coleman [<mailto:blaire.coleman@senversa.com.au>]
Sent: Wednesday, 18 December 2019 8:53 AM
To: Robert Johnston
Cc: Justin Lumsden
Subject: FW: Bulong DSI (17302) - samples received without a COC

My apologies Rob! I didn't realise that this email hadn't gone through to you on Monday. Please see attached, and let me or Justin know if you have any queries.

Cheers,
Blaire

Blaire Coleman
Associate Geoscientist

From: Georgia Hefron <Georgia.Hefron@senversa.com.au>
Sent: Monday, 16 December 2019 4:59 PM
To: Blaire Coleman <blaire.coleman@senversa.com.au>
Subject: FW: Bulong DSI (17302) - samples received without a COC

Just check 😊

Hi Rob,

Please see attached COC for the below QC samples.

Thanks,

Georgia Hefron
Project Environmental Scientist



Senversa Pty Ltd
Level 17, 140 St Georges Terrace, Perth WA 6000

m: +61 403 309 654 | e: georgia.hefron@senversa.com.au
t: +61 8 6324 0200 | w: www.senversa.com.au

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Please consider the environment before printing this email. Senversa is a carbon neutral company.

Rob Johnston 18/12/19 Eurofins 694415



Date/Time: 18/12/19 8:53
Chilled: Yes/No
Temp: 17.5
12.5
13.1
Correction: +3.5
Final Temp: 17.9°C

From: EnviroSampleWA@eurofins.com <EnviroSampleWA@eurofins.com>

Sent: Friday, 13 December 2019 3:28 PM

To: Blaire Coleman <blaire.coleman@sensversa.com.au>

Subject: Bulong DSI (17302) - samples received without a COC

Hi Blaire,

We have received samples QC05, QC08, QC10, QC12 and QC20 for this project, but without a COC (sample dates 3-11/12). Can you please provide us a COC?

Kind Regards,
Rob

Eurofins | Environment Testing

Unit 2, 91 Leach Highway

KEWDALE WA 6105

Australia

Phone : +61 8 9251 9692

Email : EnviroSampleWA@eurofins.com

Rob Johnston 18/12/19 Eurofin 694415

Laboratory: Eurofins WA
Address: 2/61 Leach Hwy, Kewdale WA 6105
Contact: Rob Johnson / Analytical Services Manager
Phone: 08 9251 9692

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

[illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name:	Matthew Hunt / Brandon Henry
----------------------	---------------------------------

Signature: _____

Date: 11/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Val Hydrochloric Acid (HCl) Preserved; VSA = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugo's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Melbourne

6 Monterey Road
Dandenong South Vic 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney

Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane

1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth

2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521

e.mail : EnviroSales@eurofins.com

web : www.eurofins.com.au

Sample Receipt Advice

Company name: **Senversa Pty Ltd WA**
Contact name: **Blaire Coleman**
Project name: **BULONG DSI**
Project ID: **P17302**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Dec 18, 2019 8:53 AM**
Eurofins reference: **694415**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☒ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- N/A Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Robert Johnston on Phone : or by e.mail: RobertJohnston@eurofins.com

Results will be delivered electronically via e.mail to Blaire Coleman - Blaire.Coleman@senversa.com.au.

Senversa Pty Ltd WA
Level 17, 140 St Georges Terrace
Perth
WA 6000



NATA Accredited
Accreditation Number 1261
Site Number 23736

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

Attention: **Blaire Coleman**

Report **694415-W**
 Project name **BULONG DSI**
 Project ID **P17302**
 Received Date **Dec 18, 2019**

Client Sample ID			QC08
Sample Matrix			Water
Eurofins Sample No.			P19-De26030
Date Sampled			Dec 03, 2019
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic (filtered)	0.001	mg/L	< 0.01
Cadmium (filtered)	0.0002	mg/L	0.0059
Chromium (filtered)	0.001	mg/L	< 0.01
Cobalt (filtered)	0.001	mg/L	< 0.01
Copper (filtered)	0.001	mg/L	< 0.01
Iron (filtered)	0.05	mg/L	< 0.5
Lead (filtered)	0.001	mg/L	< 0.01
Manganese (filtered)	0.005	mg/L	1.2
Mercury (filtered)	0.0001	mg/L	< 0.001
Nickel (filtered)	0.001	mg/L	0.15
Selenium (filtered)	0.001	mg/L	0.023
Zinc (filtered)	0.005	mg/L	< 0.05

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description

Heavy Metals (filtered)

- Method: HEAVY METALS

Mobil Metals : Metals M15

- Method:

Testing Site

Perth

Perth

Extracted

Dec 18, 2019

Dec 18, 2019

Holding Time

180 Days

28 Days

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

New Zealand

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN – 50 005 085 521

web : www.eurofins.com.au

e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000
Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail							Moisture Set																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

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

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ug/L: micrograms per litre
ppm: Parts per million	ppb: Parts per billion	%: Percentage
org/100mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

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

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Heavy Metals									
Arsenic (filtered)			mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)			mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)			mg/L	< 0.001			0.001	Pass	
Cobalt (filtered)			mg/L	< 0.001			0.001	Pass	
Copper (filtered)			mg/L	< 0.001			0.001	Pass	
Iron (filtered)			mg/L	< 0.05			0.05	Pass	
Lead (filtered)			mg/L	< 0.001			0.001	Pass	
Manganese (filtered)			mg/L	< 0.005			0.005	Pass	
Mercury (filtered)			mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)			mg/L	< 0.001			0.001	Pass	
Selenium (filtered)			mg/L	< 0.001			0.001	Pass	
Zinc (filtered)			mg/L	< 0.005			0.005	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic (filtered)			%	98			80-120	Pass	
Cadmium (filtered)			%	96			80-120	Pass	
Chromium (filtered)			%	96			80-120	Pass	
Cobalt (filtered)			%	98			80-120	Pass	
Copper (filtered)			%	87			80-120	Pass	
Iron (filtered)			%	96			80-120	Pass	
Lead (filtered)			%	98			80-120	Pass	
Manganese (filtered)			%	95			80-120	Pass	
Mercury (filtered)			%	92			70-130	Pass	
Nickel (filtered)			%	96			80-120	Pass	
Selenium (filtered)			%	99			80-120	Pass	
Zinc (filtered)			%	95			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	P19-De26990	NCP	%	109			70-130	Pass	
Cadmium (filtered)	P19-De26990	NCP	%	106			70-130	Pass	
Chromium (filtered)	P19-De26990	NCP	%	102			70-130	Pass	
Cobalt (filtered)	P19-De26990	NCP	%	103			75-125	Pass	
Copper (filtered)	P19-De26990	NCP	%	94			70-130	Pass	
Iron (filtered)	P19-De26990	NCP	%	100			70-130	Pass	
Lead (filtered)	P19-De26990	NCP	%	104			70-130	Pass	
Manganese (filtered)	P19-De26990	NCP	%	101			70-130	Pass	
Mercury (filtered)	P19-De26990	NCP	%	95			70-130	Pass	
Nickel (filtered)	P19-De26990	NCP	%	100			70-130	Pass	
Selenium (filtered)	P19-De26990	NCP	%	111			70-130	Pass	
Zinc (filtered)	P19-De26990	NCP	%	102			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	P19-De26991	NCP	mg/L	0.002	0.002	1.0	30%	Pass	
Cadmium (filtered)	P19-De26991	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	P19-De26991	NCP	mg/L	< 0.001	0.001	11	30%	Pass	
Cobalt (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Iron (filtered)	P19-De26991	NCP	mg/L	2.6	2.6	3.0	30%	Pass	
Lead (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese (filtered)	P19-De26991	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Mercury (filtered)	P19-De26991	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Selenium (filtered)	P19-De26991	NCP	mg/L	0.009	0.008	9.0	30%	Pass	
Zinc (filtered)	P19-De26991	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Comments
Sample Integrity

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

Authorised By

Robert Johnston	Analytical Services Manager
Elden Garrett	Senior Analyst-Metal (WA)


Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please [click here](#).

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

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
 Perth
 WA 6000

Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

[illegible]

NMI CHAIN OF CUSTODY (SAMPLE SUBMISSION) FORM

ENVIRONMENTAL SAMPLES to be submitted to:

NMI: 105 Delhi Rd, North Ryde NSW 2113 Ph: 1300 722 845 email: customerservice@measurement.gov.au

SENT FROM:		Internal use only	
Company Name:	SENVESA PTY LTD	NMI Quote Number:	SENVXXA-RW1911N Valid until: February 29, 2020
Address:	LEVEL 17, 140 ST GEORGES TERRACE, PERTH WA 6000.	UMS Reference:	QT-D2018 D
Contact:	Blaire Coleman	TURN AROUND TIME REQUESTED (Working days):	
Phone:	+61 8 6324 0200 / +61 403 309 654	24 hrs 48 hrs 3-4 7-10 30 other (please specify)	
ABN:	89 132 231 380	100% 50% 25% Standard dioxins	
Contact email:	blaire.coleman@senversa.com.au	*Fast TATs are not available for all tests and MUST be agreed to prior to sample submission	

If a PO number is required on your invoice, it must be provided at sample submission. PO's received after sample submission will not appear on final invoice Purchase order required: Y / N PO Number: _____

NMI LRN (NMI USE ONLY - please do not write in this column)	Hard Copy of Invoice & Report required Y/N		SAMPLE REFERENCE (Sample ID / Description / Number)	DATE & TIME SAMPLED	SAMPLE MATRIX (water / soil / biota)	ICP-MS - Se, Co, Mn, Fe, As, Cd (total and Vils), Cu, Pb, Ni, Zn	TESTS REQUIRED (Please list all tests required here and tick required tests against samples)										COMMENTS
N19/032847			BMH01	8/12/2019	water	x											
N19/032848			BMH02A	8/12/2019	water	x											
N19/032849			BMH04	8/12/2019	water	x											
N19/032850			BMH08	8/12/2019	water	x											
N19/032851			BHM11A	8/12/2019	water	x											
N19/032852			QC06	8/12/2019	water	x	not received										
			QC07	8/12/2019	water	x											
			QC13	8/12/2019	water	x	not received										
			QC14	8/12/2019	water	x											
N19/032853			MW1	8/12/2019	water	x											
N19/032854			MW2	8/12/2019	water	x											
N19/032855			MW3	8/12/2019	water	x											
N19/032856			MW4	8/12/2019	water	x											

Relinquished by:	Matt Hunt	Received at NMI laboratory by:		PAGE No:	of	PAGES
Print Name:	Matt Hunt	Print Name:				
Date & Time:	16 / 12 / 19	Date & Time:				
Signature:	MH	Signature:				

received Cyanide bottle (for Cr VI)
for all samples
SN 17/12/19

RECEIVED
16 DEC 2019
BY: 1091635
SN

Lab triplicate samples sent via ALS Environmental Wangara

Sent to: NMI.

Client: Senversa

~~_____~~ soil / _____ water samples + empty bottles.

Project: P17302

Contact Name:

blaire.coleman@senversa.com.au

Lab triplicate samples sent via ALS Environmental Wangara

Sent to: NMI

Client: Senversa

_____ soil / _____ water samples + empty bottles.

Project: P17302

Contact Name:

blaire.coleman@senversa.com.au



SAMPLE RECEIPT NOTIFICATION

CUSTOMER DETAILS

Attention: BLAIRE COLEMAN
Customer: Senversa Pty Ltd
Address: Level 17, 140 St Georges Terrace
Perth WA 6000
Email: blaire.coleman@senversa.com.au
Telephone:
Fax:

LABORATORY DETAILS

Lab: National Measurement Institute
Contact: Susanne Neuman
Address: 105 Delhi Road, North Ryde, NSW
NSW 2113
Email: Susanne.Neuman@measurement.gov.au
Telephone: 02 9449 0181
Fax:

SAMPLE DETAILS

NMI Job Name: SENV03/191216

Total No. of Samples: 15

LRNs	Customer Sample ID	Lab Sample Description
N19/032847	BMH01	WATER PROJECT: P17302
N19/032848	BMH02A	WATER PROJECT: P17302
N19/032849	BMH04	WATER PROJECT: P17302
N19/032850	BMH08	WATER PROJECT: P17302
N19/032851	BHM11A	WATER PROJECT: P17302
N19/032852	QC07	WATER PROJECT: P17302
N19/032853	MW1	WATER PROJECT: P17302
N19/032854	MW2	WATER PROJECT: P17302
N19/032855	MW3	WATER PROJECT: P17302
N19/032856	MW4	WATER PROJECT: P17302
N19/032857	MW5	WATER PROJECT: P17302

N19/032858	QC08	WATER PROJECT: P17302
N19/032859	BMH06A	WATER PROJECT: P17302
N19/032860	BMH09	WATER PROJECT: P17302
N19/032861	BM12A	WATER PROJECT: P17302

SAMPLE RECEIVED CONDITION

Date samples received: 16-DEC-2019

Sample received in good order: Yes

NMI Quotation no. provided:

Client purchase order number:

Temperature of samples: Room Temperature

Comments: ALL OK

Estimated report date: 7-JAN-2020

Mode of Delivery: Courier

Additional Terms and Conditions

Incomplete / unclear information about samples or required testing will delay the start of the analysis work

If you require your Purchase Order (PO) number to be included on our invoice, please provide the number during sample submission and before the completion of work to avoid unnecessary delays and/or additional processing/handling fees.

The lodgement of an order or receipt of samples for NMI services referenced in this Sample Receipt Notification constitutes an acceptance of the current version of NMI Terms and Conditions or other applicable Terms referenced in the NMI Quotation. NMI Terms and Conditions are available on the web at <http://www.measurement.gov.au/Services/EnvironmentalTesting/Pages/Terms-and-Conditions.aspx>



QUALITY ASSURANCE REPORT

Client: SENVERSA PTY LTD

NMI QA Report No: SENV03/191216 T1

Sample Matrix: Water

Analyte	Method	LOR	Blank	Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		ug/L	ug/L	mg/L	mg/L	%	%	%
Inorganics Section				N19/032857				N19/032857
Arsenic Total	NT2.47	1	<1	<1	<1	NA	92	NA
Cadmium Total	NT2.47	0.1	<0.1	1.3	1.4	7.4	101	105
Chromium Total	NT2.47	1	<1	1.6	1.6	0.0	87	NA
Cobalt Total	NT2.47	1	<1	42	42	0.0	91	118
Copper Total	NT2.47	1	<1	9.7	9.7	0.0	94	105
Iron Total	NT2.47	5	<5	77	79	2.6	92	#
Lead Total	NT2.47	1	<1	<1	<1	NA	96	102
Manganese Total	NT2.47	1	<1	15800	15900	0.6	88	93
Mercury - Total	NT2.47	0.1	<0.1	<0.1	<0.1	NA	103	112
Nickel Total	NT2.47	1	<1	87	87	0.0	93	111
Selenium Total	NT2.47	1	<1	4.3	4.3	0.0	95	#
Zinc Total	NT2.47	1	<1	19	19	0.0	92	114

Filename =

K:\Inorganics\Quality System\QA Reports\TE\QAR2020\Water\

Legend:

Acceptable recovery is 75-120%.

Acceptable RPDs on duplicates is 44% at concentrations >5 times LOR. Greater RPD may be expected at <5 times LOR.

LOR = Limit Of Reporting

ND = Not Determined

RPD = Relative Percent Difference

NA = Not Applicable

LCS = Laboratory Control Sample.

#: Spike level is less than 50% of the sample's concentration, hence the recovery data is not reliable.

Comments:

Results greater than ten times LOR have been rounded to two significant figures.

This report shall not be reproduced except in full.

Signed:

Dr Andrew Evans
Inorganics, NMI-North Ryde
7/01/2020

Date:



REPORT OF ANALYSIS

Page: 1 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000		Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :		Phone : (02) 94490161
Lab Reg No.	Sample Ref	Sample Description
N19/032847	BMH01	WATER PROJECT: P17302
N19/032848	BMH02A	WATER PROJECT: P17302
N19/032849	BMH04	WATER PROJECT: P17302
N19/032850	BMH08	WATER PROJECT: P17302

Lab Reg No.		N19/032847	N19/032848	N19/032849	N19/032850	
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BMH01	BMH02A	BMH04	BMH08	
	Units					Method
Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	2.4	< 1	5.0	21	NT2_47
Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.9	2.1	1.4	1.5	NT2_47
Cadmium Total	ug/L	1.3	5.5	3.6	2.4	NT2_47
Chromium Total	ug/L	9.4	1.9	11	110	NT2_47
Cobalt Total	ug/L	21	< 1	< 1	< 1	NT2_47
Copper Total	ug/L	7.5	3.8	50	31	NT2_47
Iron Total	ug/L	9.6	48	< 5	65	NT2_47
Lead Total	ug/L	2.4	< 1	1.5	5.9	NT2_47
Manganese Total	ug/L	1100	1770	12	8.7	NT2_47
Nickel Total	ug/L	410	200	21	15	NT2_47
Selenium Total	ug/L	6.8	6.4	7.6	14	NT2_47
Zinc Total	ug/L	100	18	290	120	NT2_47
Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	

N19/032847

- N19/032861

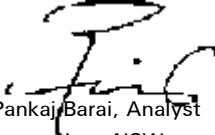
Chromium Trivalent result is calculated by the difference between Chromium Total and Chromium Hexavalent

REPORT OF ANALYSIS

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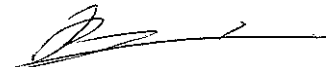
Report No. RN1258403

Lab Reg No.	Units	N19/032847	N19/032848	N19/032849	N19/032850	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BMH01	BMH02A	BMH04	BMH08	


 Pankaj Barai, Analyst
 Inorganics - NSW
 Accreditation No. 198

07-JAN-2020

Lab Reg No.	Units	N19/032847	N19/032848	N19/032849	N19/032850	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BMH01	BMH02A	BMH04	BMH08	
Miscellaneous						
Chromium - Hexavalent	mg/L	0.007	0.002	0.006	0.089	NW D2


 Wei Huang, Analyst
 Inorganics - NSW
 Accreditation No. 198

07-JAN-2020

REPORT OF ANALYSIS

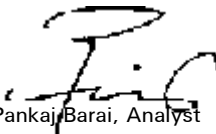
Page: 3 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000	Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :	Phone : (02) 94490161

Lab Reg No.	Sample Ref	Sample Description
N19/032851	BHM11A	WATER PROJECT: P17302
N19/032852	QC07	WATER PROJECT: P17302
N19/032853	MW1	WATER PROJECT: P17302
N19/032854	MW2	WATER PROJECT: P17302

Lab Reg No.		N19/032851	N19/032852	N19/032853	N19/032854	
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BHM11A	QC07	MW1	MW2	
	Units					Method
Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	5.0	< 1	3.4	< 1	NT2_47
Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.7	1.4	< 1	< 1	NT2_47
Cadmium Total	ug/L	2.7	5.9	1.3	1.9	NT2_47
Chromium Total	ug/L	10	2	3.4	2.9	NT2_47
Cobalt Total	ug/L	< 1	< 1	16	18	NT2_47
Copper Total	ug/L	7.1	2.3	10	18	NT2_47
Iron Total	ug/L	31	48	24	< 5	NT2_47
Lead Total	ug/L	1	< 1	< 1	< 1	NT2_47
Manganese Total	ug/L	63	1820	10600	8880	NT2_47
Nickel Total	ug/L	7.6	210	52	130	NT2_47
Selenium Total	ug/L	3.3	6.1	4.1	8.3	NT2_47
Zinc Total	ug/L	19	14	34	7.5	NT2_47
Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	


 Pankaj Barai, Analyst
 Inorganics - NSW
 Accreditation No. 198

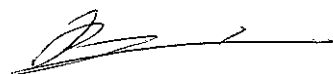
07-JAN-2020

REPORT OF ANALYSIS

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Report No. RN1258403

Lab Reg No.	Units	N19/032851	N19/032852	N19/032853	N19/032854	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BHM11A	QC07	MW1	MW2	
Miscellaneous						
Chromium - Hexavalent	mg/L	0.005	0.002	<0.001	0.002	NW D2



Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

REPORT OF ANALYSIS

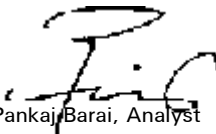
Page: 5 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000	Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :	Phone : (02) 94490161

Lab Reg No.	Sample Ref	Sample Description
N19/032855	MW3	WATER PROJECT: P17302
N19/032856	MW4	WATER PROJECT: P17302
N19/032857	MW5	WATER PROJECT: P17302
N19/032858	QC08	WATER PROJECT: P17302

Lab Reg No.		N19/032855	N19/032856	N19/032857	N19/032858	
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		MW3	MW4	MW5	QC08	
	Units					Method
Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	1.6	1.5	1.6	< 1	NT2_47
Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.2	1	< 1	1.1	NT2_47
Cadmium Total	ug/L	2.1	4.4	1.4	5.8	NT2_47
Chromium Total	ug/L	1.6	1.5	1.6	1.5	NT2_47
Cobalt Total	ug/L	12	68	42	< 1	NT2_47
Copper Total	ug/L	46	41	9.7	5.4	NT2_47
Iron Total	ug/L	74	130	78	32	NT2_47
Lead Total	ug/L	< 1	< 1	< 1	< 1	NT2_47
Manganese Total	ug/L	3090	26800	15900	1730	NT2_47
Nickel Total	ug/L	120	430	87	200	NT2_47
Selenium Total	ug/L	6.8	13	4.3	6.4	NT2_47
Zinc Total	ug/L	12	40	19	25	NT2_47
Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	


 Pankaj Barai, Analyst
 Inorganics - NSW
 Accreditation No. 198

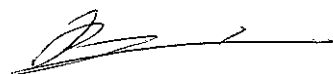
07-JAN-2020

REPORT OF ANALYSIS

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Report No. RN1258403

Lab Reg No.	Units	N19/032855	N19/032856	N19/032857	N19/032858	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		MW3	MW4	MW5	QC08	
Miscellaneous						
Chromium - Hexavalent	mg/L	<0.001	<0.001	<0.001	0.002	NW D2



Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

REPORT OF ANALYSIS

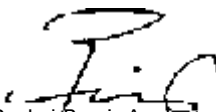
Page: 7 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000	Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :	Phone : (02) 94490161

Lab Reg No.	Sample Ref	Sample Description
N19/032859	BMH06A	WATER PROJECT: P17302
N19/032860	BMH09	WATER PROJECT: P17302
N19/032861	BM12A	WATER PROJECT: P17302

Lab Reg No.		N19/032859	N19/032860	N19/032861		
Date Sampled		10-DEC-2019	10-DEC-2019	10-DEC-2019		
Sample Reference		BMH06A	BMH09	BM12A		
	Units					Method
Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	8.0	< 1	< 1		NT2_47
Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.4	2.4	1.5		NT2_47
Cadmium Total	ug/L	1.9	5.6	5.6		NT2_47
Chromium Total	ug/L	24	< 1	1.5		NT2_47
Cobalt Total	ug/L	1.5	19	17		NT2_47
Copper Total	ug/L	8.3	3.1	2		NT2_47
Iron Total	ug/L	11	9.2	< 5		NT2_47
Lead Total	ug/L	1.5	< 1	< 1		NT2_47
Manganese Total	ug/L	390	69700	4110		NT2_47
Nickel Total	ug/L	29	4090	990		NT2_47
Selenium Total	ug/L	14	4.2	2.9		NT2_47
Zinc Total	ug/L	74	69	22		NT2_47
Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020		
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020		

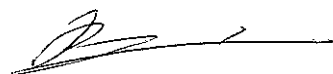

 Pankaj Barai, Analyst
 Inorganics - NSW
 Accreditation No. 198

07-JAN-2020

REPORT OF ANALYSIS

Page: 8 of 8
Report No. RN1258403

Lab Reg No.		N19/032859	N19/032860	N19/032861		
Date Sampled		10-DEC-2019	10-DEC-2019	10-DEC-2019		
Sample Reference		BMH06A	BMH09	BM12A		
	Units					Method
Miscellaneous						
Chromium - Hexavalent	mg/L	0.016	0.001	0.002		NW_D2



Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

Total = acid extractable elements



Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

This Report supersedes reports: *RN1258365* *RN1258401*

Measurement Uncertainty is available upon request.

Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EN1908941**

Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: blaire.coleman@senversa.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Facsimile	: +61 03 9606 0074	Facsimile	: +61 2 4967 7382
Project	: P17302 Bulong DSI	Page	: 1 of 2
Order number	: ----	Quote number	: EP2019SENV0005 (EP/382/19 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Brandon Henry, MATTHEW HUNT		

Dates

Date Samples Received	: 17-Dec-2019 12:00	Issue Date	: 17-Dec-2019
Client Requested Due Date	: 24-Dec-2019	Scheduled Reporting Date	: 24-Dec-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 5 / 5

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
- 5 samples for As, Cd, Cr, Cu, Co, Mn, Ni, Zn, Fe, Pb, Se & Hg conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- 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.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EN1908941-001 : [05-Dec-2019] : PVC2515042 - PVC2515042
EN1908941-002 : [09-Dec-2019] : PVC2515043 - PVC2515043
EN1908941-003 : [11-Dec-2019] : PVC2515044 - PVC2515044
EN1908941-004 : [10-Dec-2019] : PVC2515045 - PVC2515045
EN1908941-005 : [08-Dec-2019] : PVC2515046 - PVC2515046

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: **AIR**

Laboratory sample ID	Client sampling date / time	Client sample ID	AIR - EA143-OC-TSP Total Suspended Particulates - 25mm Filters	AIR - EA144-AES-OH Particulate Metals by ICPAES (Mass per volume)	AIR - EA144-HG-OH Particulate Mercury on Occupational Air Filters by
EN1908941-001	05-Dec-2019 00:00	PVC2515042 PVC25150...	✓	✓	✓
EN1908941-002	09-Dec-2019 00:00	PVC2515043 PVC25150...	✓	✓	✓
EN1908941-003	11-Dec-2019 00:00	PVC2515044 PVC25150...	✓	✓	✓
EN1908941-004	10-Dec-2019 00:00	PVC2515045 PVC25150...	✓	✓	✓
EN1908941-005	08-Dec-2019 00:00	PVC2515046 PVC25150...	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

INVOICES

- A4 - AU Tax Invoice (INV)	Email	accounts@senversa.com.au
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SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order	: EN1908941	Page	: 1 of 3
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 17-Dec-2019 12:00
Order number	: ----	Date Analysis Commenced	: 20-Dec-2019
C-O-C number	: ----	Issue Date	: 29-Jan-2020 15:35
Sampler	: Brandon Henry, MATTHEW HUNT		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 5		
No. of samples analysed	: 5		



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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Jennifer Targett	Laboratory Technician	Newcastle, Mayfield West, NSW
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- 5 samples for As, Cd, Cr, Cu, Co, Mn, Ni, Zn, Fe, Pb, Se & Hg conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EA143-OC: Results for sample 005 will bias low as filter was recieved with significant damage.
- EA144: NATA accreditation covers the standard 8 metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg)
- Inhalable Dust and Respirable Dust analysed and reported in accordance with Airborne Dust Licence no. MLA 201800893 under the NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 where applicable.
- Amendment (28/01/2020): This report has been amended and re-released to allow the reporting of additional analytical data.
- NATA accreditation is not held for results reported in µg/m³. Concentration in µg/m³ is calculated from air volume data provided by the client.
- EA144: The metal concentration in the filter is reported in µg/filter on a total filter basis calculated up from the proportion of the filter analysed.
- EA143-OC: Sampling was not conducted by ALS and may not fall under accredited methods for sampling of inhalable and respirable dusts. Particulates outside the inhalable and respirable dust definitions under AS3640 and AS2985 respectively have the potential to introduce a bias. Results should be scrutinised accordingly.



Analytical Results

Sub-Matrix: FILTER
 (Matrix: AIR)

Client sample ID

				PVC2515042 PVC2515042	PVC2515043 PVC2515043	PVC2515044 PVC2515044	PVC2515045 PVC2515045	PVC2515046 PVC2515046
Client sampling date / time				05-Dec-2019 00:00	09-Dec-2019 00:00	11-Dec-2019 00:00	10-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EN1908941-001	EN1908941-002	EN1908941-003	EN1908941-004	EN1908941-005
				Result	Result	Result	Result	Result
EA143: Particulates in Air								
Inhalable Dust	----	10	µg/filter	277	198	257	76	139
ø Inhalable Dust	----	10	µg/m³	289	179	207	70	134
EA144: Particulate Base Metals (Calc Conc)								
ø Arsenic	7440-38-2	10	µg/m³	<10	<10	<10	<10	<10
ø Cadmium	7440-43-9	5	µg/m³	<5	<5	<5	<5	<5
ø Chromium	7440-47-3	5	µg/m³	<5	<5	<5	<5	<5
ø Cobalt	7440-48-4	5	µg/m³	<5	<5	<5	<5	<5
ø Copper	7440-50-8	5	µg/m³	<5	<5	<5	<5	<5
ø Manganese	7439-96-5	5	µg/m³	<5	<5	<5	<5	<5
ø Nickel	7440-02-0	5	µg/m³	<5	<5	<5	<5	<5
ø Zinc	7440-66-6	5	µg/m³	<5	<5	<5	<5	<5
ø Iron	7439-89-6	10	µg/m³	11	<10	<10	<10	<10
ø Lead	7439-92-1	10	µg/m³	<10	<10	<10	<10	<10
ø Selenium	7782-49-2	10	µg/m³	<10	<10	<10	<10	<10
ø Mercury	7439-97-6	0.5	µg/m³	<0.5	<0.5	<0.5	<0.5	<0.5
EA144: Particulate Base Metals in Filter Papers								
Arsenic	7440-38-2	10	µg/filter	<10	<10	<10	<10	<10
Cadmium	7440-43-9	5	µg/filter	<5	<5	<5	<5	<5
Chromium	7440-47-3	5	µg/filter	<5	<5	<5	<5	<5
Cobalt	7440-48-4	5	µg/filter	<5	<5	<5	<5	<5
Copper	7440-50-8	5	µg/filter	<5	<5	<5	<5	<5
Manganese	7439-96-5	5	µg/filter	<5	<5	<5	<5	<5
Nickel	7440-02-0	5	µg/filter	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/filter	<5	<5	<5	<5	<5
Iron	7439-89-6	10	µg/filter	11	<10	<10	<10	<10
Lead	7439-92-1	10	µg/filter	<10	<10	<10	<10	<10
Selenium	7782-49-2	10	µg/filter	<10	<10	<10	<10	<10
Mercury	7439-97-6	0.5	µg/filter paper	<0.5	<0.5	<0.5	<0.5	<0.5
OHAS: Occupational Air Sampling								
ø Volume	----	1	L	958	1100	1240	1090	1030

QUALITY CONTROL REPORT

Work Order : **EN1908941**

Page : 1 of 3

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Newcastle

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 5/585 Maitland Road Mayfield West NSW Australia 2304

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 17-Dec-2019

Order number : ----

Date Analysis Commenced : 20-Dec-2019

C-O-C number : ----

Issue Date : 29-Jan-2020

Sampler : Brandon Henry, MATTHEW HUNT

Site : ----

Quote number : EP/382/19 V2

No. of samples received : 5

No. of samples analysed : 5



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. 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
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Jennifer Targett	Laboratory Technician	Newcastle, Mayfield West, NSW
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

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



Method Blank (MB) and Laboratory Control Spike (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 Spike (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: AIR				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low
EA144: Particulate Base Metals in Filter Papers (QCLot: 2780910)								
EA144-Hg: Mercury	7439-97-6	0.5	µg/filter paper	<0.5	----	----	----	----
EA144: Particulate Base Metals in Filter Papers (QCLot: 2780911)								
EA144-AES: Arsenic	7440-38-2	10	µg/filter	<10	----	----	----	----
EA144-AES: Cadmium	7440-43-9	5	µg/filter	<5	----	----	----	----
EA144-AES: Chromium	7440-47-3	5	µg/filter	<5	----	----	----	----
EA144-AES: Cobalt	7440-48-4	5	µg/filter	<5	----	----	----	----
EA144-AES: Copper	7440-50-8	5	µg/filter	<5	----	----	----	----
EA144-AES: Manganese	7439-96-5	5	µg/filter	<5	----	----	----	----
EA144-AES: Nickel	7440-02-0	5	µg/filter	<5	----	----	----	----
EA144-AES: Zinc	7440-66-6	5	µg/filter	<5	----	----	----	----
EA144-AES: Iron	7439-89-6	10	µg/filter	<10	----	----	----	----
EA144-AES: Lead	7439-92-1	10	µg/filter	<10	----	----	----	----
EA144-AES: Selenium	7782-49-2	10	µg/filter	<10	----	----	----	----

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	: EN1908941	Page	: 1 of 4
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 17-Dec-2019
Site	: ----	Issue Date	: 29-Jan-2020
Sampler	: Brandon Henry, MATTHEW HUNT	No. of samples received	: 5
Order number	: ----	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

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

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

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

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

Matrix: **AIR**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA144: Particulate Base Metals in Filter Papers							
PVC Filter (EA144-Hg) PVC2515042 - PVC2515042	05-Dec-2019	23-Dec-2019	02-Jun-2020	✓	23-Dec-2019	02-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515046 - PVC2515046	08-Dec-2019	23-Dec-2019	05-Jun-2020	✓	23-Dec-2019	05-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515043 - PVC2515043	09-Dec-2019	23-Dec-2019	06-Jun-2020	✓	23-Dec-2019	06-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515045 - PVC2515045	10-Dec-2019	23-Dec-2019	07-Jun-2020	✓	23-Dec-2019	07-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515044 - PVC2515044	11-Dec-2019	23-Dec-2019	08-Jun-2020	✓	23-Dec-2019	08-Jun-2020	✓
OHAS: Occupational Air Sampling							
PVC Filter (OHAS-001) PVC2515042 - PVC2515042	05-Dec-2019	----	----	----	29-Jan-2020	04-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515046 - PVC2515046	08-Dec-2019	----	----	----	29-Jan-2020	07-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515043 - PVC2515043	09-Dec-2019	----	----	----	29-Jan-2020	08-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515045 - PVC2515045	10-Dec-2019	----	----	----	29-Jan-2020	09-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515044 - PVC2515044	11-Dec-2019	----	----	----	29-Jan-2020	10-Dec-2020	✓



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: **AIR** 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	
Method Blanks (MB)							
Filter paper analysis by FIMS	EA144-Hg	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Filter paper analysis by ICP AES	EA144-AES	1	5	20.00	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
Inhalable and Respirable Dust	EA143-OC	AIR	In house: Referenced to AS 2985-2009: Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust In house: Referenced to AS 3640-2009: Workplace atmospheres - Method for sampling and gravimetric determination of inhalable dust
Inhalable and Respirable Dust (mass/volume)	* EA143O-MV	AIR	In house: Referenced to AS 2985-2009: Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust In house: Referenced to AS 3640-2009: Workplace atmospheres - Method for sampling and gravimetric determination of inhalable dust Default LORs are based on a sample volume of 1000L (approx 2L/min for 8hr)
Filter paper analysis by ICP AES	EA144-AES	AIR	In house: Referenced to USEPA Method IO-3.2. Residue in air from either High Volume samplers or personal OH&S papers are digested in Nitric acid and analyzed for metals.
Particulate Base Metals - Occupational Samples	* EA144-AES-OH	AIR	In house: Referenced to NIOSH 7303 Particulate Metals in Air. Occupational air filters are digested in Nitric acid and analyzed by ICP-AES for metals. This method calculates metals as mass per unit air volume based on inputs from ICPAES and the air volume sampled. Default LORs are based on a sample volume of 1000L (approx 2L/min for 8hr)
Filter paper analysis by FIMS	EA144-Hq	AIR	In house: Referenced to USEPA Method IO-3.2 Residue in air from either High or Low Volume samplers are digested in Nitric acid and analyzed for metals. In house: Referenced to OSHA ID-145 Particulate Mercury in Workplace Atmospheres
Particulate Mercury on Occupational Air Filters by FIMS (Cal	* EA144-HG-OH	AIR	In house: Referenced to OSHA ID-145 Particulate Mercury in Workplace Atmospheres Residue in air from occupational air samples are digested in Nitric acid and analyzed for metals. This method calculates metals as mass per unit air volume based on inputs from FIMS and the air volume sampled. Default LORs are based on a sample volume of 1000L (approx 2L/min for 8hr)
Occupational Air Sampling - Particulates	* OHAS-001	AIR	Active Sampling of Air for Particulates in Occupational Environments
Preparation Methods	Method	Matrix	Method Descriptions
Particulate Base Metals - HVS	EA144	AIR	In house: Referenced to AS2800-1985 Residue in air from either High Volume samplers or personal OH&S papers are digested in Nitric acid and analyzed for metals.

STARTRACK: 3HIG200003706

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

[illegible]

Environmental Division
Newcastle
Work Order Reference
EN2001788



Telephone : + 61 2 4014 2500

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	11/3/2020	Date:
Of:	Time:	Date/Time:	Of:		Time:
Name/Signature: <i>ALB BERTH</i>	Date:	Carrier / Reference #:	Name/Signature: <i>ALB</i>	11/3/20	Date:
Of:	Time: 12/3/2020	Date/Time:	Of:	11:00	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		Date:
Of:	Time:	Date/Time:	Of:		Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; SH = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=LuGlu's Iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

COC 11March_dust

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EN2001788**

Client : SENVERSA PTY LTD
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES
TERRACE
PERTH 6000

Laboratory : Environmental Division Newcastle
Contact : Lauren Biagioni
Address : 5/585 Maitland Road Mayfield West
NSW Australia 2304

E-mail : blaire.coleman@senversa.com.au
Telephone : +61 08 6557 8881
Facsimile : +61 03 9606 0074

E-mail : Lauren.biagioni@alsglobal.com
Telephone : 08 9406 1307
Facsimile : +61 2 4967 7382

Project : P17302 Bulong DSI
Order number : ----
C-O-C number : ----
Site : ----
Sampler : Brandon Henry

Page : 1 of 2
Quote number : EP2019SENV0005 (EP/382/19 V3)
QC Level : NEPM 2013 B3 & ALS QC Standard

Dates

Date Samples Received : 17-Mar-2020 11:00
Client Requested Due Date : 27-Mar-2020

Issue Date : 19-Mar-2020
Scheduled Reporting Date : **27-Mar-2020**

Delivery Details

Mode of Delivery : Carrier
No. of coolers/boxes : ----
Receipt Detail :

Security Seal : Not Available
Temperature : ----
No. of samples received / analysed : 4 / 4

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
- Metals analysis conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Calculated Rainfall : EA130		
DG2 04/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG3 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG5 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG6 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
Total Solids (TS) : EA142		
DG2 04/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG3 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG5 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG6 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EN2001788-001 : [24-Feb-2020] : DG2 - 04/12/19 - 24/02/20
EN2001788-002 : [24-Feb-2020] : DG3 - 03/12/19 - 24/02/20
EN2001788-003 : [24-Feb-2020] : DG5 - 03/12/19 - 24/02/20
EN2001788-004 : [24-Feb-2020] : DG6 - 03/12/19 - 24/02/20

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: AIR

Laboratory sample ID	Client sampling date / time	Client sample ID	AIR - EA130-Vol Volume	AIR - EA142 Total Solids (TS)	AIR - EG020T Total Metals by ICP/MS (including digestion)
EN2001788-001	24-Feb-2020 00:00	DG2 04/12/19 - 24/0...	✓	✓	✓
EN2001788-002	24-Feb-2020 00:00	DG3 03/12/19 - 24/0...	✓	✓	✓
EN2001788-003	24-Feb-2020 00:00	DG5 03/12/19 - 24/0...	✓	✓	✓
EN2001788-004	24-Feb-2020 00:00	DG6 03/12/19 - 24/0...	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EN2001788**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **Brandon Henry**
Site : **----**
Quote number : **EP/382/19 V3**
No. of samples received : **4**
No. of samples analysed : **4**

Page : 1 of 4
Laboratory : Environmental Division Newcastle
Contact : Lauren Biagioni
Address : 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone : 08 9406 1307
Date Samples Received : 17-Mar-2020 11:00
Date Analysis Commenced : 23-Mar-2020
Issue Date : 25-Mar-2020 13:00



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Quality Coordinator	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Metals analysis conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 82 days for sample #001 and 83 days for samples #002, 003 and 004 which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- No copper sulfate correction was applied to samples.



Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST**
 (Matrix: **AIR**)

Client sample ID

				DG2 04/12/19 - 24/02/20	DG3 03/12/19 - 24/02/20	DG5 03/12/19 - 24/02/20	DG6 03/12/19 - 24/02/20	----
Client sampling date / time				24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----
Compound	CAS Number	LOR	Unit	EN2001788-001	EN2001788-002	EN2001788-003	EN2001788-004	-----
				Result	Result	Result	Result	----
EA130: Volume								
Volume	----	1	mL	1100	1190	1380	790	----
EA142: Total Solids								
Total Solids	----	0.1	g/m ² .month	2.7	1.6	2.1	6.3	----
Total Solids (mg)	----	1	mg	129	80	105	310	----



Analytical Results

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

Client sample ID

				DG2 04/12/19 - 24/02/20	DG3 03/12/19 - 24/02/20	DG5 03/12/19 - 24/02/20	DG6 03/12/19 - 24/02/20	----
Client sampling date / time				24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----
Compound	CAS Number	LOR	Unit	EN2001788-001	EN2001788-002	EN2001788-003	EN2001788-004	-----
				Result	Result	Result	Result	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Chromium	7440-47-3	0.001	mg/L	0.005	0.002	0.001	0.023	----
Cobalt	7440-48-4	0.001	mg/L	0.001	<0.001	<0.001	0.006	----
Copper	7440-50-8	0.001	mg/L	0.009	0.006	0.006	0.017	----
Lead	7439-92-1	0.001	mg/L	0.003	0.002	0.002	0.015	----
Manganese	7439-96-5	0.001	mg/L	0.026	0.020	0.030	0.074	----
Nickel	7440-02-0	0.001	mg/L	0.015	0.004	0.004	0.058	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L	1.23	1.36	0.978	1.73	----
Iron	7439-89-6	0.05	mg/L	0.58	0.36	0.34	2.55	----

QUALITY CONTROL REPORT

Work Order	: EN2001788	Page	: 1 of 3
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 17-Mar-2020
Order number	: ----	Date Analysis Commenced	: 23-Mar-2020
C-O-C number	: ----	Issue Date	: 25-Mar-2020
Sampler	: Brandon Henry		
Site	: ----		
Quote number	: EP/382/19 V3		
No. of samples received	: 4		
No. of samples analysed	: 4		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Quality Coordinator	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 2933137)									
EN2001788-001	DG2 04/12/19 - 24/02/20	EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.009	0.010	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.026	0.026	0.00	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.015	0.015	0.00	0% - 50%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	1.23	1.26	2.24	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.58	0.57	0.00	0% - 50%
ES2009747-001	Anonymous	EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.206	0.232	11.8	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	1.99	2.23	11.2	0% - 20%



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020T: Total Metals by ICP-MS (QCLot: 2933137)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	91.4	82.0	114
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	93.0	86.0	116
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	88.8	84.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	90.0	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	89.4	85.0	115
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	92.3	85.0	113
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	88.3	84.0	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	88.0	68.0	126
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.1	79.0	117
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	93.6	85.0	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**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2933137)							
EN2001788-002	DG3 03/12/19 - 24/02/20	EG020A-T: Arsenic	7440-38-2	1 mg/L	90.8	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	101	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	90.6	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	89.4	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	93.3	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	99.9	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	90.8	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	92.5	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EN2001788**

Page : 1 of 4

Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Project : P17302 Bulong DSI
Site : ----
Sampler : Brandon Henry
Order number : ----

Laboratory : Environmental Division Newcastle
Telephone : 08 9406 1307
Date Samples Received : 17-Mar-2020
Issue Date : 25-Mar-2020
No. of samples received : 4
No. of samples analysed : 4

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

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

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

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

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

Matrix: **AIR**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA130: Volume								
Dust Gauge - Unpreserved (EA130)								
DG2 - 04/12/19 - 24/02/20, DG5 - 03/12/19 - 24/02/20,	DG3 - 03/12/19 - 24/02/20, DG6 - 03/12/19 - 24/02/20	24-Feb-2020	----	----	----	23-Mar-2020	22-Aug-2020	✔
EA142: Total Solids								
Dust Gauge - Unpreserved (EA142)								
DG2 - 04/12/19 - 24/02/20, DG5 - 03/12/19 - 24/02/20,	DG3 - 03/12/19 - 24/02/20, DG6 - 03/12/19 - 24/02/20	24-Feb-2020	----	----	----	23-Mar-2020	22-Aug-2020	✔

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG020T: Total Metals by ICP-MS								
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG020A-T)								
DG2 - 04/12/19 - 24/02/20, DG5 - 03/12/19 - 24/02/20,	DG3 - 03/12/19 - 24/02/20, DG6 - 03/12/19 - 24/02/20	24-Feb-2020	24-Mar-2020	22-Aug-2020	✔	24-Mar-2020	22-Aug-2020	✔



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)							
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)							
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
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
Calculated Rainfall	EA130	AIR	In house: Referenced to AS 3580.10.1. A volumetric determination of total rainfall in the period.
Total Solids (TS)	EA142	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Total Solids in deposited dust.
Total Metals by ICP-MS - Suite A	EG020A-T	AIR	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.

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	AIR	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 (2013) Schedule B(3)

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Blagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@sensversa.com.au	Phone/Mobile:	+61 409 296 017

[illegible]

Environmental Division
Perth

Work Order Reference
EP1913220



Telephone : +61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:	Sampler Name: <u>atthew Hunt/Brandon He</u>	Signature: _____	Date: _____
---	---	------------------	-------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	12-12-19
Of:	Time:	Date/Time:	Of:	Time:	Sam
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;

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Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Bagdon / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information					Container Information					8 Metals Fe EGC	Clay Content	Redox	pH (Ca)	Total Hg digestion	Exchange treatment	Total Cr Analysis	1:5 leach	Deionised	8 Metals FIMS	Water Sb, Co	Hexavalent	HOLD	
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles																	
11	XRF_BG	Soil	3/12/2019	-	2 jars, 2 bags	4	X	X	X		X	X	x	x	x	x	x	x	x	x	x		
12	MW1_0.05-0.15	Soil	3/12/2019	-	1 jar	1											x	x			x		
13	MW1_1.0-1.1	Soil	3/12/2019	-	1 jar	1															x		
14	MW1_2.0-2.1	Soil	3/12/2019	-	1 jar	1															x		
15	MW1_3.0-3.1	Soil	3/12/2019	-	1 jar	1															x		
16	MW1_4.0-4.1	Soil	3/12/2019	-	1 jar	1															x		
17	MW2_0.05-0.15	Soil	3/12/2019	-	1 jar	1															x		
18	MW2_0.5-0.6	Soil	3/12/2019	-	1 jar	1															x		
19	MW2_1.0-1.1	Soil	3/12/2019	-	1 jar	1															x		
20	MW2_2.0-2.1	Soil	3/12/2019	-	1 jar	1															x		
21	MW2_3.0-3.1	Soil	3/12/2019	-	1 jar	1															x		
22	MW2_4.0-4.1	Soil	3/12/2019	-	1 jar	1															x		
23	MW2_5.0-5.1	Soil	3/12/2019	-	1 jar	1															x		
24	MW2_6.0-6.1	Soil	3/12/2019	-	1 jar	1															x		
25	MW2_8.4-8.5	Soil	3/12/2019	-	1 jar	1															x		
26	MW4_0.05-0.15	Soil	5/12/2019	-	1 jar	1															x		
27	MW5_0.05-0.15	Soil	6/12/2019	-	1 jar	1															x		
28	MW3_0.05-0.15	Soil	6/12/2019	-	1 jar	1															x		
29	S3T1_0.05-0.15	Soil	8/12/2019	-	2 jars, 2 bags	4	X	x							x	x	x	x	x	x		Relabel T1-3	
30	S3T1_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	X	x							x	x	x	x	x	x		Relabel T1-3, 0.3-0.4	
Total						29	3	3	1	1	1	1	1	1	2	2	2	2	2	2	18		

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project
Sampler Name: Matthew Hunt/Brandon Henry
Signature: 
Date: 8/12/2019

Relinquished By:	Date:	Method of Shipment (if applicable):	Received by:	Date:
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO3) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic;
V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

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Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Blagioni / Client Services Coordin
Phone: 08 9406 1301

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Tin	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information							Analysis Required														Comments: e.g. Highly contaminated sample, hazardous materials present, trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals (S-02)	Total Metals by ICP-AES: Se, Co, Mn, Fe (EG005T)	Clay Content by Hydrometer	Redox Potential (1:5)	pH (CaCl)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cyanide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	8 Metals (Water Leachable) ICPMS & FIMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	
30	T9-T15	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
31	T9-T15_0.15-0.25	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
32	T9-7	Soil	9/12/2019		2 jars, 2 bags	4	X	X	X			x		x	x	x	x	x	x	X	
33	T9-7_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
34	T13-2	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
35	T13-2_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
36	T13-8	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
37	T13-8_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
38	T24-4	Soil	9/12/2019		2 jars, 2 bags	4	X	X	x			x		x	x	x	x	x	x	X	
39	T24-20	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
40	T24-20_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
41	T17-4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
42	T17-4_0.05-0.15	Soil	9/12/2019		2 jars	2	X	X												X	
43	T8-3	Soil	9/12/2019		2 jars, 2 bags	4	X	X	x			x		x	x	x	x	x	x	X	
44	T8-3_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
45	T8-12	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
46	T8-12_0.3-0.4	Soil	9/12/2019		2 jars, 2 bags	4	X	X												X	
Total:							66	17	17	3	0	0	3	0	3	3	3	3	3	17	

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures | Sampler Name: Matthew Hunt/Brandon Henry | Signature: | Date: 8/12/2019

Relinquished By:	Method of Shipment (if applicable):	Received by:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:

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Project Manager:	Blair Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 405 296 017

Sample Information							Container Information		Analysis Required														Comments: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles			8 Metals (S-O2)	Total Metals by ICP-AES; Se, Co, Mn, Fe (EG005T)	Clay Content by Hydrometer	Redox Potential (1:5)	pH (CaCl2)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analysis	Exchangeable Cations with pre-treatment - Default Parameters	Total Cyanide by Segmented Flow Analyser	1:5 Leach	Deionised Water Leach	8 Metals (Water/Leachable) ICPMS & FIMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	
48417	QC04	Soil	8/12/2019	-	2 jars, 2 bags	1																x	
	QC05	Soil	8/12/2019	-	2 jars, 2 bags	1																x	FWD to Eurofins
48418	QC09	Soil	8/12/2019	-	2 jars, 2 bags	4																x	
	QC10	Soil	8/12/2019	-	2 jars, 2 bags	4	X	x						x	x	X	x	x	x	x	x	x	FWD to Eurofins
48419	QC11	Soil	8/12/2019	-	2 jars, 2 bags	4																x	
	QC12	Soil	8/12/2019	-	2 jars, 2 bags	4																x	FWD to Eurofins
Total:							18		1	4	0	0	0			1	1	1	1	1	1	5	

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or Sampler Name: Matthew Hunt/Brandon Henry Signature:  Date: 8/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date: 12-12-19
Of:	Time:	Date/Time:		Of:	Time: 8am
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic;
 V = VOA Vol Hydrochloric Acid (HCl) Preserved; VS = VOA Vol Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
 F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L = Lugol's iodine preserved white plastic bottle; SW = sulfuric acid preserved wide mouth glass jar

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913220

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : 17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Matthew Hunt/Brandon Henry</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 4</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 12-Dec-2019 08:00	Issue Date : 16-Dec-2019
Client Requested Due Date : 23-Dec-2019	Scheduled Reporting Date : 23-Dec-2019

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 8	Temperature : 20.2 - Ice present
Receipt Detail :	No. of samples received / analysed : 49 / 30

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
- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- **Clay Content analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Moisture Content : EA055		
T23-3_0.3-0.4	- Snap Lock Bag - Friable Asbestos/PSD Bag	- Soil Glass Jar - Unpreserved
Total Mercury by FIMS : EG035T		
T23-3_0.3-0.4	- Snap Lock Bag - Friable Asbestos/PSD Bag	- Soil Glass Jar - Unpreserved
Total Metals by ICP-AES : EG005T		
T23-3_0.3-0.4	- Snap Lock Bag - Friable Asbestos/PSD Bag	- Soil Glass Jar - Unpreserved

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	Client sampling date / time	Client sample ID	SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - EA075 Redox Potential (1:5)	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - S-02 8 Metals (incl. Digestion)
EP1913220-001	08-Dec-2019 00:00	T19-4	✓	✓	✓	✓	✓	✓	✓
EP1913220-002	08-Dec-2019 00:00	T19-4_0.3-0.4		✓			✓		✓
EP1913220-003	08-Dec-2019 00:00	T4-3	✓	✓	✓	✓	✓		✓
EP1913220-004	08-Dec-2019 00:00	T4-3_0.3-0.4		✓			✓		✓
EP1913220-005	08-Dec-2019 00:00	T23-13		✓			✓	✓	✓
EP1913220-006	08-Dec-2019 00:00	T23-13_0.3-0.4		✓			✓		✓
EP1913220-007	08-Dec-2019 00:00	T11-11		✓			✓		✓
EP1913220-008	08-Dec-2019 00:00	T11-11_0.3-0.4		✓			✓		✓
EP1913220-009	08-Dec-2019 00:00	T123-3		✓			✓	✓	✓
EP1913220-010	08-Dec-2019 00:00	T23-3_0.3-0.4		✓			✓		✓
EP1913220-011	03-Dec-2019 00:00	XRF_BG	✓	✓	✓	✓	✓	✓	✓
EP1913220-028	08-Dec-2019 00:00	T1-3		✓			✓	✓	✓
EP1913220-029	08-Dec-2019 00:00	T1-3_0.3-0.4		✓			✓		✓
EP1913220-030	09-Dec-2019 00:00	T9-T15		✓			✓		✓
EP1913220-031	09-Dec-2019 00:00	T9-T15_0.15-0.25		✓			✓		✓
EP1913220-032	09-Dec-2019 00:00	T9-7		✓		✓	✓	✓	✓
EP1913220-033	09-Dec-2019 00:00	T9-7_0.3-0.4		✓			✓		✓
EP1913220-034	09-Dec-2019 00:00	T13-2		✓			✓		✓
EP1913220-035	09-Dec-2019 00:00	T13-2_0.3-0.4		✓			✓		✓
EP1913220-036	09-Dec-2019 00:00	T13-8		✓			✓		✓
EP1913220-037	09-Dec-2019 00:00	T13-8_0.3-0.4		✓			✓		✓
EP1913220-038	09-Dec-2019 00:00	T24-4		✓		✓	✓	✓	✓
EP1913220-039	09-Dec-2019 00:00	T24-20		✓			✓		✓
EP1913220-040	09-Dec-2019 00:00	T24-20_0.3-0.4		✓			✓		✓
EP1913220-041	09-Dec-2019 00:00	T17-4		✓			✓		✓
EP1913220-042	09-Dec-2019 00:00	T17-4_0.05-0.15		✓			✓		✓
EP1913220-043	09-Dec-2019 00:00	T8-3		✓		✓	✓	✓	✓
EP1913220-044	09-Dec-2019 00:00	T8-3_0.3-0.4		✓			✓		✓



			SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - EA075 Redox Potential (1:5)	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - S-02 8 Metals (incl. Digestion)
EP1913220-045	09-Dec-2019 00:00	T8-12		✓			✓		✓
EP1913220-046	09-Dec-2019 00:00	T8-12_0.3-0.4		✓			✓		✓
			(On Hold) SOIL No analysis requested	SOIL - ED008 Def Exchangeable Cations with pre-treatment -	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EG048G Total Hexavalent Chromium (Alkaline digestion)	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - EN60-D1a Deionised Water Leach	SOIL - W-02W (ICPMS) 8 Metals (Water Leachable) ICPMS & FIMS
EP1913220-001	08-Dec-2019 00:00	T19-4			✓	✓	✓	✓	✓
EP1913220-005	08-Dec-2019 00:00	T23-13			✓	✓	✓	✓	✓
EP1913220-009	08-Dec-2019 00:00	T123-3			✓	✓	✓	✓	✓
EP1913220-011	03-Dec-2019 00:00	XRF_BG		✓	✓	✓	✓	✓	✓
EP1913220-012	03-Dec-2019 00:00	MW1_0.05-0.15	✓						
EP1913220-013	03-Dec-2019 00:00	MW1_1.0-1.1	✓						
EP1913220-014	03-Dec-2019 00:00	MW1_2.0-2.1	✓						
EP1913220-015	03-Dec-2019 00:00	MW1_3.0-3.1	✓						
EP1913220-016	03-Dec-2019 00:00	MW1_4.0-4.1	✓						
EP1913220-017	03-Dec-2019 00:00	MW2_0.05-0.15	✓						
EP1913220-018	03-Dec-2019 00:00	MW2_0.5-0.6	✓						
EP1913220-019	03-Dec-2019 00:00	MW2_1.0-1.1	✓						
EP1913220-020	03-Dec-2019 00:00	MW2_2.0-2.1	✓						
EP1913220-021	03-Dec-2019 00:00	MW2_3.0-3.1	✓						
EP1913220-022	03-Dec-2019 00:00	MW2_4.0-4.1	✓						
EP1913220-023	03-Dec-2019 00:00	MW2_5.0-5.1	✓						
EP1913220-024	03-Dec-2019 00:00	MW2_6.0-6.1	✓						
EP1913220-025	03-Dec-2019 00:00	MW2_9.4-9.5	✓						
EP1913220-026	06-Dec-2019 00:00	MW5_0.05-0.15	✓						
EP1913220-027	06-Dec-2019 00:00	MW3_0.05-0.15	✓						
EP1913220-028	08-Dec-2019 00:00	T1-3			✓		✓	✓	✓
EP1913220-032	09-Dec-2019 00:00	T9-7			✓	✓	✓	✓	✓
EP1913220-038	09-Dec-2019 00:00	T24-4			✓	✓	✓	✓	✓
EP1913220-043	09-Dec-2019 00:00	T8-3			✓	✓	✓	✓	✓
EP1913220-047	08-Dec-2019 00:00	QC04	✓						
EP1913220-048	08-Dec-2019 00:00	QC09	✓						
EP1913220-049	08-Dec-2019 00:00	QC11	✓						

Matrix: SOIL

Laboratory sample ID Client sampling date / time Client sample ID



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: SOIL

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
EA001: pH in soil using a 0.01M CaCl2 extract							
XRF_BG	Soil Glass Jar - Unpreserved	10-Dec-2019	16-Dec-2019	12-Dec-2019	✖	----	----

Requested Deliverables

Blaire Coleman

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Attachment - Report (SUBCO)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email blaire.coleman@senversa.com.au
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Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.au

CERTIFICATE OF ANALYSIS

Work Order : **EP1913220**
Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES TERRACE
 PERTH 6000
Telephone : +61 08 6557 8881
Project : 17302 Bulong DSI
Order number : ----
C-O-C number : ----
Sampler : Matthew Hunt/Brandon Henry
Site : ----
Quote number : EP/382/19 V2
No. of samples received : 49
No. of samples analysed : 30

Page : 1 of 11
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 08:00
Date Analysis Commenced : 13-Dec-2019
Issue Date : 24-Dec-2019 23:18



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Michael Byrne	Laboratory Technician	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EA150H: Soil particle density results for EP1913220-001 fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- EG005T: Total metals for sample #10 confirmed by re-extraction and re-analysis.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H^+ + Al^{3+}).



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				T19-4	T23-13	T123-3	XRF_BG	T1-3
Client sampling date / time				08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	03-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913220-001	EP1913220-005	EP1913220-009	EP1913220-011	EP1913220-028
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.006	0.002	<0.001	0.003	0.004
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	0.270	0.007	<0.001	0.088	0.044
Cobalt	7440-48-4	0.001	mg/L	0.032	<0.001	<0.001	0.004	0.002
Copper	7440-50-8	0.001	mg/L	0.009	0.002	<0.001	0.002	0.002
Lead	7439-92-1	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.323	0.013	<0.001	0.039	0.041
Nickel	7440-02-0	0.001	mg/L	0.494	0.016	<0.001	0.076	0.015
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	0.071	<0.005	0.006	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L	11.6	0.41	<0.05	3.09	1.76
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				T9-7	T24-4	T8-3	----	----
Client sampling date / time				09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	----	----
Compound	CAS Number	LOR	Unit	EP1913220-032	EP1913220-038	EP1913220-043	-----	-----
				Result	Result	Result	----	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.005	<0.001	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	0.038	<0.001	0.026	----	----
Cobalt	7440-48-4	0.001	mg/L	0.004	<0.001	0.002	----	----
Copper	7440-50-8	0.001	mg/L	0.003	<0.001	0.002	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.056	<0.001	0.044	----	----
Nickel	7440-02-0	0.001	mg/L	0.053	<0.001	0.016	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	----	----
Iron	7439-89-6	0.05	mg/L	2.18	<0.05	1.63	----	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T19-4	T19-4_0.3-0.4	T4-3	T4-3_0.3-0.4	T23-13
Client sampling date / time					08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-001	EP1913220-002	EP1913220-003	EP1913220-004	EP1913220-005
					Result	Result	Result	Result	Result
EA001: pH in soil using 0.01M CaCl extract									
pH (CaCl2)	----	0.1	pH Unit		6.2	----	6.2	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		4.8	22.0	17.0	8.1	27.1
EA075: Redox Potential									
Redox Potential	----	0.1	mV		193	----	204	----	----
pH Redox	----	0.1	pH Unit		7.6	----	8.2	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		10	----	9	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		4.64	----	2.73	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		54	52	21	21	62
Iron	7439-89-6	50	mg/kg		51900	50000	53700	41700	54600
Manganese	7439-96-5	5	mg/kg		567	594	431	318	851
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		8	8	6	8	6
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		823	718	708	360	719
Copper	7440-50-8	5	mg/kg		18	20	24	36	27
Lead	7439-92-1	5	mg/kg		<5	<5	5	<5	<5
Nickel	7440-02-0	2	mg/kg		728	699	180	138	786
Zinc	7440-66-6	5	mg/kg		21	21	38	46	36
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	----	----	----	<0.5
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	----	----	----	<1
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		6.5	----	----	----	7.7



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T23-13_0.3-0.4	T1-11	T1-11_0.3-0.4	T123-3	T23-3_0.3-0.4
Client sampling date / time					08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-006	EP1913220-007	EP1913220-008	EP1913220-009	EP1913220-010
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		7.8	2.4	26.8	32.0	15.6
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		57	30	29	12	<2
Iron	7439-89-6	50	mg/kg		55800	70000	52900	30900	540
Manganese	7439-96-5	5	mg/kg		628	745	702	230	9
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		6	6	7	10	<5
Cadmium	7440-43-9	1	mg/kg		<1	1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		784	1260	857	432	4
Copper	7440-50-8	5	mg/kg		21	18	28	17	<5
Lead	7439-92-1	5	mg/kg		<5	7	5	<5	<5
Nickel	7440-02-0	2	mg/kg		737	291	267	120	<2
Zinc	7440-66-6	5	mg/kg		25	44	31	18	<5
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		----	----	----	<0.5	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	----	----	<1	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	----	----	7.6	----

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	XRF_BG	T1-3	T1-3_0.3-0.4	T9-T15	T9-T15_0.15-0.25
Client sampling date / time				03-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	
Compound	CAS Number	LOR	Unit	EP1913220-011	EP1913220-028	EP1913220-029	EP1913220-030	EP1913220-031	
				Result	Result	Result	Result	Result	
EA001: pH in soil using 0.01M CaCl extract									
pH (CaCl2)	----	0.1	pH Unit	6.2	----	----	----	----	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%	10.7	21.3	9.2	8.0	16.0	
EA075: Redox Potential									
Redox Potential	----	0.1	mV	182	----	----	----	----	
pH Redox	----	0.1	pH Unit	7.7	----	----	----	----	
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%	11	----	----	----	----	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.76	----	----	----	----	
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g	7.2	----	----	----	----	
Exchangeable Magnesium	----	0.1	meq/100g	5.5	----	----	----	----	
Exchangeable Potassium	----	0.1	meq/100g	0.5	----	----	----	----	
Exchangeable Sodium	----	0.1	meq/100g	0.2	----	----	----	----	
Cation Exchange Capacity	----	0.1	meq/100g	13.3	----	----	----	----	
Exchangeable Sodium Percent	----	0.1	%	1.2	----	----	----	----	
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg	49	22	29	21	28	
Iron	7439-89-6	50	mg/kg	50300	62200	61800	51700	42700	
Manganese	7439-96-5	5	mg/kg	514	486	431	528	714	
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5	
Arsenic	7440-38-2	5	mg/kg	7	6	9	<5	<5	
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1	
Chromium	7440-47-3	2	mg/kg	822	1060	1040	511	578	
Copper	7440-50-8	5	mg/kg	16	19	30	12	13	
Lead	7439-92-1	5	mg/kg	<5	6	6	6	6	
Nickel	7440-02-0	2	mg/kg	682	260	278	184	199	
Zinc	7440-66-6	5	mg/kg	19	41	36	24	15	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	----	----	----	----	
EK026SF: Total CN by Segmented Flow Analyser									



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	XRF_BG	T1-3	T1-3_0.3-0.4	T9-T15	T9-T15_0.15-0.25
Client sampling date / time					03-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-011	EP1913220-028	EP1913220-029	EP1913220-030	EP1913220-031
					Result	Result	Result	Result	Result
EK026SF: Total CN by Segmented Flow Analyser - Continued									
Total Cyanide	57-12-5	1	mg/kg		<1	<1	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		7.4	8.4	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T9-7	T9-7_0.3-0.4	T13-2	T13-2_0.3-0.4	T13-8
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-032	EP1913220-033	EP1913220-034	EP1913220-035	EP1913220-036
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		5.8	24.0	17.8	16.5	14.7
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		8	----	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.72	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		48	31	12	28	4
Iron	7439-89-6	50	mg/kg		43000	39300	47100	60200	27100
Manganese	7439-96-5	5	mg/kg		645	356	271	432	119
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		6	11	<5	10	<5
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		507	503	458	732	172
Copper	7440-50-8	5	mg/kg		21	19	11	29	7
Lead	7439-92-1	5	mg/kg		<5	<5	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		514	383	109	302	22
Zinc	7440-66-6	5	mg/kg		23	18	25	40	9
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	----	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		8.2	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T13-8_0.3-0.4	T24-4	T24-20	T24-20_0.3-0.4	T17-4
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-037	EP1913220-038	EP1913220-039	EP1913220-040	EP1913220-041
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		18.1	22.1	20.0	24.8	18.3
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	4	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	2.49	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		9	32	25	15	40
Iron	7439-89-6	50	mg/kg		22600	70800	50600	35500	34600
Manganese	7439-96-5	5	mg/kg		154	713	1480	438	1030
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		6	15	<5	6	7
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		92	1190	289	186	358
Copper	7440-50-8	5	mg/kg		35	22	27	22	18
Lead	7439-92-1	5	mg/kg		<5	8	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		54	280	163	93	402
Zinc	7440-66-6	5	mg/kg		20	22	50	28	25
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		----	<0.5	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	<1	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	8.4	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T17-4_0.05-0.15	T8-3	T8-3_0.3-0.4	T8-12	T8-12_0.3-0.4
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913220-042	EP1913220-043	EP1913220-044	EP1913220-045	EP1913220-046
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		32.1	17.9	25.5	37.1	29.8
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	16	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	2.67	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		68	36	29	40	20
Iron	7439-89-6	50	mg/kg		34100	60600	30800	41600	30000
Manganese	7439-96-5	5	mg/kg		473	1000	363	956	296
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		<5	6	7	6	12
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		202	590	394	385	221
Copper	7440-50-8	5	mg/kg		35	26	37	36	39
Lead	7439-92-1	5	mg/kg		<5	7	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		315	324	307	458	215
Zinc	7440-66-6	5	mg/kg		104	48	20	42	27
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		----	<0.5	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	<1	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	7.7	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP1913220	Page	: 1 of 9
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 13-Dec-2019
C-O-C number	: ----	Issue Date	: 24-Dec-2019
Sampler	: Matthew Hunt/Brandon Henry		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 49		
No. of samples analysed	: 30		



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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Michael Byrne	Laboratory Technician	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2777841)									
EP1913156-038	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	159	173	8.50	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	16	14	9.89	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	47	40	16.4	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	9	9	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	16	16	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	517	474	8.67	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	50	47	6.34	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	32100	30500	5.26	0% - 20%
EP1913220-010	T23-3_0.3-0.4	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	4	4	25.2	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	9	7	14.1	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	540	520	3.80	0% - 50%
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2777844)									
EP1913220-036	T13-8	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	172	173	0.700	0% - 20%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2777844) - continued									
EP1913220-036	T13-8	EG005T: Cobalt	7440-48-4	2	mg/kg	4	4	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	22	21	0.00	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	7	6	16.5	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	119	111	6.98	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	9	10	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	27100	28200	3.86	0% - 20%
EP1913220-046	T8-12_0.3-0.4	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	221	218	1.59	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	20	20	0.00	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	215	217	0.961	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	12	11	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	39	37	4.84	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	296	297	0.00	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	27	27	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	30000	29400	1.92	0% - 20%
EA001: pH in soil using 0.01M CaCl extract (QC Lot: 2766561)									
EP1912971-010	Anonymous	EA001: pH (CaCl2)	----	0.1	pH Unit	6.0	6.1	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2778004)									
EP1913220-001	T19-4	EA055: Moisture Content	----	0.1	%	4.8	4.6	4.10	No Limit
EP1913220-010	T23-3_0.3-0.4	EA055: Moisture Content	----	0.1	%	15.6	15.7	0.669	0% - 50%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2778005)									
EP1913220-037	T13-8_0.3-0.4	EA055: Moisture Content	----	0.1	%	18.1	19.6	8.07	0% - 50%
EP1913220-046	T8-12_0.3-0.4	EA055: Moisture Content	----	0.1	%	29.8	29.4	1.10	0% - 20%
EA075: Redox Potential (QC Lot: 2776159)									
EP1913220-011	XRF_BG	EA075: Redox Potential	----	0.1	mV	182	184	0.710	0% - 20%
		EA075: pH Redox	----	0.1	pH Unit	7.7	7.5	1.84	0% - 20%
EA075: Redox Potential (QC Lot: 2777861)									
EP1913220-001	T19-4	EA075: Redox Potential	----	0.1	mV	193	192	0.728	0% - 20%
		EA075: pH Redox	----	0.1	pH Unit	7.6	7.6	0.00	0% - 20%
ED007: Exchangeable Cations (QC Lot: 2777756)									
EP1913220-011	XRF_BG	ED007: Exchangeable Sodium Percent	----	0.1	%	1.2	1.0	16.0	0% - 50%
		ED007: Exchangeable Calcium	----	0.1	meq/100g	7.2	6.7	7.34	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	5.5	5.2	4.11	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.5	0.5	0.00	No Limit

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Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED007: Exchangeable Cations (QC Lot: 2777756) - continued									
EP1913220-011	XRF_BG	ED007: Exchangeable Sodium	----	0.1	meq/100g	0.2	0.1	0.00	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	13.3	12.5	6.14	0% - 20%
EP1913338-021	Anonymous	ED007: Exchangeable Sodium Percent	----	0.1	%	1.8	1.7	0.00	0% - 50%
		ED007: Exchangeable Calcium	----	0.1	meq/100g	19.7	19.8	0.00	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.6	0.7	0.00	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	0.00	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	0.4	0.4	0.00	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	20.8	20.8	0.484	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2777842)									
EP1913156-038	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913220-010	T23-3_0.3-0.4	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2777843)									
EP1913220-036	T13-8	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913220-046	T8-12_0.3-0.4	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 2777758)									
EP1913220-001	T19-4	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP1913377-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2773713)									
EP1913220-001	T19-4	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
EP1913250-011	Anonymous	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743)									
EP1913220-001	T19-4	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.270	0.323	17.8	0% - 20%
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	0.032	0.034	6.33	0% - 20%
		EG020A-W: Copper	7440-50-8	0.001	mg/L	0.009	0.010	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	0.323	0.340	5.24	0% - 20%
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.494	0.558	12.2	0% - 20%
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	0.071	0.078	10.3	0% - 50%
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	11.6	13.1	12.0	0% - 20%
EP1913250-011	Anonymous	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.002	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	0.001	<0.001	0.00	No Limit

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 Client : SENVERSA PTY LTD
 Project : 17302 Bulong DSI



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743) - continued									
EP1913250-011	Anonymous	EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2776745)									
EP1913173-004	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913220-043	T8-3	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2781907)									
EP1913151-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913220-011	XRF_BG	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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.

Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
	Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High		
	<5	22 mg/kg	102	81.5	118
	<1	5 mg/kg	92.0	76.2	106
	<2	42.2 mg/kg	90.3	66.9	138
	<2	----	----	----	----
	<5	34 mg/kg	97.9	79.1	113
	<50	----	----	----	----
	<5	40 mg/kg	99.5	78.9	112
	<5	----	----	----	----
	<2	55.5 mg/kg	101	81.5	126
	<5	----	----	----	----
	<5	62 mg/kg	100	81.0	119
	<5	22 mg/kg	104	81.5	118
	<1	5 mg/kg	94.0	76.2	106
	<2	42.2 mg/kg	94.0	66.9	138
	<2	----	----	----	----
	<5	34 mg/kg	97.8	79.1	113
	<50	----	----	----	----
	<5	40 mg/kg	102	78.9	112
	<5	----	----	----	----
	<2	55.5 mg/kg	102	81.5	126
	<5	----	----	----	----
	<5	62 mg/kg	104	81.0	119
	----	4 pH Unit	100	98.8	101
	----	7 pH Unit	100	99.2	101
	<0.1	21.6 meq/100g	101	82.9	117
	<0.1	1.76 meq/100g	102	78.4	119
	<0.1	1 meq/100g	109	87.9	129
	<0.1	0.9 meq/100g	103	92.9	132
	<0.1	25.3 meq/100g	101	84.7	117
	<0.1	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			LCS	Low	High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777842) - continued								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	96.3	81.0	115
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777843)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	98.2	81.0	115
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2777758)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	40 mg/kg	99.8	70.0	130
				<0.5	20 mg/kg	82.1	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773713)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	91.5	74.2	106

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743)								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	108	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	104	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	103	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	101	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.5	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	95.4	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	114	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.0	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2781907)								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	102	93.0	115

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: SOIL				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2777841)							
EP1913156-038	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	89.6	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2777841) - continued							
EP1913156-038	Anonymous	EG005T: Cadmium	7440-43-9	12.5 mg/kg	94.0	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	81.0	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	91.6	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	104	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	93.9	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	78.2	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	87.5	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2777844)							
EP1913220-036	T13-8	EG005T: Arsenic	7440-38-2	50 mg/kg	90.4	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	103	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	103	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	99.2	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	103	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	96.8	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	103	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	104	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777842)							
EP1913156-038	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	91.9	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2777843)							
EP1913220-036	T13-8	EG035T: Mercury	7439-97-6	1 mg/kg	95.8	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2777758)							
EP1913220-001	T19-4	EG048G: Hexavalent Chromium	18540-29-9	40 mg/kg	95.1	70.0	130
EP1913220-001	T19-4	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	114	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773713)							
EP1913220-005	T23-13	EK026SF: Total Cyanide	57-12-5	20 mg/kg	95.5	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743)							
EP1913220-005	T23-13	EG020A-W: Arsenic	7440-38-2	1 mg/L	112	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	111	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	103	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	103	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	110	70.0	130



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743) - continued							
EP1913220-005	T23-13	EG020A-W: Lead	7439-92-1	1 mg/L	108	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	109	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	108	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	114	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)							
EP1913220-009	T123-3	EG035W: Mercury	7439-97-6	0.01 mg/L	100	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2781907)							
EP1913151-003	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	102	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913220	Page	: 1 of 10
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 24-Dec-2019
Sampler	: Matthew Hunt/Brandon Henry	No. of samples received	: 49
Order number	: ----	No. of samples analysed	: 30

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP1913156--038	Anonymous	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA001: pH in soil using 0.01M CaCl extract						
Soil Glass Jar - Unpreserved XRF_BG	16-Dec-2019	10-Dec-2019	6	----	----	----
Soil Glass Jar - Unpreserved T19-4, T4-3	16-Dec-2019	15-Dec-2019	1	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved XRF_BG	----	----	----	20-Dec-2019	17-Dec-2019	3
EA075: Redox Potential						
Soil Glass Jar - Unpreserved XRF_BG	19-Dec-2019	17-Dec-2019	2	----	----	----
Soil Glass Jar - Unpreserved T19-4, T4-3	23-Dec-2019	22-Dec-2019	1	----	----	----
EK026SF: Total CN by Segmented Flow Analyser						
Soil Glass Jar - Unpreserved XRF_BG	19-Dec-2019	17-Dec-2019	2	----	----	----

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	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
Container / Client Sample ID(s)							



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA001: pH in soil using 0.01M CaCl extract							
Soil Glass Jar - Unpreserved (EA001) XRF_BG	03-Dec-2019	16-Dec-2019	10-Dec-2019	✖	16-Dec-2019	16-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA001) T19-4, T4-3	08-Dec-2019	16-Dec-2019	15-Dec-2019	✖	16-Dec-2019	16-Dec-2019	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA055) T23-3_0.3-0.4	08-Dec-2019	----	----	----	20-Dec-2019	22-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA055) XRF_BG	03-Dec-2019	----	----	----	20-Dec-2019	17-Dec-2019	✖
Soil Glass Jar - Unpreserved (EA055) T19-4, T4-3, T23-13, T1-11, T123-3, T1-3_0.3-0.4 T19-4_0.3-0.4, T4-3_0.3-0.4, T23-13_0.3-0.4, T1-11_0.3-0.4, T1-3,	08-Dec-2019	----	----	----	20-Dec-2019	22-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA055) T9-T15, T9-7, T13-2, T13-8, T24-4, T24-20_0.3-0.4, T17-4_0.05-0.15, T8-3_0.3-0.4, T8-12_0.3-0.4 T9-T15_0.15-0.25, T9-7_0.3-0.4, T13-2_0.3-0.4, T13-8_0.3-0.4, T24-20, T17-4, T8-3, T8-12,	09-Dec-2019	----	----	----	20-Dec-2019	23-Dec-2019	✓
EA075: Redox Potential							
Soil Glass Jar - Unpreserved (EA075) XRF_BG	03-Dec-2019	19-Dec-2019	17-Dec-2019	✖	19-Dec-2019	19-Dec-2019	✓
Soil Glass Jar - Unpreserved (EA075) T19-4, T4-3	08-Dec-2019	23-Dec-2019	22-Dec-2019	✖	23-Dec-2019	23-Dec-2019	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) XRF_BG	03-Dec-2019	----	----	----	19-Dec-2019	31-May-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) T19-4, T4-3	08-Dec-2019	----	----	----	19-Dec-2019	05-Jun-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) T9-7, T8-3, T24-4,	09-Dec-2019	----	----	----	19-Dec-2019	06-Jun-2020	✓



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA152: Soil Particle Density							
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) XRF_BG	03-Dec-2019	----	----	----	19-Dec-2019	31-May-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) T19-4, T4-3	08-Dec-2019	----	----	----	19-Dec-2019	05-Jun-2020	✓
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) T9-7, T24-4, T8-3	09-Dec-2019	----	----	----	19-Dec-2019	06-Jun-2020	✓
ED007: Exchangeable Cations							
Soil Glass Jar - Unpreserved (ED007) XRF_BG	03-Dec-2019	20-Dec-2019	31-Dec-2019	✓	20-Dec-2019	31-Dec-2019	✓
EG005(ED093)T: Total Metals by ICP-AES							
Snap Lock Bag - Friable Asbestos/PSD Bag (EG005T) T23-3_0.3-0.4	08-Dec-2019	20-Dec-2019	05-Jun-2020	✓	20-Dec-2019	05-Jun-2020	✓
Soil Glass Jar - Unpreserved (EG005T) XRF_BG	03-Dec-2019	20-Dec-2019	31-May-2020	✓	20-Dec-2019	31-May-2020	✓
Soil Glass Jar - Unpreserved (EG005T) T19-4, T4-3, T23-13, T1-11, T123-3, T1-3_0.3-0.4 T19-4_0.3-0.4, T4-3_0.3-0.4, T23-13_0.3-0.4, T1-11_0.3-0.4, T1-3,	08-Dec-2019	20-Dec-2019	05-Jun-2020	✓	20-Dec-2019	05-Jun-2020	✓
Soil Glass Jar - Unpreserved (EG005T) T9-T15, T9-7, T13-2, T13-8, T24-4, T24-20_0.3-0.4, T17-4_0.05-0.15, T8-3_0.3-0.4, T8-12_0.3-0.4 T9-T15_0.15-0.25, T9-7_0.3-0.4, T13-2_0.3-0.4, T13-8_0.3-0.4, T24-20, T17-4, T8-3, T8-12,	09-Dec-2019	20-Dec-2019	06-Jun-2020	✓	20-Dec-2019	06-Jun-2020	✓



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG035T: Total Recoverable Mercury by FIMS								
Snap Lock Bag - Friable Asbestos/PSD Bag (EG035T) T23-3_0.3-0.4	08-Dec-2019	20-Dec-2019	05-Jan-2020	✓	20-Dec-2019	05-Jan-2020	✓	
Soil Glass Jar - Unpreserved (EG035T) XRF_BG	03-Dec-2019	20-Dec-2019	31-Dec-2019	✓	20-Dec-2019	31-Dec-2019	✓	
Soil Glass Jar - Unpreserved (EG035T) T19-4, T4-3, T23-13, T1-11, T123-3, T1-3_0.3-0.4	T19-4_0.3-0.4, T4-3_0.3-0.4, T23-13_0.3-0.4, T1-11_0.3-0.4, T1-3,	08-Dec-2019	20-Dec-2019	05-Jan-2020	✓	20-Dec-2019	05-Jan-2020	✓
Soil Glass Jar - Unpreserved (EG035T) T9-T15, T9-7, T13-2, T13-8, T24-4, T24-20_0.3-0.4, T17-4_0.05-0.15, T8-3_0.3-0.4, T8-12_0.3-0.4	T9-T15_0.15-0.25, T9-7_0.3-0.4, T13-2_0.3-0.4, T13-8_0.3-0.4, T24-20, T17-4, T8-3, T8-12,	09-Dec-2019	20-Dec-2019	06-Jan-2020	✓	20-Dec-2019	06-Jan-2020	✓
EG048: Hexavalent Chromium (Alkaline Digest)								
Soil Glass Jar - Unpreserved (EG048G) XRF_BG	03-Dec-2019	20-Dec-2019	31-Dec-2019	✓	23-Dec-2019	27-Dec-2019	✓	
Soil Glass Jar - Unpreserved (EG048G) T19-4, T123-3	T23-13,	08-Dec-2019	20-Dec-2019	05-Jan-2020	✓	23-Dec-2019	27-Dec-2019	✓
Soil Glass Jar - Unpreserved (EG048G) T9-7, T8-3	T24-4,	09-Dec-2019	20-Dec-2019	06-Jan-2020	✓	23-Dec-2019	27-Dec-2019	✓
EK026SF: Total CN by Segmented Flow Analyser								
Soil Glass Jar - Unpreserved (EK026SF) XRF_BG	03-Dec-2019	19-Dec-2019	17-Dec-2019	✗	20-Dec-2019	02-Jan-2020	✓	
Soil Glass Jar - Unpreserved (EK026SF) T19-4, T123-3,	T23-13, T1-3	08-Dec-2019	19-Dec-2019	22-Dec-2019	✓	20-Dec-2019	02-Jan-2020	✓
Soil Glass Jar - Unpreserved (EK026SF) T9-7, T8-3	T24-4,	09-Dec-2019	19-Dec-2019	23-Dec-2019	✓	20-Dec-2019	02-Jan-2020	✓



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) XRF_BG	03-Dec-2019	13-Dec-2019	31-Dec-2019	✓	----	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) T19-4, T123-3, T123-3, T1-3	08-Dec-2019	13-Dec-2019	05-Jan-2020	✓	----	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) T9-7, T8-3	09-Dec-2019	13-Dec-2019	06-Jan-2020	✓	----	----	----

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG020W: Water Leachable Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) T19-4, T123-3, T1-3, T24-4,	T23-13, XRF_BG, T9-7, T8-3	13-Dec-2019	20-Dec-2019	10-Jun-2020	✓	20-Dec-2019	10-Jun-2020	✓
EG035W: Water Leachable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) T19-4, T123-3, T1-3, T24-4,	T23-13, XRF_BG, T9-7, T8-3	13-Dec-2019	----	----	----	19-Dec-2019	10-Jan-2020	✓
EG050G-W: Hexavalent Chromium - Water Leachable								
Clear Plastic Bottle - NaOH (EG050G-W) T19-4, T123-3, T1-3, T24-4,	T23-13, XRF_BG, T9-7, T8-3	13-Dec-2019	---	----	----	23-Dec-2019	10-Jan-2020	✓

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.

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

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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							



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 Control Samples (LCS) - Continued							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	14	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	14	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	14	7.14	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH in soil using a 0.01M CaCl ₂ extract	EA001	SOIL	In house: Referenced to Rayment and Lyons (2011) 4B3 (mod.) or 4B4 (mod.) 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Redox Potential	EA075	SOIL	In house: Ion selective electrode. Analysis is performed on a 1:5 soil:de-ionised water extract.
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060A. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.
pH in soil using a 0.01M CaCl ₂ extract	EA001-PR	SOIL	In house: Referenced to Rayment and Higginson 4B1, 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH ₄ Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	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 (2013) Schedule B(3)
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Deionised Water Leach	EN60-Dia	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information							Analysis Required														Comments: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals (S-02)	Total Metals by CP-AES: Se, Co, Mn, Fe (EG005T)	Clay Content by Hydrometer	Redox Potential (1:5)	pH (CaCl)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cyanide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	8 Metals (Water Leachable) (CPMS & FIMS / As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	
1	T16-1	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X	X					X	X	X	X	X	X	X	
2	T16-0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4			X											X	
3	T16-9	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X												X	
4	T16_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4								X	X	X	X	X	X	X	
5	T20-3	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X												X	
6	T20-3_0.1	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
7	T6-8	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X	X											X	
8	T6-8_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
9	T6-4	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X												X	
10	T6-4_0.15-0.25	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
11	T11-9	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X						X	X	X	X	X	X	X	
12	T11-9_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
13	T11-1	Soil	11/12/2019	-	2 jars, 2 bags	4	X	X	X											X	
14	T11-1_0.3-0.4	Soil	11/12/2019	-	2 jars, 2 bags	4														X	
15	QC19	Soil	11/12/2019	-	2 jars, 1 bag	3	X	X	X					X	X	X	X	X	X	X	
16	QC20	Soil	11/12/2019	-	2 jars, 1 bag	3	X	X													FWD to Eurofins
17	QC21	Water	11/12/2019	-	1N	1													X		
18	LAST SAMPLE End of TB Surface 1																				
Total						63	9	9	5	0	0	0	0	4	4	4	4	4	16		

Environmental Division
Perth
Work Order Reference
EP1913250



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt / Brandon Henry Signature: Date: 11/12/2019

Relinquished By:	Method of Shipment (if applicable):	Received by:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:
Name/Signature:	Carrier / Reference #:	Name/Signature:
Of:	Date/Time:	Of:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913250

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Brandon Henry, Matthew Hunt</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 12-Dec-2019 10:00	Issue Date : 12-Dec-2019
Client Requested Due Date : 24-Dec-2019	Scheduled Reporting Date : 24-Dec-2019

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 4	Temperature : 9.0/24.0 - Ice Bricks present
Receipt Detail :	No. of samples received / analysed : 18 / 9

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
- EA150-H conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EP1913250-017 : [11-Dec-2019] : LRSF SAMPLE - North Border

EP1913250-018 : [11-Dec-2019] : End of T13 Surface Soil

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	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - EN60-D1a Deionised Water Leach	SOIL - S-02 Metals (incl. Digestion)	SOIL - W-02W (ICPMS) Metals (Water Leachable) ICPMS & FIMS
EP1913250-001	11-Dec-2019 00:00	T16-1	✓	✓	✓	✓	✓	✓	✓
EP1913250-002	11-Dec-2019 00:00	T16-0.3-0.4		✓					
EP1913250-003	11-Dec-2019 00:00	T16-9	✓		✓			✓	
EP1913250-005	11-Dec-2019 00:00	T20-3	✓		✓	✓	✓	✓	✓
EP1913250-007	11-Dec-2019 00:00	T6-8	✓	✓	✓			✓	
EP1913250-009	11-Dec-2019 00:00	T6-4	✓		✓			✓	
EP1913250-011	11-Dec-2019 00:00	T11-9	✓		✓	✓	✓	✓	✓
EP1913250-013	11-Dec-2019 00:00	T11-1	✓	✓	✓			✓	
EP1913250-015	11-Dec-2019 00:00	QC19	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser
EP1913250-001	11-Dec-2019 00:00	T16-1		✓	✓
EP1913250-004	11-Dec-2019 00:00	T16_0.3-0.4	✓		
EP1913250-005	11-Dec-2019 00:00	T20-3		✓	✓
EP1913250-006	11-Dec-2019 00:00	T20-3_0.1	✓		
EP1913250-008	11-Dec-2019 00:00	T6-8_0.3-0.4	✓		
EP1913250-010	11-Dec-2019 00:00	T6-4_0.15-0.25	✓		
EP1913250-011	11-Dec-2019 00:00	T11-9		✓	✓
EP1913250-012	11-Dec-2019 00:00	T11-9_0.3-0.4	✓		
EP1913250-014	11-Dec-2019 00:00	T11-1_0.3-0.4	✓		
EP1913250-015	11-Dec-2019 00:00	QC19		✓	✓
EP1913250-017	11-Dec-2019 00:00	LRSF SAMPLE North B...	✓		
EP1913250-018	11-Dec-2019 00:00	End of T13 Surface S...	✓		



Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested
EP1913250-016	11-Dec-2019 00:00	QC21	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

JUSTIN LUMSDEN

- *AU Certificate of Analysis - NATA (COA)	Email	justin.lumsden@senversa.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	justin.lumsden@senversa.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	justin.lumsden@senversa.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	justin.lumsden@senversa.com.au
- Attachment - Report (SUBCO)	Email	justin.lumsden@senversa.com.au
- Chain of Custody (CoC) (COC)	Email	justin.lumsden@senversa.com.au
- EDI Format - ENMRG (ENMRG)	Email	justin.lumsden@senversa.com.au
- EDI Format - ESDAT (ESDAT)	Email	justin.lumsden@senversa.com.au
- EDI Format - XTab (XTAB)	Email	justin.lumsden@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EP1913250**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **Brandon Henry, Matthew Hunt**
Site : **----**
Quote number : **EP/382/19 V2**
No. of samples received : **18**
No. of samples analysed : **9**

Page : 1 of 5
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 10:00
Date Analysis Commenced : 13-Dec-2019
Issue Date : 27-Dec-2019 11:53



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA150-H conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EA150H: Soil particle density results fell outside the scope of AS1289.3.6.3 due to high amounts of iron present. Results should be scrutinised accordingly.



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				T16-1	T20-3	T11-9	QC19	----
Client sampling date / time				11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	----
Compound	CAS Number	LOR	Unit	EP1913250-001	EP1913250-005	EP1913250-011	EP1913250-015	-----
				Result	Result	Result	Result	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	0.002	0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	0.004	<0.001	0.003	0.002	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	0.002	0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L	0.006	<0.001	<0.001	<0.001	----
Nickel	7440-02-0	0.001	mg/L	0.003	0.097	0.001	0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T16-1	T16-0.3-0.4	T16-9	T20-3	T6-8
Client sampling date / time					11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913250-001	EP1913250-002	EP1913250-003	EP1913250-005	EP1913250-007
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		1.3	----	15.5	23.4	1.9
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		5	4	----	----	8
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.91	2.89	----	----	2.58
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		25	----	24	49	50
Iron	7439-89-6	50	mg/kg		52000	----	39900	39000	39800
Manganese	7439-96-5	5	mg/kg		756	----	613	469	1520
Selenium	7782-49-2	5	mg/kg		<5	----	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		<5	----	<5	8	41
Cadmium	7440-43-9	1	mg/kg		1	----	<1	<1	1
Chromium	7440-47-3	2	mg/kg		758	----	441	386	843
Copper	7440-50-8	5	mg/kg		11	----	12	25	36
Lead	7439-92-1	5	mg/kg		7	----	<5	<5	<5
Nickel	7440-02-0	2	mg/kg		174	----	221	648	686
Zinc	7440-66-6	5	mg/kg		20	----	20	31	19
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	----	<0.1	<0.1	<0.1
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	----	----	<1	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		7.6	----	----	7.4	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T6-4	T11-9	T11-1	QC19	----
Client sampling date / time					11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	11-Dec-2019 00:00	----
Compound	CAS Number	LOR	Unit		EP1913250-009	EP1913250-011	EP1913250-013	EP1913250-015	-----
					Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		1.3	<1.0	4.7	3.4	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	----	3	5	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		----	----	2.60	2.66	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		39	28	27	52	----
Iron	7439-89-6	50	mg/kg		45600	36400	38800	42300	----
Manganese	7439-96-5	5	mg/kg		1220	567	633	1570	----
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	----
Arsenic	7440-38-2	5	mg/kg		6	5	7	40	----
Cadmium	7440-43-9	1	mg/kg		1	<1	<1	1	----
Chromium	7440-47-3	2	mg/kg		326	429	367	931	----
Copper	7440-50-8	5	mg/kg		36	18	32	41	----
Lead	7439-92-1	5	mg/kg		<5	<5	<5	<5	----
Nickel	7440-02-0	2	mg/kg		477	290	244	691	----
Zinc	7440-66-6	5	mg/kg		44	17	30	19	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		----	<1	----	<1	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	8.9	----	8.8	----

QUALITY CONTROL REPORT

Work Order	: EP1913250	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 13-Dec-2019
C-O-C number	: ----	Issue Date	: 27-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 18		
No. of samples analysed	: 9		



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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774147)									
EP1913248-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	13	13	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	9	9	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	28	27	0.00	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	12	13	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	16	16	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	9	10	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	39	39	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	41	40	2.74	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	13600	14100	3.33	0% - 20%
EP1913248-011	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	14	13	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	6	6	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	24	25	4.83	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	10	12	10.7	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	13	13	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	9	9	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	37	37	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	39	41	4.91	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	12900	12600	2.26	0% - 20%
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774149)									
EP1913250-015	QC19	EG005T: Cadmium	7440-43-9	1	mg/kg	1	1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	931	902	3.23	0% - 20%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774149) - continued									
EP1913250-015	QC19	EG005T: Cobalt	7440-48-4	2	mg/kg	52	51	0.00	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	691	664	4.03	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	40	39	3.16	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	41	40	2.64	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	1570	1420	10.0	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	19	18	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	42300	40200	5.17	0% - 20%
EP1913323-003	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	2	2	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	470	480	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2772669)									
EP1913250-001	T16-1	EA055: Moisture Content	----	0.1	%	1.3	1.2	11.0	No Limit
EP1913287-002	Anonymous	EA055: Moisture Content	----	0.1	%	16.1	16.5	2.04	0% - 50%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2774148)									
EP1913248-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913248-011	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2774150)									
EP1913250-015	QC19	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913323-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2773713)									
EP1913220-001	Anonymous	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
EP1913250-011	T11-9	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743)									
EP1913220-001	Anonymous	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.270	0.323	17.8	0% - 20%
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	0.032	0.034	6.33	0% - 20%



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2776743) - continued									
EP1913220-001	Anonymous	EG020A-W: Copper	7440-50-8	0.001	mg/L	0.009	0.010	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	0.323	0.340	5.24	0% - 20%
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.494	0.558	12.2	0% - 20%
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	0.071	0.078	10.3	0% - 50%
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	11.6	13.1	12.0	0% - 20%
EP1913250-011	T11-9	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.002	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2776745)									
EP1913173-004	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913220-043	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2782805)									
EP1913173-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913269-002	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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.

Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
	Spike	Spike Recovery (%)	Recovery Limits (%)		
Result	Concentration	LCS	Low	High	
<5	22 mg/kg	104	81.5	118	
<1	5 mg/kg	96.0	76.2	106	
<2	42.2 mg/kg	91.8	66.9	138	
<2	----	----	----	----	
<5	34 mg/kg	103	79.1	113	
<50	----	----	----	----	
<5	40 mg/kg	99.0	78.9	112	
<5	----	----	----	----	
<2	55.5 mg/kg	98.6	81.5	126	
<5	----	----	----	----	
<5	62 mg/kg	101	81.0	119	
<5	22 mg/kg	104	81.5	118	
<1	5 mg/kg	99.0	76.2	106	
<2	42.2 mg/kg	98.1	66.9	138	
<2	----	----	----	----	
<5	34 mg/kg	105	79.1	113	
<50	----	----	----	----	
<5	40 mg/kg	103	78.9	112	
<5	----	----	----	----	
<2	55.5 mg/kg	104	81.5	126	
<5	----	----	----	----	
<5	62 mg/kg	103	81.0	119	
<0.1	2.154 mg/kg	104	81.0	115	
<0.1	2.154 mg/kg	109	81.0	115	
<1	40 mg/kg	91.5	74.2	106	
Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
	Spike	Spike Recovery (%)	Recovery Limits (%)		
Result	Concentration	LCS	Low	High	



Sub-Matrix: **WATER**

Method: Compound				Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
CAS Number	LOR	Unit						
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743) - continued								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	108	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	104	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	103	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	101	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.5	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	101	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	95.4	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	114	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.0	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	101	93.0	115

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: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774147)							
EP1913248-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	101	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	100	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	100.0	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	101	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	102	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	103	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	101	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	98.3	70.0	130
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149)							
EP1913250-015	QC19	EG005T: Arsenic	7440-38-2	50 mg/kg	74.5	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	92.4	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149) - continued							
EP1913250-015	QC19	EG005T: Cobalt	7440-48-4	50 mg/kg	87.4	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	100.0	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	96.5	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	# Not Determined	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	84.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774148)							
EP1913248-001	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	92.0	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774150)							
EP1913250-015	QC19	EG035T: Mercury	7439-97-6	1 mg/kg	98.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773713)							
EP1913220-005	Anonymous	EK026SF: Total Cyanide	57-12-5	20 mg/kg	95.5	70.0	130

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2776743)							
EP1913220-005	Anonymous	EG020A-W: Arsenic	7440-38-2	1 mg/L	112	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	111	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	103	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	103	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	110	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	108	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	109	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	108	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	114	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2776745)							
EP1913220-009	Anonymous	EG035W: Mercury	7439-97-6	0.01 mg/L	100	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)							
EP1913173-003	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	104	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913250	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 27-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt	No. of samples received	: 18
Order number	: ----	No. of samples analysed	: 9

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	QC19	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	QC19	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	QC19	Nickel	7440-02-0	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

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.

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
T16-1, T20-3, T6-4, T11-1, T16-9, T6-8, T11-9, QC19	11-Dec-2019	----	----	----	18-Dec-2019	25-Dec-2019	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H)							
QC19	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓
Snap Lock Bag: Separate bag received (EA150H)							
T16-1, T6-8, T16-0.3-0.4, T11-1	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓
EA152: Soil Particle Density							
Snap Lock Bag (EA152)							
QC19	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓
Snap Lock Bag: Separate bag received (EA152)							
T16-1, T6-8, T16-0.3-0.4, T11-1	11-Dec-2019	----	----	----	24-Dec-2019	08-Jun-2020	✓

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

Matrix: WATER			Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.					
Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020W: Water Leachable Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) T16-1, T20-3, T11-9, QC19		13-Dec-2019	20-Dec-2019	10-Jun-2020	✔	20-Dec-2019	10-Jun-2020	✔
EG035W: Water Leachable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) T16-1, T20-3, T11-9, QC19		13-Dec-2019	----	----	----	19-Dec-2019	10-Jan-2020	✔
EG050G-W: Hexavalent Chromium - Water Leachable								
Clear Plastic Bottle - NaOH (EG050G-W) T16-1, T20-3, T11-9, QC19		13-Dec-2019	----	----	----	23-Dec-2019	10-Jan-2020	✔

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.

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

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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							



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							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	12	8.33	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazine. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.



<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	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 (2013) Schedule B(3)
Deionised Water Leach	EN60-D1a	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)



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ABN 89 132 231 380

Chain of Custody Documentation

Laboratory: ALS WA
Address: 28 Rigali Way, Wangara WA 6065
Contact: Lauren Blagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/mobile:	+61 409 296 017

Sample Information					Container Information	
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles
1	T5-T8	soil	9/12/2019			4
2	T5-6_0.3-0.4	soil	9/12/2019			4
3	T10-8	soil	9/12/2019			4
4	T10-8_0.3-0.4	soil	9/12/2019			4
5	T10-17	soil	9/12/2019			4
6	T10-17_0.3-0.4	soil	9/12/2019			4

Environmental Division
Perth

Work Order Reference

EP1913252



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name: Matthew Hunt /
Brandon Henry

Signature:

Date:

11/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by: <i>Phannon</i>	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	16/12/19
Of:	Time:	Date/Time:	Of:	Time:	4:33pm
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic;
V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's Iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

P17302_COC_10.12.19__Soil_161219



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ABN 89 132 231 380

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number: P17302		Purchase Order:	
Project Name: Bulong DSI		Quote No: EP-382-19 (V2)	
Sampled By: Matthew Hunt / Brandon Henry		Turn Around Time: Standard	
Project Manager: Blaire Coleman		Page: of	
Email Report To: blaire.coleman@senversa.com.au		Phone/Mobile: +61 409 296 017	

Sample Information					Container Information		Analysis Required													Comments: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	1:5 Leach	Total Metals by ICP-AES: Fe	Redox Potential (1:5)	pH (CaCl)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Clay Content by Hydrometer	Deionised Water Leach	8 Metals (Water Leachable) CPMS & FIMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	Total Cyanide by Segmented Flow Analyser	HOLD	
1	T5-6	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X		
2	T5-6_0.3-0.4	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X		
3	T10-8	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X		
4	T10-8_0.3-0.4	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X		
5	T10-17	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X		
6	T10-17_0.3-0.4	Soil	9/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X		
Total						24	6	6	6	6	6	6	6	6	6	6	6	6	0	

COC updated

Environmental Division
Perth
Work Order Reference
EP1913252

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt / Brandon Henry Signature: Date: 10/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date: 12/12/19	
Of:	Time:	Date/Time:	Of:	Time: 1000	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913252

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Brandon Henry, Matthew Hunt</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 12-Dec-2019 10:00	Issue Date : 17-Dec-2019
Client Requested Due : 30-Dec-2019	Scheduled Reporting Date : 30-Dec-2019
Date	

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 4	Temperature : 9.0/24.0 - Ice present
Receipt Detail :	No. of samples received / analysed : 6 / 3

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
- PSD analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- **PSD analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - EN60-Dia Deionised Water Leach	SOIL - S-02 & Metals (incl. Digestion)
EP1913252-001	09-Dec-2019 00:00	T5-T6		✓	✓	✓	✓		✓
EP1913252-002	09-Dec-2019 00:00	T5-6_0.3-0.4	✓						
EP1913252-003	09-Dec-2019 00:00	T10-8		✓		✓	✓	✓	✓
EP1913252-004	09-Dec-2019 00:00	T10-8_0.3-0.4	✓						
EP1913252-005	09-Dec-2019 00:00	T10-17		✓		✓	✓		✓
EP1913252-006	09-Dec-2019 00:00	T10-17_0.3-0.4	✓						

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - W-02W (ICPMS) & Metals (Water Leachable) ICPMS & FIMS
EP1913252-003	09-Dec-2019 00:00	T10-8	✓	✓	✓

Proactive Holding Time Report

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



Requested Deliverables

Blaire Coleman

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

JUSTIN LUMSDEN

- *AU Certificate of Analysis - NATA (COA)	Email	justin.lumsden@senversa.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	justin.lumsden@senversa.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	justin.lumsden@senversa.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	justin.lumsden@senversa.com.au
- Attachment - Report (SUBCO)	Email	justin.lumsden@senversa.com.au
- Chain of Custody (CoC) (COC)	Email	justin.lumsden@senversa.com.au
- EDI Format - ENMRG (ENMRG)	Email	justin.lumsden@senversa.com.au
- EDI Format - ESDAT (ESDAT)	Email	justin.lumsden@senversa.com.au
- EDI Format - XTab (XTAB)	Email	justin.lumsden@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EP1913252**
Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES TERRACE
 PERTH 6000
Telephone : +61 08 6557 8881
Project : P17302 Bulong DSI
Order number : ----
C-O-C number : ----
Sampler : Brandon Henry, Matthew Hunt
Site : ----
Quote number : EP/382/19 V2
No. of samples received : 6
No. of samples analysed : 3

Page : 1 of 4
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 10:00
Date Analysis Commenced : 18-Dec-2019
Issue Date : 30-Dec-2019 15:57



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- PSD analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				T10-8	----	----	----	----
Client sampling date / time				09-Dec-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP1913252-003	-----	-----	-----	-----
				Result	----	----	----	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.002	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.003	----	----	----	----
Cobalt	7440-48-4	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	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.08	----	----	----	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	T5-T6	T10-8	T10-17	----	----
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		EP1913252-001	EP1913252-003	EP1913252-005	-----	-----
					Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		23.3	23.4	27.4	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		1	----	----	----	----
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.56	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg		46	23	47	----	----
Iron	7439-89-6	50	mg/kg		42900	46200	64800	----	----
Manganese	7439-96-5	5	mg/kg		1270	685	948	----	----
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	----	----
Arsenic	7440-38-2	5	mg/kg		6	6	7	----	----
Cadmium	7440-43-9	1	mg/kg		<1	1	2	----	----
Chromium	7440-47-3	2	mg/kg		359	404	607	----	----
Copper	7440-50-8	5	mg/kg		26	23	24	----	----
Lead	7439-92-1	5	mg/kg		<5	<5	<5	----	----
Nickel	7440-02-0	2	mg/kg		520	268	476	----	----
Zinc	7440-66-6	5	mg/kg		36	14	45	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	1	mg/kg		<1	<1	<1	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		----	9.0	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP1913252	Page	: 1 of 6
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 18-Dec-2019
C-O-C number	: ----	Issue Date	: 30-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 6		
No. of samples analysed	: 3		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2774149)									
EP1913250-015	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	1	1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	931	902	3.23	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	52	51	0.00	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	691	664	4.03	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	40	39	3.16	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	41	40	2.64	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	1570	1420	10.0	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	19	18	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	42300	40200	5.17	0% - 20%
EP1913323-003	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	2	2	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	470	480	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2785204)									
EP1913252-001	T5-T6	EA055: Moisture Content	----	0.1	%	23.3	23.2	0.00	0% - 20%
EP1913486-006	Anonymous	EA055: Moisture Content	----	0.1	%	3.8	4.0	6.11	No Limit

Page : 3 of 6
 Work Order : EP1913252
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2774150)									
EP1913250-015	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP1913323-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2773721)									
EP1913252-001	T5-T6	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2779442)									
EP1913252-003	T10-8	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.004	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	0.08	0.06	25.9	No Limit
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2779455)									
EP1913409-005	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913434-007	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2782805)									
EP1913173-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913269-002	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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 Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	22 mg/kg	104	81.5	118
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	5 mg/kg	99.0	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	42.2 mg/kg	98.1	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	----	----	----	----
EG005T: Copper	7440-50-8	5	mg/kg	<5	34 mg/kg	105	79.1	113
EG005T: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	103	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.5 mg/kg	104	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	62 mg/kg	103	81.0	119
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774150)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	109	81.0	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773721)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	89.9	74.2	106

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	109	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.4	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	100	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	99.8	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.0	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	97.9	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	100	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.2	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)								



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit		Spike	Spike Recovery (%)	Recovery Limits (%)	
					Concentration	LCS	Low	High
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805) - continued								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	101	93.0	115

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: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2774149)							
EP1913250-015	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	74.5	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	92.4	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	87.4	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	100.0	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	96.5	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	# Not Determined	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	84.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2774150)							
EP1913250-015	Anonymous	EG035T: Mercury	7439-97-6	1 mg/kg	98.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2773721)							
EP1913252-003	T10-8	EK026SF: Total Cyanide	57-12-5	20 mg/kg	83.3	70.0	130

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)							
EP1913434-001	Anonymous	EG020A-W: Arsenic	7440-38-2	1 mg/L	127	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	117	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	96.9	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	109	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	106	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	106	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	111	70.0	130



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442) - continued							
EP1913434-001	Anonymous	EG020A-W: Zinc	7440-66-6	1 mg/L	124	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)							
EP1913434-002	Anonymous	EG035W: Mercury	7439-97-6	0.01 mg/L	99.6	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782805)							
EP1913173-003	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	104	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913252	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 30-Dec-2019
Sampler	: Brandon Henry, Matthew Hunt	No. of samples received	: 6
Order number	: ----	No. of samples analysed	: 3

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	Anonymous	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	Anonymous	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP1913250--015	Anonymous	Nickel	7440-02-0	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved							
T5-T6, T10-17	T10-8,	----	----	----	24-Dec-2019	23-Dec-2019	1

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	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) T5-T6, T10-17	T10-8,	09-Dec-2019	----	----	----	24-Dec-2019	23-Dec-2019	✘
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) T5-T6		09-Dec-2019	----	----	----	24-Dec-2019	06-Jun-2020	✔



Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA152: Soil Particle Density							
Snap Lock Bag (EA152) T5-T6	09-Dec-2019	----	----	----	24-Dec-2019	06-Jun-2020	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) T5-T6, T10-17	09-Dec-2019	18-Dec-2019	06-Jun-2020	✓	19-Dec-2019	06-Jun-2020	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) T5-T6, T10-17	09-Dec-2019	18-Dec-2019	06-Jan-2020	✓	19-Dec-2019	06-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser							
Soil Glass Jar - Unpreserved (EK026SF) T5-T6, T10-17	09-Dec-2019	18-Dec-2019	23-Dec-2019	✓	27-Dec-2019	01-Jan-2020	✓
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a) T10-8	09-Dec-2019	19-Dec-2019	06-Jan-2020	✓	----	----	----

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020W: Water Leachable Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) T10-8	19-Dec-2019	23-Dec-2019	16-Jun-2020	✓	23-Dec-2019	16-Jun-2020	✓
EG035W: Water Leachable Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) T10-8	19-Dec-2019	----	----	----	20-Dec-2019	16-Jan-2020	✓
EG050G-W: Hexavalent Chromium - Water Leachable							
Clear Plastic Bottle - NaOH (EG050G-W) T10-8	19-Dec-2019	----	----	----	23-Dec-2019	16-Jan-2020	✓

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.

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

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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							



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							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	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
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazine. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.



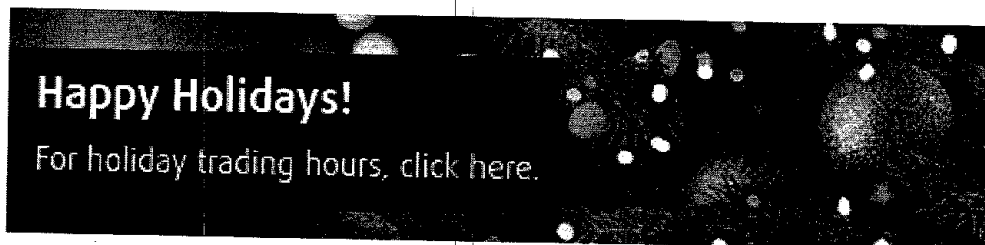
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)
Deionised Water Leach	EN60-D1a	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Rhiannon Chenoweth

From: ALS Enviro Perth
Sent: Wednesday, 8 January 2020 11:36 AM
To: Samples Perth
Subject: FW: [EXTERNAL] - 17302 - DMIRS, Bulong, DSI
Attachments: EP1913220_COC (1).pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Please see the additional analysis request for EP1913220.



Kind Regards,

Rhiannon Steere

Client Services Officer, Environmental - Perth
Western Australia



T +61 08 9406 1301
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EnviroMail™ 124 – PFOS Analysis to Freshwater Species Protection Lvl 99%

From: Brandon Henry [mailto:Brandon.Henry@senversa.com.au]

Sent: Wednesday, 8 January 2020 11:17 AM

To: ALS Enviro Perth <ALSEnviro.Perth@ALSGlobal.com>

Cc: Blaire Coleman <blaire.coleman@senversa.com.au>

Subject: [EXTERNAL] - 17302 - DMIRS, Bulong, DSI

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

Hi,

Can I please get soil sample QC09 (COC attached) analysed for Metals (8) & Total Metals by ICP-AES; Se, Co, Mn, Fe (EG005T) with standard turn around time.

Please send results to myself and Blaire Coleman (CC'd to this email).

Kind regards,

Brandon Henry

Graduate Environmental Scientist

 **senversa**

Senversa Pty Ltd

Ground Floor, 190 Flinders Street, Adelaide SA 5000

m: +61 417 822 624 | e: Brandon.Henry@senversa.com.au

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Laboratory: ALS WA
Address: 26 Rigall Way, Wangara WA 6065
Contact: Lauren Bagdon / Client Services Coordinator
Phone: 08 9406 1301

Chain of Custody Documentation

Job Number:	17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaine Coleman	Page:	of
Email Report To:	blaine.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information					Container Information										Analysis Required										Comments: e.g. Highly contaminated sample; hazardous materials present, trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals (S-02)	Total Metals by ICP-AES; Se, Co, Mn, Fe (E5005T)	Clay Content by Hydrometer	Redox Potential (1-5)	pH (C-CD)	Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cyanide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	9 Metals (Water Leachable) ICPMS & FIMS As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD					
1	S19T4_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x	x	x	x	x		x	x	x	x	x	x	x		Relabel T19-4			
2	S19T4_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x												x		Relabel T19-4_0.3-0.4			
3	S3T4_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x	x	x	x								x			Relabel T4-3			
4	S3T4_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x			Relabel T4-3_0.3-0.4			
5	S13T23_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x				x		x	x	x	x	x	x	x		Relabel T23-13			
6	S13T23_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x			Relabel T23-13_0.3-0.4			
7	S11T1_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x			Relabel T1-11			
8	S11T1_0.3-0.35	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x			Relabel T1-11_0.3-0.4			
9	S3T23_0.0-0.05	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x				x		x	x	x	x	x	x	x		Relabel T123-3			
10	S3T23_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	x	x											x			Relabel T23-3_0.3-0.4			
			</																						

Environmental Division
Perth
Work Order Reference
EP1913220

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt/Brandon Henry Signature: Date:

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	12-12-19
Of:	Time:	Date/Time:	Of:	Date:	8am
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Date:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Date:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;

sonversa
www.sonversa.com.au
ARN 89 132 231 380

Laboratory: ALS WA
Address: 25 Rygel Way, Wangara WA 2055
Contact: Luron Segoni / Client Services Coordinator
Phone: 08 9406 1301

Chain of Custody Documentation

Job Number:	17302	Purchase Order:	
Project Name:	Bulung DS1	Quote No:	EP-362-19 (V3)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blairst.coleman@sonversa.com.au	Phone/Mobile:	+61 403 296 017

Sample Information							Analysis Required																
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	8 Metals (SCD)	Total Metals by ICP-AES: As, Co, Mn, Fe (EC0003T)	Clay Content by Hydrometer	Redox Potential (1:5)	pH (CaCl2)	Total Hexavalent Chromium (Alkaline digestion) by Decolor Analyser	Exchangeable Cations with pre-treatment - Default Parameters	Total Cymide by Segmented Flow Analyser	1:5 leach	Deionised Water Leach	8 Metals (Water Leachable) ICPMS & FILMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Fe	Water Leachable Metals by ICPMS: Se, Co, Mn, Fe	Hexavalent Chromium in Leachate	HOLD	Remarks: e.g. Highly contaminated sample; hazardous materials present; trace LORs etc.		
11	XRF_BG	Soil	3/12/2019	-	2 jars, 2 bags	4	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
12	MW1_0.05-0.15	Soil	3/12/2019	-	1 jar	1																	
13	MW1_1.0-1.1	Soil	3/12/2019	-	1 jar	1																	
14	MW1_2.0-2.1	Soil	3/12/2019	-	1 jar	1																	
15	MW1_3.0-3.1	Soil	3/12/2019	-	1 jar	1																	
16	MW1_4.0-4.1	Soil	3/12/2019	-	1 jar	1																	
17	MW2_0.05-0.15	Soil	3/12/2019	-	1 jar	1																	
18	MW2_0.5-0.8	Soil	3/12/2019	-	1 jar	1																	
19	MW2_1.0-1.1	Soil	3/12/2019	-	1 jar	1																	
20	MW2_2.0-2.1	Soil	3/12/2019	-	1 jar	1																	
21	MW2_3.0-3.1	Soil	3/12/2019	-	1 jar	1																	
22	MW2_4.0-4.1	Soil	3/12/2019	-	1 jar	1																	
23	MW2_5.0-5.1	Soil	3/12/2019	-	1 jar	1																	
24	MW2_6.0-6.1	Soil	3/12/2019	-	1 jar	1																	
25	MW2_8.4-9.5	Soil	3/12/2019	-	1 jar	1																	
26	MW4_0.05-0.15	Soil	5/12/2019	-	1 jar	1																	
27	MW5_0.05-0.15	Soil	6/12/2019	-	1 jar	1																	
28	MW3_0.05-0.15	Soil	6/12/2019	-	1 jar	1																	
29	S3T1_0.05-0.15	Soil	8/12/2019	-	2 jars, 2 bags	4	X	X						X	X	X	X	X	X		Relabel T1-3		
30	S3T1_0.3-0.4	Soil	8/12/2019	-	2 jars, 2 bags	4	X	X						X	X	X	X	X	X		Relabel T1-3 0.3-0.4		
Total																							

Sampler: I attest that proper field sampling procedures in accordance with Sonversa standard procedures and/or project. Sampler Name: Matthew Hunt/Brandon Henry Signature: Date: 8/12/2019

Relinquished By:	Date:	Method of Shipment (if applicable):	Received by:	Date:
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:		Carrier / Reference #:	Name/Signature:	
Of:	Time:	Date/Time:	Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO3) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium Hydroxide Preserved Plastic;
V = VOA/Viol Hydrochloric Acid (HCl) Preserved; VS = VOA/Viol Sulphuric Preserved; USA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Specimen Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; UA = Unpreserved Amber Glass; LUGLO's Iodine preserved white plastic bottle; SW = sulfuric acid preserved white mouth glass jar

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EP2000242**

Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: blaire.coleman@senversa.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Facsimile	: +61 03 9606 0074	Facsimile	: +61-8-9406 1399
Project	: 17302 Bulong DSI	Page	: 1 of 2
Order number	: ----	Quote number	: EP2019SENV0005 (EP/382/19 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 12-Dec-2019 08:00	Issue Date	: 09-Jan-2020
Client Requested Due Date	: 16-Jan-2020	Scheduled Reporting Date	: 16-Jan-2020

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - S-02 8 Metals (incl. Digestion)
EP2000242-001	08-Dec-2019 00:00	QC09	✓	✓	✓

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: SOIL

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
EA055: Moisture Content								
QC09	Soil Glass Jar - Unpreserved		----	22-Dec-2019	12-Dec-2019	✓	08-Jan-2020	✗
EG035T: Total Mercury by FIMS								
QC09	Soil Glass Jar - Unpreserved		05-Jan-2020	05-Jan-2020	12-Dec-2019	✓	08-Jan-2020	✗

Requested Deliverables

Blaire Coleman

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

Brandon Henry

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

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
-----------------------------	-------	----------------------------------

CERTIFICATE OF ANALYSIS

Work Order : **EP2000242**
Client : **SENVERSA PTY LTD**
Contact : Blaire Coleman
Address : LEVEL 25, 108 ST GEORGES TERRACE
 PERTH 6000
Telephone : +61 08 6557 8881
Project : 17302 Bulong DSI
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : EP/382/19 V2
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 2
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 12-Dec-2019 08:00
Date Analysis Commenced : 10-Jan-2020
Issue Date : 15-Jan-2020 17:37



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

- EG005T: Poor matrix spike recovery was obtained for arsenic on sample EP2000208-002 due to possible matrix interference. Results have been confirmed by re-extraction and re-analysis.

Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Client sample ID

				QC09	----	----	----	----
Client sampling date / time				08-Dec-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2000242-001	-----	-----	-----	-----
Result				----	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	5.2	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Cobalt	7440-48-4	2	mg/kg	20	----	----	----	----
Iron	7439-89-6	50	mg/kg	41800	----	----	----	----
Manganese	7439-96-5	5	mg/kg	420	----	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
Arsenic	7440-38-2	5	mg/kg	5	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	691	----	----	----	----
Copper	7440-50-8	5	mg/kg	25	----	----	----	----
Lead	7439-92-1	5	mg/kg	<5	----	----	----	----
Nickel	7440-02-0	2	mg/kg	170	----	----	----	----
Zinc	7440-66-6	5	mg/kg	33	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP2000242	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 10-Jan-2020
C-O-C number	: ----	Issue Date	: 15-Jan-2020
Sampler	: ----		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 1		
No. of samples analysed	: 1		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2802740)									
EP2000208-002	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	82	84	2.11	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	4	4	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	7	7	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	13	13	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	21	20	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	9	9	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.00	No Limit
EG005T: Iron	7439-89-6	50	mg/kg	50000	50600	1.16	0% - 20%		
EP2000208-042	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	31	29	8.01	0% - 50%
		EG005T: Cobalt	7440-48-4	2	mg/kg	5	5	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	6	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	10	9	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	9	8	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	97	76	24.9	0% - 50%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	5	0.00	No Limit
EG005T: Iron	7439-89-6	50	mg/kg	19400	18300	5.71	0% - 20%		
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2802751)									
EP2000235-001	Anonymous	EA055: Moisture Content	----	0.1	%	0.1	0.2	0.00	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2802741)									
EP2000208-002	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP2000208-042	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2802740)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	22 mg/kg	107	81.5	118
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	5 mg/kg	93.0	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	42.2 mg/kg	86.2	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	----	----	----	----
EG005T: Copper	7440-50-8	5	mg/kg	<5	34 mg/kg	111	79.1	113
EG005T: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	102	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.5 mg/kg	94.9	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	62 mg/kg	103	81.0	119
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2802741)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	88.0	81.0	115

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: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2802740)							
EP2000208-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	# 54.2	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	98.5	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	108	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	98.7	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	106	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	103	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	102	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	98.6	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	97.9	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2802741)							
EP2000208-002	Anonymous	EG035T: Mercurv	7439-97-6	1 mg/kg	74.4	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP2000242	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: 17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 15-Jan-2020
Sampler	: ----	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP2000208--002	Anonymous	Arsenic	7440-38-2	54.2 %	70.0-130%	Recovery less than lower data quality objective

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved QC09	----	----	----	10-Jan-2020	22-Dec-2019	19
EG035T: Total Recoverable Mercury by FIMS						
Soil Glass Jar - Unpreserved QC09	13-Jan-2020	05-Jan-2020	8	14-Jan-2020	05-Jan-2020	9

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	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) QC09	08-Dec-2019	----	----	----	10-Jan-2020	22-Dec-2019	✘
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) QC09	08-Dec-2019	13-Jan-2020	05-Jun-2020	✔	13-Jan-2020	05-Jun-2020	✔
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) QC09	08-Dec-2019	13-Jan-2020	05-Jan-2020	✘	14-Jan-2020	05-Jan-2020	✘



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)							
Moisture Content	EA055	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	7.14	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
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Chain of Custody Documentation

Senversa Pty Ltd
www.senversa.com.au
ABN 89 132 231 380

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6066
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Brandon Henry	Turn Around	Standard
Project Manager:	Blaira Coleman	Page:	of
Email Report To:	re.coleman@senversa.com	Phone/Mob	+61 409 296 017

[illegible]

Environmental Division
Perth
Work Order Reference
EP2002272



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard	Sampler Na Brandon Henry	Signature:	Date: 24/02/2020
--	--------------------------	------------	------------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	SP	5.3.2016
Of:	Time:	Date/Time:	Of:	ALU	1645
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		
Of:	Time:	Date/Time:	Of:		
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		
Of:	Time:	Date/Time:	Of:		
<p>Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar</p>					

Chain of Custody Documentation

Laboratory: - ALSWA
Address: - 26 Rigali Way, Wangara WA
Contact: Lauren - Biagioni
Phone: 98 - 94061301

Job Number: P17302	Purchase Order:
Project Name: Bulong DMRS DSI	Quote No:
Sampled By: Brandon Henry	Turn Around Time: Standard
Project Manager: Blaire Coleman	Page: of
Email Report To: Blaire.coleman@senversa.com.au #N/A	Phone/Mobile: +61 409 296 017 #N/A

[illegible][illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name: Brandon F1

Signature:

Date: 24/2/20

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature: <i>Louise W</i>	Date: <i>28/2/200</i>
Of:	Time:	Date/Time:		Of: <i>AL-S</i>	Time: <i>1130</i>
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugo's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Natalie Duncan

From: Natalie Duncan
Sent: Wednesday, 26 February 2020 11:50 AM
To: blaire.coleman@sensversa.com.au
Cc: Samples Perth; Lauren Biagioni
Subject: P17302 Bulong PSI
Attachments: 26022020114228-0001.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Blaire,

We have just received the attached COC via Toll.

We unfortunately only received the satchel containing the soil samples and are missing the 'jugs' (toll connote number 8994917939). Are you able to follow this up through toll?

Do you require analysis on these soil samples? If so, can you please send through an updated COC or analysis request.

We will retain all samples in our cold room for the meantime.

ALS Environmental Perth is closed on Monday the 2nd of March for Labor Day public holiday

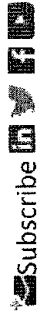
Kind Regards,

Natalie Duncan
Sample Receipt Supervisor
Wangara – Environmental

T +61 8 9406 1301
D +61 8 9406 1351

natalie.duncan@alsglobal.com

26 Rigali Way,
Wangara WA 6065
AUSTRALIA



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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP2002272

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Brandon Henry</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V3)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
--	--

Dates

Date Samples Received : 03-Mar-2020 16:40	Issue Date : 04-Mar-2020
Client Requested Due : 12-Mar-2020	Scheduled Reporting Date : 12-Mar-2020
Date	

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 1	Temperature : 24.5
Receipt Detail :	No. of samples received / analysed : 3 / 3

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
- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- **Clay Content analysis will be conducted by ALS Environmental, Newcastle, NATA accreditation no. 825, Site No. 1656.**
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - EA075 Redox Potential (1:5)	SOIL - EG005T (solids) Total Metals by ICP-AES	SOIL - EG048G Total Hexavalent Chromium (Alkaline digestion)	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - S-02 8 Metals (incl. Digestion)
EP2002272-001	24-Feb-2020 00:00	QC22		✓		✓			✓
EP2002272-002	24-Feb-2020 00:00	BG2	✓	✓	✓	✓	✓	✓	✓
EP2002272-003	24-Feb-2020 00:00	BG3	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA150H-C Clay Content by Hydrometer	SOIL - ED008 Def Exchangeable Cations with pre-treatment -
EP2002272-002	24-Feb-2020 00:00	BG2	✓	✓
EP2002272-003	24-Feb-2020 00:00	BG3	✓	✓

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: **SOIL**

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

Method	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
Client Sample ID(s)				Date	Evaluation	Date	Evaluation
EA001: pH in soil using a 0.01M CaCl2 extract							
BG2	Soil Glass Jar - Unpreserved	02-Mar-2020	02-Mar-2020	03-Mar-2020	✗	----	----
BG3	Soil Glass Jar - Unpreserved	02-Mar-2020	02-Mar-2020	03-Mar-2020	✗	----	----



Requested Deliverables

Blaire Coleman

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Attachment - Report (SUBCO)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email	supplieraccounts@senversa.com.au
-------	----------------------------------

CERTIFICATE OF ANALYSIS

Work Order : **EP2002272**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **Brandon Henry**
Site : **----**
Quote number : **EP/382/19 V3**
No. of samples received : **3**
No. of samples analysed : **3**

Page : 1 of 4
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 03-Mar-2020 16:40
Date Analysis Commenced : 05-Mar-2020
Issue Date : 13-Mar-2020 22:41



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Stephanie Tilson	Instrument Chemist	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Clay Content analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EG048G (Hexavalent Chromium): Poor Hexavalent Chromium spike recoveries possibly due to sample matrix effects. Confirmed by re-extraction and re-analysis.
- EG048G (Hexavalent Chromium): LOR for sample EP2002272-002 raised due to possible sample matrix interference.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H^+ + Al^{3+}).

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	QC22	BG2	BG3	----	----
Client sampling date / time				24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----	----	
Compound	CAS Number	LOR	Unit	EP2002272-001	EP2002272-002	EP2002272-003	-----	-----	
				Result	Result	Result	----	----	
EA001: pH in soil using 0.01M CaCl extract									
pH (CaCl2)	----	0.1	pH Unit	----	7.4	7.5	----	----	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%	9.0	9.2	6.1	----	----	
EA075: Redox Potential									
Redox Potential	----	0.1	mV	----	190	188	----	----	
pH Redox	----	0.1	pH Unit	----	8.3	8.4	----	----	
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%	----	11	13	----	----	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	2.58	2.59	----	----	
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g	----	13.2	5.7	----	----	
Exchangeable Magnesium	----	0.1	meq/100g	----	2.0	1.7	----	----	
Exchangeable Potassium	----	0.1	meq/100g	----	1.0	0.5	----	----	
Exchangeable Sodium	----	0.1	meq/100g	----	0.1	<0.1	----	----	
Cation Exchange Capacity	----	0.1	meq/100g	----	21.5	13.3	----	----	
Exchangeable Sodium Percent	----	0.1	%	----	0.6	1.1	----	----	
EG005(ED093)T: Total Metals by ICP-AES									
Cobalt	7440-48-4	2	mg/kg	16	15	24	----	----	
Iron	7439-89-6	50	mg/kg	45000	40700	52600	----	----	
Manganese	7439-96-5	5	mg/kg	908	821	2120	----	----	
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	----	----	
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	----	----	
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	----	
Chromium	7440-47-3	2	mg/kg	214	210	152	----	----	
Copper	7440-50-8	5	mg/kg	33	26	28	----	----	
Lead	7439-92-1	5	mg/kg	<5	<5	<5	----	----	
Nickel	7440-02-0	2	mg/kg	81	77	70	----	----	
Zinc	7440-66-6	5	mg/kg	44	43	61	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	----	
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg	----	<2.5	<0.5	----	----	
EK026SF: Total CN by Segmented Flow Analyser									



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	QC22	BG2	BG3	----	----
Client sampling date / time					24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----	----
Compound	CAS Number	LOR	Unit		EP2002272-001	EP2002272-002	EP2002272-003	-----	-----
					Result	Result	Result	----	----
EK026SF: Total CN by Segmented Flow Analyser - Continued									
Total Cyanide	57-12-5	1	mg/kg		----	<1	<1	----	----

QUALITY CONTROL REPORT

Work Order	: EP2002272	Page	: 1 of 5
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 03-Mar-2020
Order number	: ----	Date Analysis Commenced	: 05-Mar-2020
C-O-C number	: ----	Issue Date	: 13-Mar-2020
Sampler	: Brandon Henry		
Site	: ----		
Quote number	: EP/382/19 V3		
No. of samples received	: 3		
No. of samples analysed	: 3		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Stephanie Tilson	Instrument Chemist	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2894993)									
EP2002272-001	QC22	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	214	228	6.06	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	16	15	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	81	80	0.00	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	33	29	10.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	908	887	2.32	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	44	42	4.49	No Limit
EG005T: Iron	7439-89-6	50	mg/kg	45000	45400	0.939	0% - 20%		
EA001: pH in soil using 0.01M CaCl extract (QC Lot: 2894986)									
EP2002272-002	BG2	EA001: pH (CaCl2)	----	0.1	pH Unit	7.4	7.5	1.34	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2895081)									
EP2002272-001	QC22	EA055: Moisture Content	----	0.1	%	9.0	8.9	1.52	No Limit
EP2002317-007	Anonymous	EA055: Moisture Content	----	0.1	%	21.5	21.6	0.00	0% - 20%
EA075: Redox Potential (QC Lot: 2895006)									
EP2002272-002	BG2	EA075: Redox Potential	----	0.1	mV	190	190	0.158	0% - 20%
		EA075: pH Redox	----	0.1	pH Unit	8.3	8.3	0.00	0% - 20%
ED007: Exchangeable Cations (QC Lot: 2902230)									
EP2002272-002	BG2	ED007: Exchangeable Sodium Percent	----	0.1	%	0.6	0.6	0.00	No Limit
		ED007: Exchangeable Calcium	----	0.1	meq/100g	13.2	12.5	5.88	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	2.0	1.8	6.15	0% - 50%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	1.0	0.9	0.00	No Limit

Page : 3 of 5
 Work Order : EP2002272
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED007: Exchangeable Cations (QC Lot: 2902230) - continued									
EP2002272-002	BG2	ED007: Exchangeable Sodium	----	0.1	meq/100g	0.1	<0.1	0.00	No Limit
		ED007: Cation Exchange Capacity	----	0.1	meq/100g	21.5	20.6	4.42	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2894994)									
EP2002272-001	QC22	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 2895009)									
EP2002272-002	BG2	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<2.5	<2.5	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2895003)									
EP2002272-002	BG2	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2894993)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	22 mg/kg	103	81.5	118
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	5 mg/kg	91.0	76.2	106
EG005T: Chromium	7440-47-3	2	mg/kg	<2	42.2 mg/kg	89.2	66.9	138
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	----	----	----	----
EG005T: Copper	7440-50-8	5	mg/kg	<5	34 mg/kg	92.0	79.1	113
EG005T: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	95.1	78.9	112
EG005T: Manganese	7439-96-5	5	mg/kg	<5	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.5 mg/kg	96.4	81.5	126
EG005T: Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	62 mg/kg	104	81.0	119
EA001: pH in soil using 0.01M CaCl extract (QCLot: 2894986)								
EA001: pH (CaCl2)	----	----	pH Unit	----	4 pH Unit	101	98.8	101
				----	7 pH Unit	100	99.2	101
ED007: Exchangeable Cations (QCLot: 2902230)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	21.6 meq/100g	109	82.9	117
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.76 meq/100g	99.4	78.4	119
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	1 meq/100g	108	87.9	129
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.9 meq/100g	110	92.9	132
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	25.3 meq/100g	108	84.7	117
ED007: Exchangeable Sodium Percent	----	0.1	%	<0.1	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2894994)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.154 mg/kg	94.2	81.0	115
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2895009)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	40 mg/kg	76.6	70.0	130
				<0.5	20 mg/kg	96.6	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2895003)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	40 mg/kg	92.3	74.2	106

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: **SOIL**

Matrix Spike (MS) Report



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2894993)							
EP2002272-001	QC22	EG005T: Arsenic	7440-38-2	50 mg/kg	84.2	70.0	130
		EG005T: Cadmium	7440-43-9	12.5 mg/kg	99.3	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	97.3	70.0	130
		EG005T: Copper	7440-50-8	50 mg/kg	97.1	70.0	130
		EG005T: Lead	7439-92-1	50 mg/kg	100	70.0	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	97.7	70.0	130
		EG005T: Zinc	7440-66-6	50 mg/kg	98.6	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2894994)							
EP2002272-001	QC22	EG035T: Mercury	7439-97-6	1 mg/kg	85.7	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2895009)							
EP2002272-002	BG2	EG048G: Hexavalent Chromium	18540-29-9	40 mg/kg	# 24.9	70.0	130
EP2002272-002	BG2	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	71.0	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2895003)							
EP2002272-003	BG3	EK026SF: Total Cyanide	57-12-5	20 mg/kg	91.3	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP2002272	Page	: 1 of 6
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 03-Mar-2020
Site	: ----	Issue Date	: 13-Mar-2020
Sampler	: Brandon Henry	No. of samples received	: 3
Order number	: ----	No. of samples analysed	: 3

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005(ED093)T: Total Metals by ICP-AES	EP2002272--001	QC22	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG005(ED093)T: Total Metals by ICP-AES	EP2002272--001	QC22	Manganese	7439-96-5	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG048: Hexavalent Chromium (Alkaline Digest)	EP2002272--002	BG2	Hexavalent Chromium	18540-29-9	24.9 %	70.0-130%	Recovery less than lower data quality objective

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA001: pH in soil using 0.01M CaCl extract							
Soil Glass Jar - Unpreserved BG2,		BG3	06-Mar-2020	02-Mar-2020	4	----	----

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		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA001: pH in soil using 0.01M CaCl extract								
Soil Glass Jar - Unpreserved (EA001) BG2,		BG3	24-Feb-2020	06-Mar-2020	02-Mar-2020	✖	06-Mar-2020	06-Mar-2020
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) QC22, BG3		BG2,	24-Feb-2020	----	----	----	05-Mar-2020	09-Mar-2020
EA075: Redox Potential								
Soil Glass Jar - Unpreserved (EA075) BG2,		BG3	24-Feb-2020	06-Mar-2020	09-Mar-2020	✔	06-Mar-2020	06-Mar-2020



Matrix: **SOIL**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Soil Classification based on Particle Size								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA150H) BG2,	BG3	24-Feb-2020	----	----	----	12-Mar-2020	22-Aug-2020	✓
EA152: Soil Particle Density								
Snap Lock Bag - Friable Asbestos/PSD Bag (EA152) BG2,	BG3	24-Feb-2020	----	----	----	12-Mar-2020	22-Aug-2020	✓
ED007: Exchangeable Cations								
Soil Glass Jar - Unpreserved (ED007) BG2,	BG3	24-Feb-2020	10-Mar-2020	23-Mar-2020	✓	10-Mar-2020	23-Mar-2020	✓
EG005(ED093)T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T) QC22, BG3	BG2,	24-Feb-2020	05-Mar-2020	22-Aug-2020	✓	06-Mar-2020	22-Aug-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T) QC22, BG3	BG2,	24-Feb-2020	05-Mar-2020	23-Mar-2020	✓	06-Mar-2020	23-Mar-2020	✓
EG048: Hexavalent Chromium (Alkaline Digest)								
Soil Glass Jar - Unpreserved (EG048G) BG2,	BG3	24-Feb-2020	05-Mar-2020	23-Mar-2020	✓	06-Mar-2020	12-Mar-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
Soil Glass Jar - Unpreserved (EK026SF) BG2,	BG3	24-Feb-2020	09-Mar-2020	09-Mar-2020	✓	10-Mar-2020	23-Mar-2020	✓



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)							
Exchangeable Cations	ED007	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Redox Potential	EA075	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Exchangeable Cations	ED007	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Exchangeable Cations	ED007	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	9	11.11	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 in soil using a 0.01M CaCl ₂ extract	EA001	SOIL	In house: Referenced to Rayment and Lyons (2011) 4B3 (mod.) or 4B4 (mod.) 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Redox Potential	EA075	SOIL	In house: Ion selective electrode. Analysis is performed on a 1:5 soil:de-ionised water extract.
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060A. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.



Preparation Methods	Method	Matrix	Method Descriptions
pH in soil using a 0.01M CaCl ₂ extract	EA001-PR	SOIL	In house: Referenced to Rayment and Higginson 4B1, 10 g of soil is mixed with 50 mL of 0.01M CaCl ₂ and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH ₄ Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)

Robert Johnston

To: Blaire Coleman
Subject: RE: Bulong DSI (17302) - samples received without a COC

From: Blaire Coleman [<mailto:blaire.coleman@senversa.com.au>]
Sent: Wednesday, 18 December 2019 8:53 AM
To: Robert Johnston
Cc: Justin Lumsden
Subject: FW: Bulong DSI (17302) - samples received without a COC

My apologies Rob! I didn't realise that this email hadn't gone through to you on Monday. Please see attached, and let me or Justin know if you have any queries.

Cheers,
Blaire

Blaire Coleman
Associate Geoscientist

From: Georgia Hefron <Georgia.Hefron@senversa.com.au>
Sent: Monday, 16 December 2019 4:59 PM
To: Blaire Coleman <blaire.coleman@senversa.com.au>
Subject: FW: Bulong DSI (17302) - samples received without a COC

Just check 😊

Hi Rob,

Please see attached COC for the below QC samples.

Thanks,

Georgia Hefron
Project Environmental Scientist



Senversa Pty Ltd
Level 17, 140 St Georges Terrace, Perth WA 6000

m: +61 403 309 654 | e: georgia.hefron@senversa.com.au
t: +61 8 6324 0200 | w: www.senversa.com.au

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Please consider the environment before printing this email. Senversa is a carbon neutral company.

Rob Johnston 18/12/19 Eurofin 694415



Date/Time: 18/12/19 8:53
Chilled: Yes/No
Temp: 17.5
12.5
13.1
Correction: +3.5
Final Temp: 17.9°C

From: EnviroSampleWA@eurofins.com <EnviroSampleWA@eurofins.com>

Sent: Friday, 13 December 2019 3:28 PM

To: Blaire Coleman <blaire.coleman@sensversa.com.au>

Subject: Bulong DSI (17302) - samples received without a COC

Hi Blaire,

We have received samples QC05, QC08, QC10, QC12 and QC20 for this project, but without a COC (sample dates 3-11/12). Can you please provide us a COC?

Kind Regards,
Rob

Eurofins | Environment Testing

Unit 2, 91 Leach Highway

KEWDALE WA 6105

Australia

Phone : +61 8 9251 9692

Email : EnviroSampleWA@eurofins.com

Rob Johnston 18/12/19 Eurofin 694415

Laboratory: Eurofins WA
Address: 2/61 Leach Hwy, Kewdale WA 6105
Contact: Rob Johnson / Analytical Services Manager
Phone: 08 9251 9692

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

[illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name:	Matthew Hunt / Brandon Henry
----------------------	---------------------------------

Signature: _____

Date:	11/12/2019
-------	------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Melbourne

6 Monterey Road
Dandenong South Vic 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney

Unit F3, Building F
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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane

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Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth

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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521

e.mail : EnviroSales@eurofins.com

web : www.eurofins.com.au

Sample Receipt Advice

Company name: **Senversa Pty Ltd WA**
Contact name: **Blaire Coleman**
Project name: **BULONG DSI**
Project ID: **P17302**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Dec 18, 2019 8:53 AM**
Eurofins reference: **694415**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☒ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- N/A Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Robert Johnston on Phone : or by e.mail: RobertJohnston@eurofins.com

Results will be delivered electronically via e.mail to Blaire Coleman - Blaire.Coleman@senversa.com.au.

Senversa Pty Ltd WA
Level 17, 140 St Georges Terrace
Perth
WA 6000



NATA Accredited
Accreditation Number 1261
Site Number 23736

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

Attention: **Blaire Coleman**

Report **694415-S**
 Project name **BULONG DSI**
 Project ID **P17302**
 Received Date **Dec 18, 2019**

Client Sample ID			QC05	QC10	QC12	QC20
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			P19-De26029	P19-De26031	P19-De26032	P19-De26033
Date Sampled			Dec 03, 2019	Dec 03, 2019	Dec 03, 2019	Dec 03, 2019
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	2	mg/kg	6.8	15	14	41
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	< 0.4
Chromium	5	mg/kg	420	1100	870	1600
Cobalt	5	mg/kg	20	22	25	110
Copper	5	mg/kg	25	27	33	51
Iron	20	mg/kg	48000	80000	63000	57000
Lead	5	mg/kg	< 5	8.7	5.0	< 5
Manganese	5	mg/kg	180	450	400	8800
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	180	190	180	800
Selenium	2	mg/kg	< 2	< 2	< 2	< 2
Zinc	5	mg/kg	70	37	58	21
% Moisture	1	%	24	1.9	5.5	5.2

Client Sample ID			QC02
Sample Matrix			Soil
Eurofins Sample No.			P19-De26034
Date Sampled			Dec 03, 2019
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic	2	mg/kg	16
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	1400
Cobalt	5	mg/kg	58
Copper	5	mg/kg	28
Iron	20	mg/kg	80000
Lead	5	mg/kg	8.9
Manganese	5	mg/kg	940
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	750
Selenium	2	mg/kg	< 2
Zinc	5	mg/kg	52
% Moisture	1	%	25

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Heavy Metals - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Perth	Dec 18, 2019	180 Days
Mercury - Method: USEPA 7470/1 Mercury	Perth	Dec 18, 2019	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Perth	Dec 18, 2019	14 Days

Australia

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Site # 1254 & 14271

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NATA # 1261 Site # 18217

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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN – 50 005 085 521

web : www.eurofins.com.au

e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000
Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail							Moisture Set																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

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

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

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

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

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

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Method Blank								
Heavy Metals								
Arsenic			mg/kg	< 2		2	Pass	
Cadmium			mg/kg	< 0.4		0.4	Pass	
Chromium			mg/kg	< 5		5	Pass	
Cobalt			mg/kg	< 5		5	Pass	
Copper			mg/kg	< 5		5	Pass	
Iron			mg/kg	< 20		20	Pass	
Lead			mg/kg	< 5		5	Pass	
Manganese			mg/kg	< 5		5	Pass	
Mercury			mg/kg	< 0.1		0.1	Pass	
Nickel			mg/kg	< 5		5	Pass	
Selenium			mg/kg	< 2		2	Pass	
Zinc			mg/kg	< 5		5	Pass	
LCS - % Recovery								
Heavy Metals								
Arsenic			%	94		80-120	Pass	
Cadmium			%	94		80-120	Pass	
Chromium			%	94		80-120	Pass	
Cobalt			%	95		80-120	Pass	
Copper			%	86		80-120	Pass	
Iron			%	94		80-120	Pass	
Lead			%	96		80-120	Pass	
Manganese			%	92		80-120	Pass	
Mercury			%	91		70-130	Pass	
Nickel			%	92		80-120	Pass	
Selenium			%	95		80-120	Pass	
Zinc			%	92		80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
Heavy Metals				Result 1				
Cadmium	P19-De25877	NCP	%	101		75-125	Pass	
Chromium	P19-De25877	NCP	%	99		75-125	Pass	
Cobalt	P19-De25877	NCP	%	101		75-125	Pass	
Copper	P19-De25877	NCP	%	96		75-125	Pass	
Iron	P19-De27620	NCP	%	93		75-125	Pass	
Lead	P19-De25877	NCP	%	108		75-125	Pass	
Mercury	P19-De25877	NCP	%	94		70-130	Pass	
Nickel	P19-De25877	NCP	%	99		75-125	Pass	
Zinc	P19-De25877	NCP	%	85		75-125	Pass	
Spike - % Recovery								
Heavy Metals				Result 1				
Manganese	P19-De27620	NCP	%	98		75-125	Pass	
Spike - % Recovery								
Heavy Metals				Result 1				
Arsenic	P19-De27620	NCP	%	100		75-125	Pass	
Selenium	P19-De27620	NCP	%	101		75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	P19-De26033	CP	mg/kg	41	41	1.0	30%	Pass	
Cadmium	P19-De26033	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	P19-De26033	CP	mg/kg	1600	1600	5.0	30%	Pass	
Cobalt	P19-De26033	CP	mg/kg	110	110	1.0	30%	Pass	
Copper	P19-De26033	CP	mg/kg	51	42	18	30%	Pass	
Iron	P19-De26033	CP	mg/kg	57000	57000	1.0	30%	Pass	
Lead	P19-De26033	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Manganese	P19-De26033	CP	mg/kg	8800	8900	1.0	30%	Pass	
Mercury	P19-De26033	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	P19-De26033	CP	mg/kg	800	780	2.0	30%	Pass	
Selenium	P19-De26033	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Zinc	P19-De26033	CP	mg/kg	21	21	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	P19-De26033	CP	%	5.2	5.1	2.0	30%	Pass	

Comments
Sample Integrity

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

Authorised By

Robert Johnston	Analytical Services Manager
Elden Garrett	Senior Analyst-Metal (WA)



Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please [click here](#).

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

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
 Perth
 WA 6000

Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

[illegible]

Sample Receipt Advice

Company name: **Senversa Pty Ltd WA**
Contact name: **Blaire Coleman**
Project name: **BULONG DSI**
Project ID: **P17302**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Mar 11, 2020 11:21 AM**
Eurofins reference: **707123**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☐ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- ☐ Split sample sent to requested external lab.
- ☐ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Robert Johnston on Phone : or by e.mail: RobertJohnston@eurofins.com

Results will be delivered electronically via e.mail to Blaire Coleman - Blaire.Coleman@senversa.com.au.

Senversa Pty Ltd WA
Level 17, 140 St Georges Terrace
Perth
WA 6000



NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Attention: **Blaire Coleman**

Report **707123-S**
 Project name **BULONG DSI**
 Project ID **P17302**
 Received Date **Mar 11, 2020**

Client Sample ID			QC23
Sample Matrix			Soil
Eurofins Sample No.			S20-Ma15326
Date Sampled			Feb 24, 2020
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic	2	mg/kg	6.5
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	360
Cobalt	5	mg/kg	19
Copper	5	mg/kg	40
Iron	20	mg/kg	35000
Lead	5	mg/kg	8.5
Manganese	5	mg/kg	1000
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	120
Selenium	2	mg/kg	< 2
Zinc	5	mg/kg	60
% Moisture	1	%	8.3

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Metals M8	Sydney	Mar 17, 2020	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals	Sydney	Mar 17, 2020	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Sydney	Mar 11, 2020	14 Days
- Method: LTM-GEN-7080 Moisture			

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

New Zealand

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35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN – 50 005 085 521

web : www.eurofins.com.au

e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000

Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 707123
Phone: 0437 472 990
Fax:

Received: Mar 11, 2020 11:21 AM
Due: Mar 18, 2020
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Cobalt	Iron	Manganese	Selenium	Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271											
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	QC23	Feb 24, 2020		Soil	S20-Ma15326	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

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

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ug/L: micrograms per litre
ppm: Parts per million	ppb: Parts per billion	%: Percentage
org/100mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

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

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Heavy Metals									
Arsenic			mg/kg	< 2			2	Pass	
Cadmium			mg/kg	< 0.4			0.4	Pass	
Chromium			mg/kg	< 5			5	Pass	
Cobalt			mg/kg	< 5			5	Pass	
Copper			mg/kg	< 5			5	Pass	
Iron			mg/kg	< 20			20	Pass	
Lead			mg/kg	< 5			5	Pass	
Manganese			mg/kg	< 5			5	Pass	
Mercury			mg/kg	< 0.1			0.1	Pass	
Nickel			mg/kg	< 5			5	Pass	
Selenium			mg/kg	< 2			2	Pass	
Zinc			mg/kg	< 5			5	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic			%	109			70-130	Pass	
Cadmium			%	88			70-130	Pass	
Chromium			%	110			70-130	Pass	
Cobalt			%	108			70-130	Pass	
Copper			%	108			70-130	Pass	
Iron			%	112			70-130	Pass	
Lead			%	108			70-130	Pass	
Manganese			%	107			70-130	Pass	
Mercury			%	106			70-130	Pass	
Nickel			%	109			70-130	Pass	
Selenium			%	100			70-130	Pass	
Zinc			%	104			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S20-Ma18126	NCP	%	117			70-130	Pass	
Cadmium	S20-Ma18126	NCP	%	108			70-130	Pass	
Chromium	S20-Ma18126	NCP	%	119			70-130	Pass	
Cobalt	S20-Ma18126	NCP	%	111			70-130	Pass	
Copper	S20-Ma18126	NCP	%	107			70-130	Pass	
Lead	S20-Ma18126	NCP	%	111			70-130	Pass	
Manganese	S20-Ma14270	NCP	%	124			70-130	Pass	
Mercury	S20-Ma18126	NCP	%	118			70-130	Pass	
Nickel	S20-Ma18126	NCP	%	115			70-130	Pass	
Selenium	S20-Ma18126	NCP	%	103			70-130	Pass	
Zinc	S20-Ma18126	NCP	%	118			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S20-Ma19565	NCP	mg/kg	3.0	2.3	27	30%	Pass	
Cadmium	S20-Ma19565	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S20-Ma19565	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Cobalt	S20-Ma19565	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Copper	S20-Ma19565	NCP	mg/kg	7.0	7.4	6.0	30%	Pass	
Iron	S20-Ma23546	NCP	mg/kg	43000	48000	12	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	S20-Ma19565	NCP	mg/kg	43	50	17	30%	Pass	
Manganese	S20-Ma19565	NCP	mg/kg	96	110	18	30%	Pass	
Mercury	S20-Ma19565	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S20-Ma19565	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Selenium	S20-Ma19565	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Zinc	S20-Ma19565	NCP	mg/kg	190	170	9.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S20-Ma15491	NCP	%	22	23	3.0	30%	Pass	

Comments

Sample Integrity

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

Authorised By

Robert Johnston	Analytical Services Manager
Gabriele Cordero	Senior Analyst-Metal (NSW)



Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please [click here](#).

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Australia

Melbourne
6 Monterey Road
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Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

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Brisbane
1/21 Smallwood Place
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NATA # 1261 Site # 20794

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Rolleston, Christchurch 7675
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ABN – 50 005 085 521

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e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000

Project Name: BULONG DSI
Project ID: P17302

Order No.:
Report #: 707123
Phone: 0437 472 990
Fax:

Received: Mar 11, 2020 11:21 AM
Due: Mar 18, 2020
Priority: 5 Day
Contact Name: Blaire Coleman

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail						Cobalt	Iron	Manganese	Selenium	Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271											
Sydney Laboratory - NATA Site # 18217						X	X	X	X	X	X
Brisbane Laboratory - NATA Site # 20794											
Perth Laboratory - NATA Site # 23736											
External Laboratory											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	QC23	Feb 24, 2020		Soil	S20-Ma15326	X	X	X	X	X	X
Test Counts						1	1	1	1	1	1

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Sample Information							Analysis Required										Comments: e.g. Highly contaminated sample, hazardous materials present; trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	EA038-AVS: SEM: Acid Volatile Sulphides (AVS) and Simultaneously Extractable Metals (SEM)	EG020-SD: Total Metals in Sediments by ICPMS (NODG): As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn	EG005-SD: Total Metals in Sediments by ICPAES (NODG): Fe	EG035-SD: Mercury in Sediments by FIMS (NODG-required Level of Reporting)	EG020-SDH: 1M HCl Extractable Se in Sediments by ICPMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn	EG005-SDH: 1M HCl Extractable Metals: Fe	EG035-SDH: 1M HCl Extractable Mercury in Sediments by FIMS	EP003: Total Organic Carbon (TOC) in Soil	EA150/HEA152: Particle Sizing with Hydrometer + Soil Particle Density	EG048G: Total Hexavalent Chromium (Alkaline digestion) by Discrete Analyser	
1	PW1	Sediment	2/12/2019	-	7 bags	0	X	X	X	X	X	X	X	X	X	X	Metals Total: As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn Total metals by ICPMS: As, Cd, Cr, Cu, Pb, Ni, Zn, Se, Co, Mn, Fe FWD to Eurofins
2	PW2	Sediment	2/12/2019	-	7 bags	0											
3	PW3	Sediment	2/12/2019	-	7 bags	0											
4	PW4	Sediment	2/12/2019	-	7 bags	0											
5	PW5	Sediment	2/12/2019	-	7 bags	0											
6	PW6	Sediment	2/12/2019	-	7 bags	0											
7	QC01	Sediment	2/12/2019	-	7 bags	0											
8	QC02	Sediment	2/12/2019	-	7 bags	0											
	QC03	Water	2/12/2019	-	1 water	1											
Total						1	0	0	0	0	0	0	0	0	0	0	

Environmental Division
Perth
Work Order Reference
EP1912834



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples: Sampler Name: Matthew Hunt / Brandon Henry Signature: [Signature] Date: 2/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature: <u>Matthew Hunt</u>	Date: <u>3/12</u>	Carrier / Reference #:		Name/Signature: <u>MS</u>	Date: <u>4/12/19</u>
Of: <u>Senversa</u>	Time: <u>10:00</u>	Date/Time:		Of: <u>MS</u>	Time: <u>10:45</u>
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:		Name/Signature:	Date:
Of:	Time:	Date/Time:		Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EP1912834**

Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
E-mail	: blaire.coleman@senversa.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Facsimile	: +61 03 9606 0074	Facsimile	: +61-8-9406 1399
Project	: P17302 Bulong DSI	Page	: 1 of 5
Order number	: ----	Quote number	: EP2019SENV0005 (EP/382/19 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Brandon Henry, MATTHEW HUNT		

Dates

Date Samples Received	: 04-Dec-2019 08:45	Issue Date	: 04-Dec-2019
Client Requested Due Date	: 19-Dec-2019	Scheduled Reporting Date	: 19-Dec-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: 4	Temperature	: 6.0 - Ice present
Receipt Detail	:	No. of samples received / analysed	: 8 / 8

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
- TOC, AVS/SEM, Pore water conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
1M HCl Extractable Metals : EG005-SEM_1		
PW1	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW2	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW3	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW4	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW5	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW6	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
QC01	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
Acid Volatile Sulfides (AVS) : EA038-SEM		
PW1	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW2	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW3	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW4	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW5	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
PW6	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
QC01	- Snap Lock Bag - frozen on receipt at ALS	- Snap Lock Bag - frozen
Ferrous Iron by Discrete Analyser - Unfiltered : EG051GUF		
PW1	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW2	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW3	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW4	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW5	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
PW6	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
QC01	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - HCl - Unfiltered
Hexavalent Chromium by Alkaline Digestion and DA Finish : EG048G		
PW1	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW2	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW3	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW4	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW5	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
PW6	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
QC01	- Snap Lock Bag	- Soil Glass Jar - Unpreserved
Major Cations - Total : ED093T		
PW1	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW2	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW3	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered



Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Major Cations - Total : ED093T		
PW4	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW5	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
PW6	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered
QC01	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Unfiltered	- Clear Plastic Bottle - Nitric Acid; Unfiltered

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	Client sampling date / time	Client sample ID	SOIL - EG005-SD Total Iron and Aluminium in Sediments by	SOIL - EG005-SDH 1M HCl Extractable Metals	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG020-SDH 1M HCl Extractable Se in Sediments by ICPMS	SOIL - EG035-SD Mercury in Sediments by FIMS (NODG-required)	SOIL - EG035-SDH 1M HCl Extractable Mercury in Sediments by	SOIL - EG048G Total Hexavalent Chromium (Alkaline digestion)
EP1912834-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓	✓	✓	✓
EP1912834-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓	✓	✓	✓
EP1912834-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓	✓	✓	✓
EP1912834-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓	✓	✓	✓
EP1912834-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓	✓	✓	✓
EP1912834-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓	✓	✓	✓
EP1912834-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA005P pH (PCT)	SOIL - EA038-AVS_SEM Acid Volatile Sulphides (AVS) and Simultaneously	SOIL - EA055-103 Moisture Content	SOIL - EA065 Total Hardness as CaCO3	SOIL - EA150H/EA152 Particle Sizing with Hydrometer + Soil Particle	SOIL - EN82 Porewater Extraction	SOIL - EP003 Total Organic Carbon (TOC) in Soil
EP1912834-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓	✓	✓	✓
EP1912834-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓	✓	✓	✓
EP1912834-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓	✓	✓	✓
EP1912834-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓	✓	✓	✓
EP1912834-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓	✓	✓	✓
EP1912834-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓	✓	✓	✓
EP1912834-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓	✓	✓	✓



Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EG035T-LL Total Mercury - Low Level	SOIL - EG051GUF Ferrous Iron by Discrete Analyser - Unfiltered	SOIL - EG093-T Total Metals by ORC - Ultra Trace in Saline	SOIL - NT-01T Total Major Cations (Ca, Mg, Na, K)	SOIL - NT-02 Major Anions (Chloride, Sulphate, Alkalinity)	SOIL - NT-07 Total Nitrogen + NO2 + NO3 + NH3
EP1912834-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓	✓	✓
EP1912834-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓	✓	✓
EP1912834-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓	✓	✓
EP1912834-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓	✓	✓
EP1912834-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓	✓	✓
EP1912834-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓	✓	✓
EP1912834-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - W-02T 8 metals (Total)
EP1912834-008	02-Dec-2019 00:00	QC03	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020T Total Metals by ICP/MS (including digestion)
EP1912834-008	02-Dec-2019 00:00	QC03	✓



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

Matrix: SOIL

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
EA038-SEM: Acid Volatile Sulfides (AVS)								
PW1	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW2	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW3	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW4	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW5	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
PW6	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
QC01	Snap Lock Bag - frozen on recei	----	03-Dec-2019	04-Dec-2019	✖	----	----	
EG005-SEM_1: 1M HCl Extractable Metals								
PW1	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW2	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW3	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW4	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW5	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
PW6	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	
QC01	Snap Lock Bag - frozen on recei	03-Dec-2019	02-Mar-2020	04-Dec-2019	✖	----	----	

Requested Deliverables

Blaire Coleman

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Attachment - Report (SUBCO)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
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Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.au

CERTIFICATE OF ANALYSIS

Work Order : **EP1912834**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **Brandon Henry, MATTHEW HUNT**
Site : **----**
Quote number : **EP/382/19 V2**
No. of samples received : **8**
No. of samples analysed : **8**

Page : 1 of 9
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 04-Dec-2019 08:45
Date Analysis Commenced : 05-Dec-2019
Issue Date : 19-Dec-2019 22:31



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Carsten Emrich	Client Services	Brisbane Inorganics, Stafford, QLD
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- TOC, AVS/SEM, Pore water conducted by ALS Brisbane, NATA Site No. 818.
- PSD conducted by ALS Newcastle, NATA accreditation no. 825, site no 1656.
- EA150H: Samples 004 and 005 were pretreated to remove 90% of soluble solids. Results have been corrected for salinity and consequently, NATA endorsement does not apply to clay/silt results
- EG020-SD: Poor precision was obtained for chromium, nickel on sample EP1912834-001 due to possible sample heterogeneity. Results have been confirmed by re-extraction and re-analysis.
- EG005-SD: EP1912834-1 shows poor duplicate precision for iron due to possible sample heterogeneity. Results confirmed by re-digestion and re-analysis.



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1912834-001	EP1912834-002	EP1912834-003	EP1912834-004	EP1912834-005
				Result	Result	Result	Result	Result
EA038 / EG005 (ED093): Simultaneously Extracted Metals								
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	1.0	mg/kg	<1.0	1.4	3.6	4.5	5.5
Lead	7439-92-1	1.0	mg/kg	<1.0	1.7	1.2	1.8	2.1
Nickel	7440-02-0	1.0	mg/kg	4.1	14.3	196	165	296
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc	7440-66-6	1.0	mg/kg	1.9	2.2	3.1	3.8	3.9
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals								
Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	0.4	0.5	<0.3	0.4	1.0
Cadmium	7440-43-9	0.01	mmol/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mmol/kg	<0.01	0.02	0.06	0.07	0.09
Lead	7439-92-1	0.01	mmol/kg	<0.01	<0.01	<0.01	<0.01	0.01
Nickel	7440-02-0	0.01	mmol/kg	0.07	0.24	3.34	2.82	5.05
Silver	7440-22-4	0.01	mmol/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.01	mmol/kg	0.03	0.03	0.05	0.06	0.06
Sum of SEM (Cd, Cu, Pb, Ni, Ag, Zn)	----	0.01	mmol/kg	0.10	0.31	3.45	2.96	5.21
SEM - AVS	----	0.01	mmol/kg	<0.01	<0.01	3.45	2.54	4.21
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	15.9	28.1	26.3	23.9	24.6
EA150: Particle Sizing								
+75µm	----	1	%	8	23	22	15	20
+150µm	----	1	%	5	7	12	4	7
+300µm	----	1	%	4	3	7	2	3
+425µm	----	1	%	4	2	5	1	2
+600µm	----	1	%	3	2	4	<1	1
+1180µm	----	1	%	<1	<1	3	<1	<1
+2.36mm	----	1	%	<1	<1	2	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	8	4	<1	7	15
Silt (2-60 µm)	----	1	%	72	57	60	60	46

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1912834-001	EP1912834-002	EP1912834-003	EP1912834-004	EP1912834-005	
				Result	Result	Result	Result	Result	
EA150: Soil Classification based on Particle Size - Continued									
Sand (0.06-2.00 mm)	----	1	%	20	39	38	33	39	
Gravel (>2mm)	----	1	%	<1	<1	2	<1	<1	
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.57	2.76	2.76	2.75	2.45	
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Iron	7439-89-6	50	mg/kg	21400	54700	30400	44200	46000	
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Iron	7439-89-6	50	mg/kg	250	1360	2700	1960	1830	
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg	6.32	6.22	5.67	9.35	8.42	
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	
Chromium	7440-47-3	1.0	mg/kg	222	628	286	420	383	
Copper	7440-50-8	1.0	mg/kg	5.6	19.6	18.3	24.3	29.0	
Cobalt	7440-48-4	0.5	mg/kg	7.4	29.9	46.7	54.0	59.3	
Lead	7439-92-1	1.0	mg/kg	3.7	6.4	4.3	5.5	5.2	
Manganese	7439-96-5	10	mg/kg	136	469	492	1340	1030	
Nickel	7440-02-0	1.0	mg/kg	82.6	289	576	742	863	
Selenium	7782-49-2	0.1	mg/kg	0.2	0.2	0.2	0.3	0.2	
Zinc	7440-66-6	1.0	mg/kg	9.2	60.4	26.3	39.3	48.8	
EG020-SDH: 1M HCl Extractable metals by ICPMS									
Arsenic	7440-38-2	1.0	mg/kg	<1.0	<1.0	1.2	<1.0	1.2	
Cadmium	7440-43-9	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	
Chromium	7440-47-3	1.0	mg/kg	5.5	11.3	18.9	18.2	15.9	
Cobalt	7440-48-4	0.5	mg/kg	1.3	6.6	20.8	14.3	21.1	
Copper	7440-50-8	1.0	mg/kg	1.1	3.8	5.8	5.9	5.8	
Lead	7439-92-1	1.0	mg/kg	1.3	2.5	1.8	2.3	1.7	
Manganese	7439-96-5	10	mg/kg	43	135	303	348	288	
Nickel	7440-02-0	1.0	mg/kg	9.1	73.0	268	203	348	
Zinc	7440-66-6	1.0	mg/kg	2.1	4.2	5.3	5.6	4.1	
Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	
EG035T: Total Recoverable Mercury by FIMS									



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW1	PW2	PW3	PW4	PW5
Client sampling date / time					02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1912834-001	EP1912834-002	EP1912834-003	EP1912834-004	EP1912834-005
					Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS - Continued									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
EN82: Porewater Extraction									
Volume	----	1	mL		10	34	13	<1	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.10	0.15	1.02	0.22	0.43



Analytical Results

Sub-Matrix: **SEDIMENT**
 (Matrix: **SOIL**)

Client sample ID

				PW6	QC01	----	----	----
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP1912834-006	EP1912834-007	-----	-----	-----
				Result	Result	----	----	----
EA038 / EG005 (ED093): Simultaneously Extracted Metals								
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	----	----	----
Copper	7440-50-8	1.0	mg/kg	2.1	1.2	----	----	----
Lead	7439-92-1	1.0	mg/kg	2.0	<1.0	----	----	----
Nickel	7440-02-0	1.0	mg/kg	5.0	39.5	----	----	----
Silver	7440-22-4	1.0	mg/kg	<1.0	<1.0	----	----	----
Zinc	7440-66-6	1.0	mg/kg	2.6	1.8	----	----	----
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals								
Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	0.5	0.4	----	----	----
Cadmium	7440-43-9	0.01	mmol/kg	<0.01	<0.01	----	----	----
Copper	7440-50-8	0.01	mmol/kg	0.03	0.02	----	----	----
Lead	7439-92-1	0.01	mmol/kg	<0.01	<0.01	----	----	----
Nickel	7440-02-0	0.01	mmol/kg	0.08	0.67	----	----	----
Silver	7440-22-4	0.01	mmol/kg	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.01	mmol/kg	0.04	0.03	----	----	----
Sum of SEM (Cd, Cu, Pb, Ni, Ag, Zn)	----	0.01	mmol/kg	0.17	0.72	----	----	----
SEM - AVS	----	0.01	mmol/kg	<0.01	0.31	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	19.6	17.0	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	76	21	----	----	----
+150µm	----	1	%	48	6	----	----	----
+300µm	----	1	%	13	3	----	----	----
+425µm	----	1	%	8	2	----	----	----
+600µm	----	1	%	5	1	----	----	----
+1180µm	----	1	%	2	<1	----	----	----
+2.36mm	----	1	%	<1	<1	----	----	----
+4.75mm	----	1	%	<1	<1	----	----	----
+9.5mm	----	1	%	<1	<1	----	----	----
+19.0mm	----	1	%	<1	<1	----	----	----
+37.5mm	----	1	%	<1	<1	----	----	----
+75.0mm	----	1	%	<1	<1	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	4	<1	----	----	----
Silt (2-60 µm)	----	1	%	1	53	----	----	----

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW6	QC01	----	----	----
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EP1912834-006	EP1912834-007	-----	-----	-----	
				Result	Result	----	----	----	
EA150: Soil Classification based on Particle Size - Continued									
Sand (0.06-2.00 mm)	----	1	%	94	47	----	----	----	
Gravel (>2mm)	----	1	%	1	<1	----	----	----	
Cobbles (>6cm)	----	1	%	<1	<1	----	----	----	
EA152: Soil Particle Density									
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.80	2.81	----	----	----	
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES									
Iron	7439-89-6	50	mg/kg	56600	29700	----	----	----	
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES									
Iron	7439-89-6	50	mg/kg	420	1120	----	----	----	
EG020-SD: Total Metals in Sediments by ICPMS									
Arsenic	7440-38-2	1.00	mg/kg	2.63	4.47	----	----	----	
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	----	----	----	
Chromium	7440-47-3	1.0	mg/kg	520	335	----	----	----	
Copper	7440-50-8	1.0	mg/kg	14.0	11.7	----	----	----	
Cobalt	7440-48-4	0.5	mg/kg	13.2	24.2	----	----	----	
Lead	7439-92-1	1.0	mg/kg	7.0	5.6	----	----	----	
Manganese	7439-96-5	10	mg/kg	402	495	----	----	----	
Nickel	7440-02-0	1.0	mg/kg	89.4	244	----	----	----	
Selenium	7782-49-2	0.1	mg/kg	0.1	0.1	----	----	----	
Zinc	7440-66-6	1.0	mg/kg	32.7	28.5	----	----	----	
EG020-SDH: 1M HCl Extractable metals by ICPMS									
Arsenic	7440-38-2	1.0	mg/kg	<1.0	<1.0	----	----	----	
Cadmium	7440-43-9	0.10	mg/kg	<0.10	<0.10	----	----	----	
Chromium	7440-47-3	1.0	mg/kg	2.2	10.8	----	----	----	
Cobalt	7440-48-4	0.5	mg/kg	2.2	6.3	----	----	----	
Copper	7440-50-8	1.0	mg/kg	2.3	3.1	----	----	----	
Lead	7439-92-1	1.0	mg/kg	1.5	1.7	----	----	----	
Manganese	7439-96-5	10	mg/kg	127	138	----	----	----	
Nickel	7440-02-0	1.0	mg/kg	6.8	78.7	----	----	----	
Zinc	7440-66-6	1.0	mg/kg	2.0	3.3	----	----	----	
Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	----	----	----	
EG035-SDH: 1M HCl extractable Mercury by FIMS									
Mercury	7439-97-6	0.10	mg/kg	<0.10	<0.10	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									



Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	PW6	QC01	----	----	----
Client sampling date / time					02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1912834-006	EP1912834-007	-----	-----	-----
				Result	Result		----	----	----
EG035T: Total Recoverable Mercury by FIMS - Continued									
Mercury	7439-97-6	0.01	mg/kg		<0.01	<0.01	----	----	----
EG048: Hexavalent Chromium (Alkaline Digest)									
Hexavalent Chromium	18540-29-9	0.5	mg/kg		<0.5	<0.5	----	----	----
EN82: Porewater Extraction									
Volume	----	1	mL		----	30	----	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.14	0.18	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC03	----	----	----	----
Client sampling date / time					02-Dec-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EP1912834-008	-----	-----	-----	-----
					Result	----	----	----	----
EG020T: Total Metals by ICP-MS									
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	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----

Certificate of Analysis

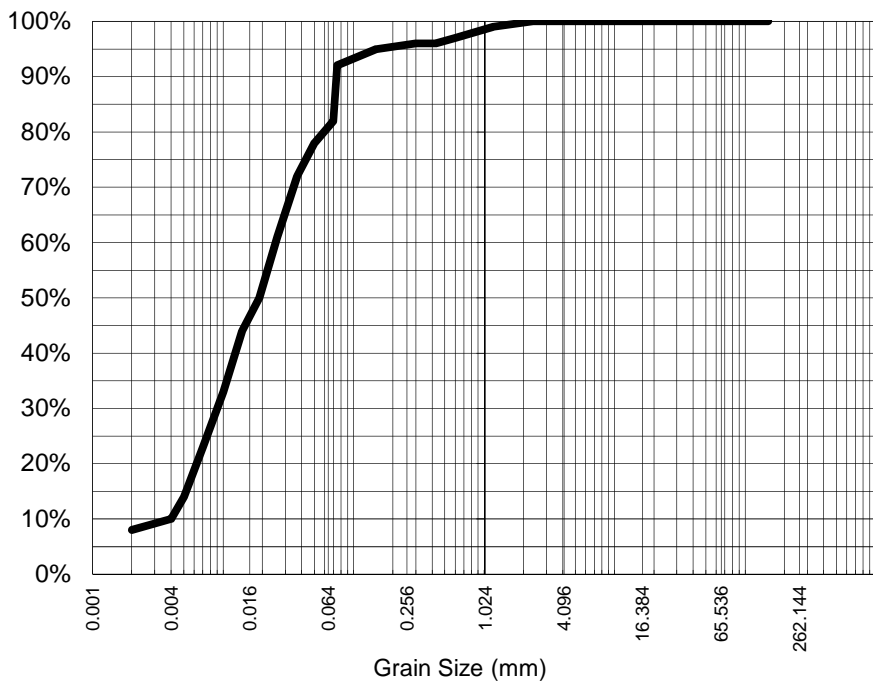
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samples.newcastle@alsenviro.com

ALS Environmental
Newcastle, NSW



CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-001 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW1

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	97%
0.425	96%
0.300	96%
0.150	95%
0.075	92%
Particle Size (microns)	
50	78%
37	72%
26	61%
19	50%
14	44%
10	33%
7	23%
5	14%
2	8%

Median Particle Size (mm)*	0.019
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.57

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

NATA Accreditation: 825 Site: Newcastle
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Technical Manager Air
Authorised Signatory

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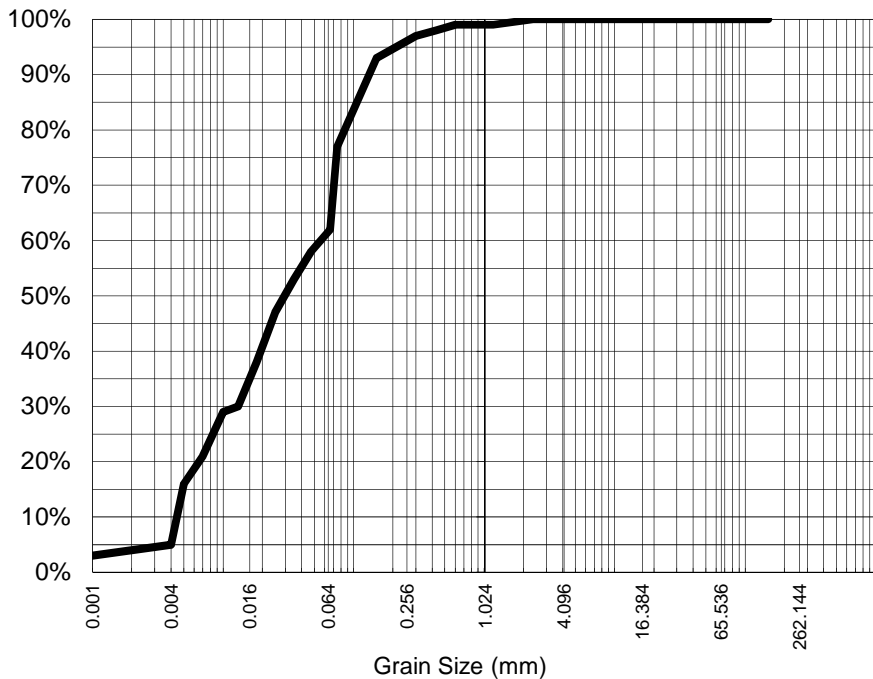
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COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-002 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW2

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	97%
0.150	93%
0.075	77%
Particle Size (microns)	
47	58%
35	53%
25	47%
18	38%
13	30%
10	29%
7	21%
5	16%
1	3%

Median Particle Size (mm)*	0.030
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.76

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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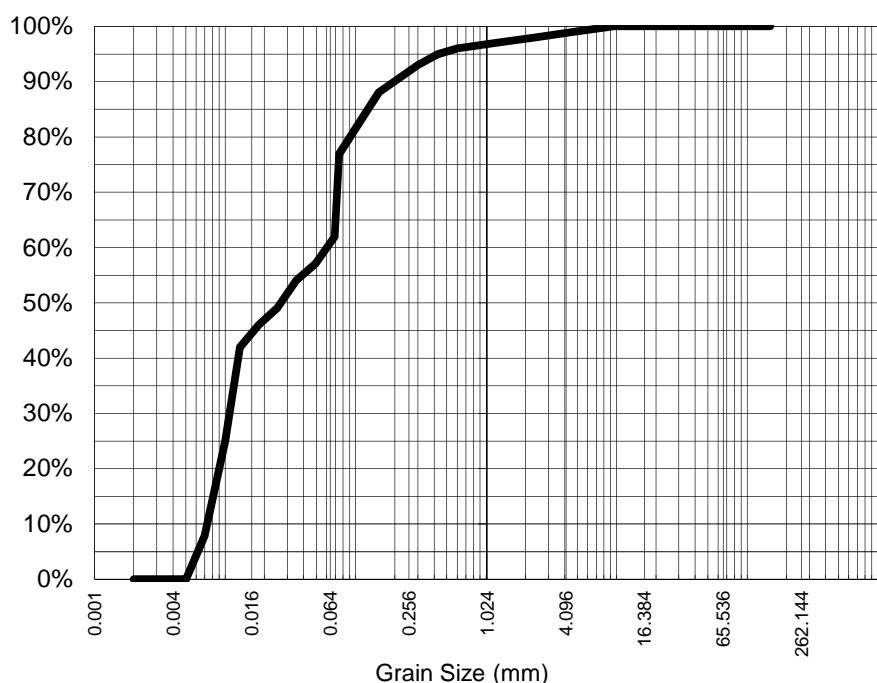
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COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-003 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW3

Particle Size Distribution



Particle Size (mm)	% Passing
9.50	100%
4.75	99%
2.36	98%
1.18	97%
0.600	96%
0.425	95%
0.300	93%
0.150	88%
0.075	77%
Particle Size (microns)	
49	57%
35	54%
25	49%
18	46%
13	42%
10	25%
7	8%
5	0%

Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.027
----------------------------	-------

Sample Comments:

Analysed: 10-Dec-19

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description: FINES, CLAY

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.76

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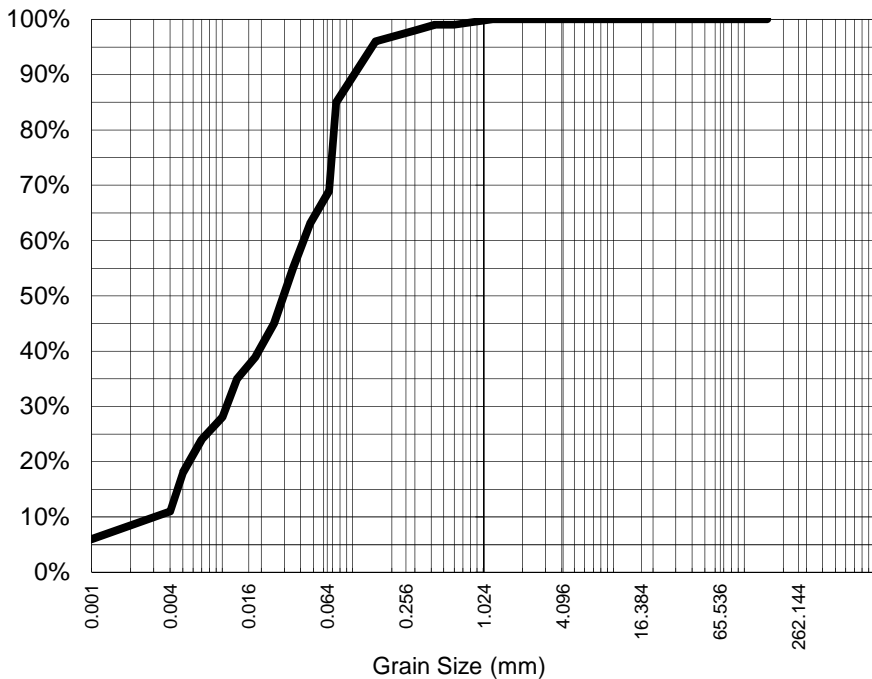
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COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-004 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW4

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	99%
0.300	98%
0.150	96%
0.075	85%
Particle Size (microns)	
47	63%
35	55%
25	45%
18	39%
13	35%
10	28%
7	24%
5	18%
1	6%

Median Particle Size (mm)*	0.030
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.75

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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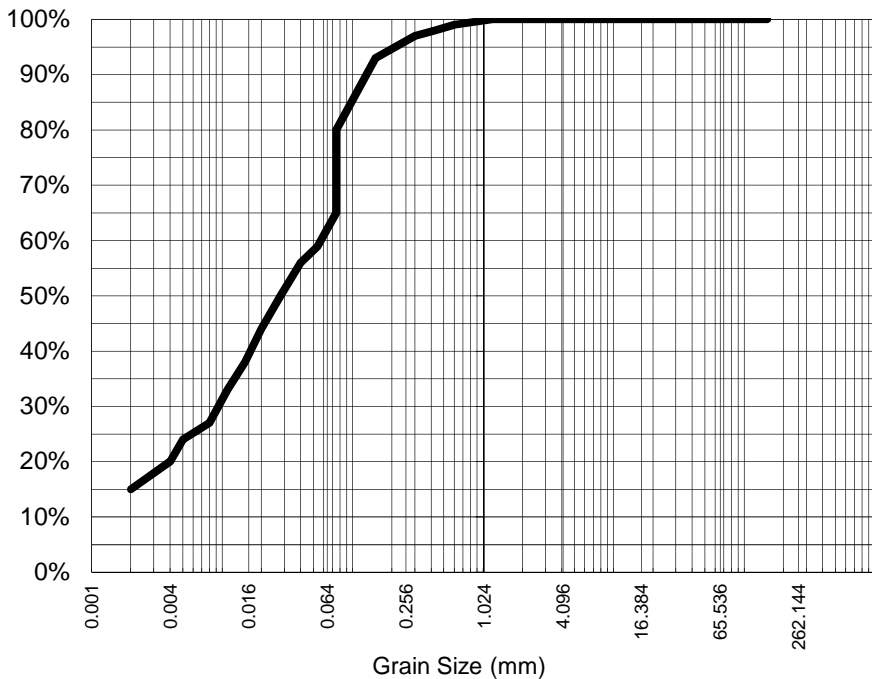
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CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-005 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW5

Particle Size Distribution



Analysis Notes

The sample was pretreated to remove 90% of soluble solids and results have been corrected for salinity. Consequently, NATA endorsement does not apply to clay/silt results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	98%
0.300	97%
0.150	93%
0.075	80%
Particle Size (microns)	
54	59%
40	56%
28	50%
20	44%
15	38%
11	33%
8	27%
5	24%
2	15%

Median Particle Size (mm)*	0.028
----------------------------	-------

Sample Comments:

Loss on Pretreatment 30%

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.45

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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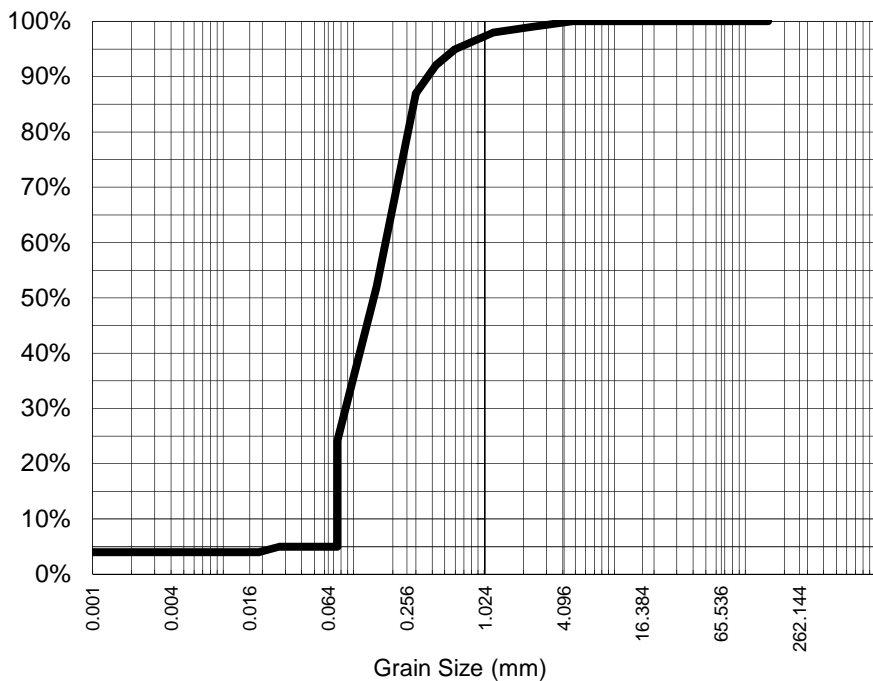
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CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-006 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** PW6

Particle Size Distribution



Particle Size (mm)	% Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	92%
0.300	87%
0.150	52%
0.075	24%
Particle Size (microns)	
55	5%
39	5%
27	5%
19	4%
14	4%
10	4%
7	4%
5	4%
1	4%

Analysis Notes

The sample was pretreated to remove 90% of soluble solids and results have been corrected for salinity. Consequently, NATA endorsement does not apply to clay/silt results

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Median Particle Size (mm)*	0.145
----------------------------	-------

Sample Comments:

Analysed: 10-Dec-19

Loss on Pretreatment 26%

Limit of Reporting: 1%

Sample Description: FINES, SAND, CLAY

Dispersion Method Shaker

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.8

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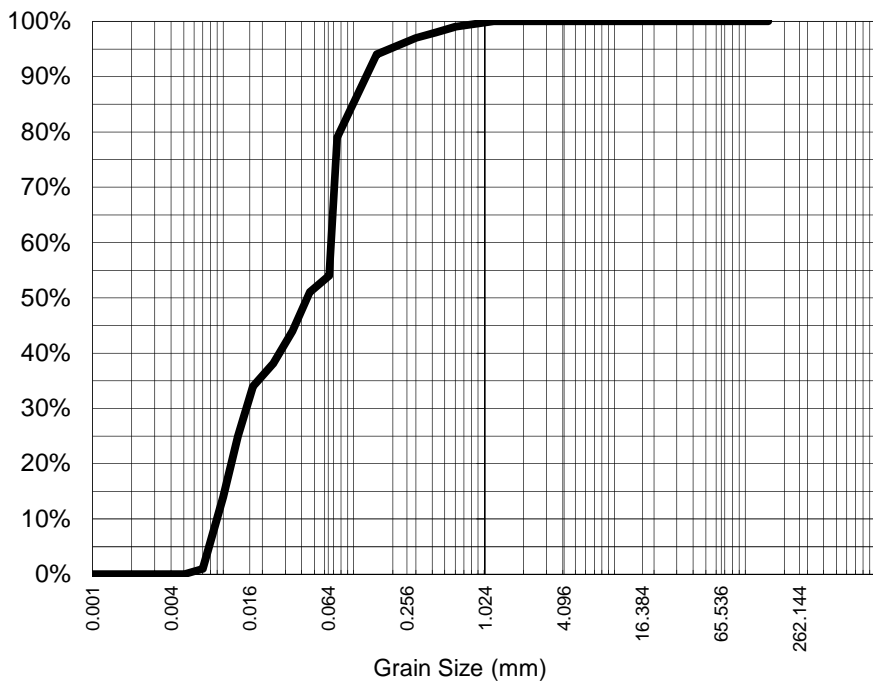
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CLIENT: Blaire Coleman **DATE REPORTED:** 17-Dec-2019
COMPANY: SENVERSA PTY LTD **DATE RECEIVED:** 4-Dec-2019
ADDRESS: Level 25, 108 St Georges Terrace **REPORT NO:** EP1912834-007 / PSD
Perth
PROJECT: P17302 Bulong DSI **SAMPLE ID:** QC01

Particle Size Distribution



Analysis Notes

Samples analysed as received.

Clay/silt results have been corrected for salinity and consequently NATA endorsement does not apply to these fractions.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Particle Size (mm)	% Passing
1.18	100%
0.600	99%
0.425	98%
0.300	97%
0.150	94%
0.075	79%
Particle Size (microns)	
46	51%
34	44%
24	38%
17	34%
13	25%
10	14%
7	1%
5	0%

Median Particle Size (mm)*	0.044
----------------------------	-------

Sample Comments:

Loss on Pretreatment NA

Sample Description: FINES, CLAY

Test Method: AS1289.3.6.2/AS1289.3.6.3

Soil Particle Density (<2.36mm) 2.81

Analysed: 10-Dec-19

Limit of Reporting: 1%

Dispersion Method Shaker

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Peter Keyte
Technical Manager Air
Authorised Signatory

QUALITY CONTROL REPORT

Work Order	: EP1912834	Page	: 1 of 7
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Order number	: ----	Date Analysis Commenced	: 05-Dec-2019
C-O-C number	: ----	Issue Date	: 19-Dec-2019
Sampler	: Brandon Henry, MATTHEW HUNT		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 8		
No. of samples analysed	: 8		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Carsten Emrich	Client Services	Brisbane Inorganics, Stafford, QLD
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Peter Keyte	Technical Manager - Air	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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**

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA038 / EG005 (ED093): Simultaneously Extracted Metals (QC Lot: 2770323)									
EP1912834-001	PW1	EG005-SEM_1: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005-SEM_1: Copper	7440-50-8	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SEM_1: Lead	7439-92-1	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SEM_1: Nickel	7440-02-0	1	mg/kg	4.1	3.8	7.32	No Limit
		EG005-SEM_1: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SEM_1: Zinc	7440-66-6	1	mg/kg	1.9	1.6	20.4	No Limit
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals (QC Lot: 2759063)									
EP1912834-001	PW1	EA038-SEM: Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	0.4	0.5	0.00	No Limit
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QC Lot: 2766587)									
EP1912834-001	PW1	EG005-SD: Iron	7439-89-6	50	mg/kg	21400	# 16200	27.7	0% - 20%
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QC Lot: 2751125)									
EP1912834-001	PW1	EG005-SDH: Iron	7439-89-6	50	mg/kg	250	160	41.2	No Limit
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 2766585)									
EP1912834-001	PW1	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2760236)									
EP1912834-001	PW1	EA055: Moisture Content	----	0.1	%	15.9	16.0	0.00	0% - 20%
EP1912951-006	Anonymous	EA055: Moisture Content	----	0.1	%	5.1	5.0	0.00	No Limit
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2766586)									
EP1912834-001	PW1	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020-SD: Selenium	7782-49-2	0.1	mg/kg	0.2	0.2	0.00	No Limit
		EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	7.4	5.5	29.7	0% - 50%
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	6.32	2.91	73.9	No Limit
		EG020-SD: Chromium	7440-47-3	1	mg/kg	222	# 127	54.8	0% - 20%
		EG020-SD: Copper	7440-50-8	1	mg/kg	5.6	2.6	72.5	No Limit

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 Work Order : EP1912834
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 2766586) - continued									
EP1912834-001	PW1	EG020-SD: Lead	7439-92-1	1	mg/kg	3.7	2.6	35.4	No Limit
		EG020-SD: Nickel	7440-02-0	1	mg/kg	82.6	# 63.1	26.8	0% - 20%
		EG020-SD: Zinc	7440-66-6	1	mg/kg	9.2	4.2	74.2	No Limit
		EG020-SD: Manganese	7439-96-5	10	mg/kg	136	108	23.6	0% - 50%
EG020-SDH: 1M HCl Extractable metals by ICPMS (QC Lot: 2751126)									
EP1912834-001	PW1	EG020-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
		EG020-SDH: Cobalt	7440-48-4	0.5	mg/kg	1.3	0.9	37.0	No Limit
		EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EG020-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG020-SDH: Chromium	7440-47-3	1	mg/kg	5.5	3.9	34.7	No Limit
		EG020-SDH: Copper	7440-50-8	1	mg/kg	1.1	<1.0	13.4	No Limit
		EG020-SDH: Lead	7439-92-1	1	mg/kg	1.3	<1.0	27.3	No Limit
		EG020-SDH: Nickel	7440-02-0	1	mg/kg	9.1	6.2	38.6	No Limit
		EG020-SDH: Zinc	7440-66-6	1	mg/kg	2.1	1.4	37.2	No Limit
EG020-SDH: Manganese	7439-96-5	10	mg/kg	43	29	40.6	No Limit		
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 2751127)									
EP1912834-001	PW1	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EG048: Hexavalent Chromium (Alkaline Digest) (QC Lot: 2757232)									
EP1912834-001	PW1	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP1913031-001	Anonymous	EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 2763279)									
EP1912834-007	QC01	EP003: Total Organic Carbon	----	0.02	%	0.18	0.16	11.2	No Limit
EB1932960-001	Anonymous	EP003: Total Organic Carbon	----	0.02	%	33.6	35.3	4.98	0% - 20%
Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 2745761)									
EP1912846-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0138	0.0137	0.903	0% - 20%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.012	0.013	10.1	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	1.28	1.30	1.66	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.338	0.345	1.77	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.301	0.311	3.14	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.018	0.020	6.62	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.942	0.991	5.16	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	10.2	9.78	4.19	0% - 20%
		EP1912820-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001
EG020A-T: Arsenic	7440-38-2	0.001		mg/L	<0.001	<0.001	0.00	No Limit	

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 Work Order : EP1912834
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 2745761) - continued									
EP1912820-001	Anonymous	EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.057	0.056	1.93	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.425	0.416	2.17	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.023	0.022	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.22	0.19	12.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2745807)									
EP1912820-013	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA038 / EG005 (ED093): Simultaneously Extracted Metals (QCLot: 2770323)								
EG005-SEM_1: Cadmium	7440-43-9	0.1	mg/kg	<0.1	1.563 mg/kg	96.0	70.0	130
EG005-SEM_1: Copper	7440-50-8	1	mg/kg	<1.0	44.944 mg/kg	103	70.0	130
EG005-SEM_1: Lead	7439-92-1	1	mg/kg	<1.0	70.538 mg/kg	102	77.0	130
EG005-SEM_1: Nickel	7440-02-0	1	mg/kg	<1.0	13.026 mg/kg	109	70.0	123
EG005-SEM_1: Silver	7440-22-4	1	mg/kg	<1.0	0.521 mg/kg	92.1	70.0	130
EG005-SEM_1: Zinc	7440-66-6	1	mg/kg	<1.0	88.509 mg/kg	108	70.0	130
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals (QCLot: 2759063)								
EA038-SEM: Acid Volatile Sulphides (mmol/kg)	----	0.3	mmol/kg	<0.3	22.553 mmol/kg	100	70.0	130
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES (QCLot: 2766587)								
EG005-SD: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 2751125)								
EG005-SDH: Iron	7439-89-6	50	mg/kg	<50	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2766585)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	2.154 mg/kg	117	80.0	120
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2766586)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	21.62091 mg/kg	107	74.0	130
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	4.6838 mg/kg	102	97.0	113
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	33.904 mg/kg	133	72.0	152
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	33.782 mg/kg	96.8	76.0	116
EG020-SD: Cobalt	7440-48-4	0.5	mg/kg	<0.5	----	----	----	----
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	40.33169 mg/kg	97.9	74.0	124
EG020-SD: Manganese	7439-96-5	10	mg/kg	<10	----	----	----	----
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	51.10088 mg/kg	116	81.0	135
EG020-SD: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	61.70999 mg/kg	118	81.0	143
EG020-SDH: 1M HCl Extractable metals by ICPMS (QCLot: 2751126)								
EG020-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.10	----	----	----	----
EG020-SDH: Chromium	7440-47-3	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Cobalt	7440-48-4	0.5	mg/kg	<0.5	----	----	----	----
EG020-SDH: Copper	7440-50-8	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Lead	7439-92-1	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Manganese	7439-96-5	10	mg/kg	<10	----	----	----	----



Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020-SDH: 1M HCl Extractable metals by ICPMS (QCLot: 2751126) - continued								
EG020-SDH: Nickel	7440-02-0	1	mg/kg	<1.0	----	----	----	----
EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	----	----	----	----
EG020-SDH: Zinc	7440-66-6	1	mg/kg	<1.0	----	----	----	----
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 2751127)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	1.34 mg/kg	125	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2757232)								
EG048G: Hexavalent Chromium	18540-29-9	0.5	mg/kg	<0.5	40 mg/kg	95.0	70.0	130
				<0.5	20 mg/kg	115	70.0	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 2763279)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	28.3 %	105	70.0	130
				<0.02	0.48 %	106	70.0	130

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020T: Total Metals by ICP-MS (QCLot: 2745761)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	109	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	98.7	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	103	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	100	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	98.9	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	103	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.4	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	99.1	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	109	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	105	87.1	120
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2745807)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.2	85.1	115

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: SOIL				Matrix Spike (MS) Report			
				Spike	Spike Recovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 2766585)							
EP1912834-002	PW2	EG035T-LL: Mercury	7439-97-6	1 mg/kg	84.0	70.0	130



Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 2766586)							
EP1912834-002	PW2	EG020-SD: Arsenic	7440-38-2	50 mg/kg	83.1	70.0	130
		EG020-SD: Cadmium	7440-43-9	12.5 mg/kg	102	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	# Not Determined	70.0	130
		EG020-SD: Copper	7440-50-8	50 mg/kg	93.7	70.0	130
		EG020-SD: Lead	7439-92-1	50 mg/kg	92.8	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	# Not Determined	70.0	130
		EG020-SD: Zinc	7440-66-6	50 mg/kg	79.6	70.0	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 2751127)							
EP1912834-002	PW2	EG035-SDH: Mercury	7439-97-6	0.5 mg/kg	96.9	70.0	130
EG048: Hexavalent Chromium (Alkaline Digest) (QCLot: 2757232)							
EP1912834-001	PW1	EG048G: Hexavalent Chromium	18540-29-9	40 mg/kg	97.6	70.0	130
EP1912834-001	PW1	EG048G: Hexavalent Chromium	18540-29-9	20 mg/kg	92.7	70.0	130

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2745761)							
EP1912812-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	127	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	113	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	105	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	108	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	110	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	106	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	103	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	112	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	130	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2745807)							
EP1912820-012	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	103	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1912834	Page	: 1 of 10
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Site	: ----	Issue Date	: 19-Dec-2019
Sampler	: Brandon Henry, MATTHEW HUNT	No. of samples received	: 8
Order number	: ----	No. of samples analysed	: 8

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EG005(ED093)-SD: Total Metals in Sediments by ICP-A	EP1912834--001	PW1	Iron	7439-89-6	27.7 %	0% - 20%	RPD exceeds LOR based limits
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--001	PW1	Chromium	7440-47-3	54.8 %	0% - 20%	RPD exceeds LOR based limits
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--001	PW1	Nickel	7440-02-0	26.8 %	0% - 20%	RPD exceeds LOR based limits
Matrix Spike (MS) Recoveries							
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--002	PW2	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EG020-SD: Total Metals in Sediments by ICPMS	EP1912834--002	PW2	Nickel	7440-02-0	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA038 / EG005 (ED093): Simultaneously Extracted Metals							
Snap Lock Bag - frozen on receipt at ALS							
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	17-Dec-2019	03-Dec-2019	14	----	----	----
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals							
Snap Lock Bag - frozen on receipt at ALS							
PW1, PW3, PW5, QC01	PW2, PW4, PW6,	----	----	----	11-Dec-2019	03-Dec-2019	8

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Control Samples (LCS)					
1M HCl Extractable Metals	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Total Fe and Al in Sediments by ICPAES	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard



Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA038 / EG005 (ED093): Simultaneously Extracted Metals							
Snap Lock Bag - frozen on receipt at ALS (EG005-SEM_1) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	02-Dec-2019	17-Dec-2019	03-Dec-2019	✖	17-Dec-2019	16-Mar-2020	✔
EA038 / EG005(ED093): Acid Volatile Sulphides & Simultaneously Extracted Metals							
Snap Lock Bag - frozen on receipt at ALS (EA038-SEM) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	02-Dec-2019	----	----	----	11-Dec-2019	03-Dec-2019	✖
EA055: Moisture Content (Dried @ 105-110°C)							
Snap Lock Bag (EA055) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	02-Dec-2019	----	----	----	12-Dec-2019	16-Dec-2019	✔
EA150: Particle Sizing							
Snap Lock Bag: Separate bag received (EA150H) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	02-Dec-2019	----	----	----	12-Dec-2019	30-May-2020	✔
EA150: Soil Classification based on Particle Size							
Snap Lock Bag: Separate bag received (EA150H) PW1, PW3, PW5, QC01 PW2, PW4, PW6,	02-Dec-2019	----	----	----	12-Dec-2019	30-May-2020	✔

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA152: Soil Particle Density								
Snap Lock Bag: Separate bag received (EA152)		02-Dec-2019	----	----	----	12-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG005(ED093)-SD: Total Metals in Sediments by ICP-AES								
Snap Lock Bag (EG005-SD)		02-Dec-2019	16-Dec-2019	30-May-2020	✓	16-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG005(ED093)-SDH: 1M HCl-Extractable Metals by ICPAES								
Snap Lock Bag (EG005-SDH)		02-Dec-2019	18-Dec-2019	30-May-2020	✓	18-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG020-SD: Total Metals in Sediments by ICPMS								
Snap Lock Bag (EG020-SD)		02-Dec-2019	16-Dec-2019	30-May-2020	✓	16-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG020-SDH: 1M HCl Extractable metals by ICPMS								
Snap Lock Bag (EG020-SDH)		02-Dec-2019	18-Dec-2019	30-May-2020	✓	18-Dec-2019	30-May-2020	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Snap Lock Bag (EG035-SDH)		02-Dec-2019	18-Dec-2019	30-Dec-2019	✓	18-Dec-2019	30-Dec-2019	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							
EG035T: Total Recoverable Mercury by FIMS								
Snap Lock Bag (EG035T-LL)		02-Dec-2019	16-Dec-2019	30-Dec-2019	✓	17-Dec-2019	30-Dec-2019	✓
PW1, PW3, PW5, QC01	PW2, PW4, PW6,							

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 Work Order : EP1912834
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Matrix: **SOIL**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG048: Hexavalent Chromium (Alkaline Digest)								
Snap Lock Bag (EG048G)		02-Dec-2019	11-Dec-2019	30-Dec-2019	✓	12-Dec-2019	18-Dec-2019	✓
PW1,	PW2,							
PW3,	PW4,							
PW5,	PW6,							
QC01								
EN82: Porewater Extraction								
Non-Volatile Leach: 14 day HT(e.g. SV organics) (EN82)		02-Dec-2019	09-Dec-2019	16-Dec-2019	✓	----	----	----
PW1,	PW2,							
PW3,	PW4,							
QC01								
Non-Volatile Leach: 14 day HT(e.g. SV organics) (EN82)		02-Dec-2019	11-Dec-2019	16-Dec-2019	✓	----	----	----
PW5,	PW6							
EP003: Total Organic Carbon (TOC) in Soil								
Snap Lock Bag (EP003)		02-Dec-2019	13-Dec-2019	30-Dec-2019	✓	13-Dec-2019	30-Dec-2019	✓
PW1,	PW2,							
PW3,	PW4,							
PW5,	PW6,							
QC01								

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) QC03	02-Dec-2019	05-Dec-2019	30-May-2020	✓	05-Dec-2019	30-May-2020	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC03	02-Dec-2019	----	----	----	05-Dec-2019	30-Dec-2019	✓



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)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SEM_1	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Acid Volatile Sulfides (AVS)	EA038-SEM	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	10	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	0	7	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SEM_1	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Acid Volatile Sulfides (AVS)	EA038-SEM	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SEM_1	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Acid Volatile Sulfides (AVS)	EA038-SEM	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Fe and Al in Sediments by ICPAES	EG005-SD	0	7	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard



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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
Analytical Methods		QC	Regular	Actual	Expected	Evaluation	
Matrix Spikes (MS) - Continued							
Total Metals in Sediments by ICPMS	EG020-SD	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard

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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
Analytical Methods		QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Total Mercury by FIMS	EG035T	1	9	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	16	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	16	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	16	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	16	6.25	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
Acid Volatile Sulfides (AVS)	EA038-SEM	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. AVS is defined as the fraction of sulfides extracted from sediments by cold digestion using HCl. The remaining solution is then run on the ICP to determine concentration of various metals and SEM is calculated as sum of Cd, Cu, Ni, Pb, Zn in mmol/kg.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 6.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Total Fe and Al in Sediments by ICPAES	EG005-SD	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NODG
1M HCl Extractable Metals	EG005-SDH	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined via ICPAES following weak acid extraction. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NAGD. ALS is not NATA accredited for the analysis of Barium, Boron, Molybdenum and Strontium by this method.
1M HCl Extractable Metals	EG005-SEM 1	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. AVS is defined as the fraction of sulfides extracted from sediments by cold digestion using HCl. The remaining solution is then run on the ICP to determine concentration of various metals and SEM is calculated as sum of Cd, Cu, Ni, Pb, Zn in mmol/kg.
Simultaneously Extractable Metals (SEM)	EG005-SEM 2	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. AVS is defined as the fraction of sulfides extracted from sediments by cold digestion using HCl. The remaining solution is then run on the ICP to determine concentration of various metals and SEM is calculated as sum of Cd, Cu, Ni, Pb, Zn in mmol/kg.
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	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. Analyte list and LORs per NODG.
1M HCl Extractable Metals by ICPMS	EG020-SDH	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020. Metals are determined via ICPMS following weak acid extraction. 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. Analyte list and LORs per NAGD. ALS is not NATA accredited for the analysis of Tin, Uranium, Barium, Boron and Strontium by this method.



Analytical Methods	Method	Matrix	Method Descriptions
1M HCl Extractable Mercury by FIMS	EG035-SDH	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B. Mercury is determined via FIMS following weak acid extraction. FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Alkaline Digestion and DA Finish	EG048G	SOIL	In house: Referenced to USEPA SW846, Method 3060A. Hexavalent chromium is extracted by alkaline digestion. The digest is determined by photometrically by automatic discrete analyser, following pH adjustment. The instrument uses colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO ₂) is automatically measured by infra-red 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.
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Alkaline digestion for Hexavalent Chromium	EG048PR	SOIL	In house: Referenced to USEPA SW846, Method 3060A.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house: Referenced to In house, Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
1M HCl Extraction for Metals in Sediments (1 hour)	EN71-SEM	SOIL	In house: Referenced to Simpson et al. 2005; Handbook for Sediment Quality Assessment. 2g of as received sample is leached at room temperature for 1 hour in 1N hydrochloric acid.
Porewater Extraction	EN82	SOIL	Extraction of porewater from sediment samples using centrifuge.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#

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Client : SENVERSA PTY LTD
Project : P17302 Bulong DSI



Preparation Methods	Method	Matrix	Method Descriptions
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 (2013) Schedule B(3)

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@servensa.com.au	Phone/Mobile:	+61 409 296 017

[illegible]

Environmental Division
Perth

Work Order Reference

EP1913434



Telephone : + 61-8-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples;	Sampler Name:	Signature:	Date:
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Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		Date:
Of:	Time:	Date/Time:	Of:		Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		Date:
Of:	Time:	Date/Time:	Of:		Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		Date:
Of:	Time:	Date/Time:	Of:		Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic;

V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;

F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's Iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Additional Leachate Analysis ALS

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9400 1301

Job Number:		P17302		Purchase Order:		
Project Name:		Bulong DSI		Quote No: EP-382-19 (V2)		
Sampled By:		Matthew Hunt / Brandon Henry		Turn Around Time:		
Project Manager:		Blair Coleman		Page: 1 of 1		
Email Report To:		blair.coleman@senversa.com.au		Phone/Mobile: +61 409 286 017		
Sample Information				Container Information		
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles
1	PW1	Sediment	2/12/2019	-	7 bags	0
2	PW2	Sediment	2/12/2019	-	7 bags	0
3	PW3	Sediment	2/12/2019	-	7 bags	0
4	PW4	Sediment	2/12/2019	-	7 bags	0
5	PW5	Sediment	2/12/2019	-	7 bags	0
6	PW6	Sediment	2/12/2019	-	7 bags	0
7	QC01	Sediment	2/12/2019	-	7 bags	0
8	QC02	Sediment	2/12/2019	-	7 bags	0
9	QC03	Water	2/12/2019	-	1 water	1
Total						1

Environmental Division
Perth

Work Order Reference:
EP1912834

Metals (Total)
Pb, Cu, Zn, Cd, Ni, Mn, Fe

Total metals by ICP/MS: Se, Co, Mn, Ni, Zn, Se, Cd, Ni, Mn, Fe

EG038-AVS-SEM: Add Volatile S (AVS) and Simultaneously Extract Metals (SEM)

EG020-SD: Total Metals in Sediment (ICP/MS (NODG); As, Cd, Cr, Cu, Se, Co, Mn)

EG005-SD: Total Metals in Sediment (ICP/MS (NODG); Fe)

EG035-SD: Mercury in Sediment (NODG-required Level of Reporting)

EG020-SDH: 1M HCl Extractable Sediments by ICP/MS: As, Cd, Cr, Cu, Ni, Zn, Se, Co, Mn

EG005-SDH: 1M HCl Extractable Sediments by FIMS

EG035-SDH: 1M HCl Extractable Sediments by FIMS

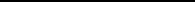
EP003: Total Organic Carbon (TOC)

EA150/HEA152: Particle Sizing w/ Hydrometer + Soil Particle Density

EG048G: Total Hexavalent Chromium (Alkaline digestion) by Discrete A

FWD to Eurofins

Environmental Division
Perth
Work Order Reference
EP1912834

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:	Sampler Name: Matthew Hunt / Brandon Henry	Signature: 	Date: 2/12/2019
---	--	--	-----------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature: <i>Matt Hunt</i>	Date: <i>3/12</i>	Carrier / Reference #:	Name/Signature: <i>NY</i>	Date: <i>4/12/19</i>	
Of: <i>Severs</i>	Time: <i>FBC</i>	Date/Time:	Of: <i>NY</i>	Time: <i>8:45</i>	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Fumaliphyslo Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Rbtlles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Luoof's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913434

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler :</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 2</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 04-Dec-2019 08:45	Issue Date : 17-Dec-2019
Client Requested Due Date : 24-Dec-2019	Scheduled Reporting Date : 24-Dec-2019

Delivery Details

Mode of Delivery : Samples On Hand	Security Seal : Not Available
No. of coolers/boxes : ----	Temperature : ----
Receipt Detail :	No. of samples received / analysed : 7 / 7

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EG020W Water Leachable Metals by ICPMS	SOIL - EG050G-W Hexavalent Chromium in Leachate	SOIL - EN60-Dia Deionised Water Leach	SOIL - W-02W (ICPMS) 8 Metals (Water Leachable) ICPMS & FIMS
EP1913434-001	02-Dec-2019 00:00	PW1	✓	✓	✓	✓
EP1913434-002	02-Dec-2019 00:00	PW2	✓	✓	✓	✓
EP1913434-003	02-Dec-2019 00:00	PW3	✓	✓	✓	✓
EP1913434-004	02-Dec-2019 00:00	PW4	✓	✓	✓	✓
EP1913434-005	02-Dec-2019 00:00	PW5	✓	✓	✓	✓
EP1913434-006	02-Dec-2019 00:00	PW6	✓	✓	✓	✓
EP1913434-007	02-Dec-2019 00:00	QC01	✓	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : **EP1913434**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **----**
Site : **----**
Quote number : **EP/382/19 V2**
No. of samples received : **7**
No. of samples analysed : **7**

Page : 1 of 6
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1307
Date Samples Received : 04-Dec-2019 08:45
Date Analysis Commenced : 19-Dec-2019
Issue Date : 27-Dec-2019 11:51



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913434-001	EP1913434-002	EP1913434-003	EP1913434-004	EP1913434-005
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.002	0.003	0.002	0.002
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
Cobalt	7440-48-4	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	0.002	0.001	0.002
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	<0.001	0.016	0.002	0.009	0.005
Nickel	7440-02-0	0.001	mg/L	<0.001	0.010	0.051	0.036	0.031
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	<0.005	0.008	<0.005	<0.005	<0.005
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01



Analytical Results

Sub-Matrix: DI WATER LEACHATE
 (Matrix: WATER)

Client sample ID

				PW6	QC01	----	----	----
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EP1913434-006	EP1913434-007	-----	-----	-----
				Result	Result	----	----	----
EG020W: Water Leachable Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	<0.001	0.024	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	0.006	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	0.011	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----
EG035W: Water Leachable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EG050G-W: Hexavalent Chromium - Water Leachable								
Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	----	----	----



Analytical Results

Sub-Matrix: **SOIL**
 (Matrix: **SOIL**)

Client sample ID

				PW1	PW2	PW3	PW4	PW5
Client sampling date / time				02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913434-001	EP1913434-002	EP1913434-003	EP1913434-004	EP1913434-005
				Result	Result	Result	Result	Result
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	6.2	6.1	6.3	6.4	6.4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	PW6	QC01	----	----	----
Client sampling date / time					02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1913434-006	EP1913434-007	-----	-----	-----
					Result	Result	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		8.4	7.7	----	----	----

QUALITY CONTROL REPORT

Work Order	: EP1913434	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Order number	: ----	Date Analysis Commenced	: 19-Dec-2019
C-O-C number	: ----	Issue Date	: 27-Dec-2019
Sampler	: ----		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 7		
No. of samples analysed	: 7		



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. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 2779442)									
EP1913252-003	Anonymous	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.003	0.004	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EG020A-W: Iron	7439-89-6	0.05	mg/L	0.08	0.06	25.9	No Limit		
EG035W: Water Leachable Mercury by FIMS (QC Lot: 2779455)									
EP1913409-005	Anonymous	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913434-007	QC01	EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG050G-W: Hexavalent Chromium - Water Leachable (QC Lot: 2782806)									
EP1913280-001	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913434-002	PW2	EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	<0.01	0.00	No Limit

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 Spike (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 Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)								
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	109	88.8	117
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	103	89.5	114
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.4	88.4	111
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	100	87.1	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	99.8	84.4	113
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	86.7	111
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.0	88.4	114
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	99.8	86.5	114
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	97.9	87.8	120
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	108	83.5	120
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	100	87.9	117
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)								
EG035W: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.2	88.7	113
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782806)								
EG050G-W: Hexavalent Chromium	18540-29-9	0.01	mg/L	<0.01	0.5 mg/L	102	93.0	115

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

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 2779442)							
EP1913434-001	PW1	EG020A-W: Arsenic	7440-38-2	1 mg/L	127	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	117	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	96.9	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	109	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	106	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	106	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	111	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	124	70.0	130
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455)							



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035W: Water Leachable Mercury by FIMS (QCLot: 2779455) - continued							
EP1913434-002	PW2	EG035W: Mercury	7439-97-6	0.01 mg/L	99.6	70.0	130
EG050G-W: Hexavalent Chromium - Water Leachable (QCLot: 2782806)							
EP1913280-002	Anonymous	EG050G-W: Hexavalent Chromium	18540-29-9	0.5 mg/L	102	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913434	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 04-Dec-2019
Site	: ----	Issue Date	: 27-Dec-2019
Sampler	: ----	No. of samples received	: 7
Order number	: ----	No. of samples analysed	: 7

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-D1a)		02-Dec-2019	19-Dec-2019	30-Dec-2019	✔	----	----
PW1,	PW2,						
PW3,	PW4,						
PW5,	PW6,						
QC01							

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG020W: Water Leachable Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-W) PW1, PW3, PW5, QC01	PW2, PW4, PW6,	19-Dec-2019	23-Dec-2019	16-Jun-2020	✔	23-Dec-2019	16-Jun-2020	✔
EG035W: Water Leachable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035W) PW1, PW3, PW5, QC01	PW2, PW4, PW6,	19-Dec-2019	----	----	----	20-Dec-2019	16-Jan-2020	✔
EG050G-W: Hexavalent Chromium - Water Leachable								
Clear Plastic Bottle - NaOH (EG050G-W) PW1, PW3, PW5, QC01	PW2, PW4, PW6,	19-Dec-2019	----	----	----	23-Dec-2019	16-Jan-2020	✔



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)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	2	15	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	2	11	18.18	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Mercury by FIMS	EG035W	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	8	12.50	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
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, 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.
Water Leachable Mercury by FIMS	EG035W	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 TCLP solution. The ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Hexavalent Chromium by Discrete Analyser - Water Leachable	EG050G-W	SOIL	In house: Referenced to APHA 3500 Cr-A & B. Hexavalent chromium is determined directly on pH adjusted water leachate samples by Discrete Analyser and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	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 (2013) Schedule B(3)
Deionised Water Leach	EN60-D1a	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigoli Way, Wangara, WA 8065
Contact: Lauren Blagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt/Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

Sample Information				Container Information			Analysis Required										Comments: e.g. Highly contaminated sample, hazardous materials present, trace LORs etc.
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	Total Hardness as CaCO3	pH (PCT)	Total Nitrogen + NO2 + NO3 + NH3	Dissolved Mercury - Low Level	Cs, Mg, Na, K, Cl, SO4, Alkalinity	Total Cyanide by Segmented Flow Anal	8 metals (Total): As, Cd, Cr, Cu, Pb, Ni, Fe	Total Metals by ICP/MS: Se, Co, Mn, F, B			
1	MW1	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
2	MW2	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
3	MW3	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
4	MW4	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
5	MW5	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
6	QC15	Water	3/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*			
7	QC16	Water	8/12/2019	-	1N	1	X	X	X	X	X	X	*	*			
Total						25	7	7	7	7	7	7	7	7			

*please forward NMI bottles to NMI for metals analysis

Environmental Division
Perth
Work Order Reference
EP1913212



Telephone : + 61-6-9406 1301

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project	Sampler Name:	Matthew Hunt/ Brandon Henry	Signature:	Date:	2/12/2019
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Relinquished By:	Date:	Method of Shipment (if applicable):	Received by:	Date:
Name/Signature:	Time:	Carrier / Reference #:	Name/Signature:	Time:
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:
Of:	Time:	Date/Time:	Of:	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:
Of:	Time:	Date/Time:	Of:	Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; SH1 = Sodium thiosulfate preserved plastic;
V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

**SAMPLE RECEIPT NOTIFICATION (SRN)****Work Order : EP1913212****Amendment : 1**

Client : SENVERSA PTY LTD
Contact : Blaire Coleman
**Address : LEVEL 25, 108 ST GEORGES
TERRACE
PERTH 6000**

Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
**Address : 26 Rigali Way Wangara WA Australia
6065**

E-mail : blaire.coleman@senversa.com.au
Telephone : +61 08 6557 8881
Facsimile : +61 03 9606 0074

E-mail : Lauren.biagioni@alsglobal.com
Telephone : 08 9406 1307
Facsimile : +61-8-9406 1399

Project : P17302 Bulong DSI
Order number : ----
C-O-C number : ----
Site : ----
Sampler : Matthew Hunt/Brandon Henry

Page : 1 of 3
Quote number : EP2019SENV0005 (EP/382/19 V3)
QC Level : NEPM 2013 B3 & ALS QC Standard

Dates

Date Samples Received : 12-Dec-2019 08:00
Client Requested Due : 19-Dec-2019
Date

Issue Date : 02-Apr-2020
Scheduled Reporting Date : 19-Dec-2019

Delivery Details

Mode of Delivery : Carrier
No. of coolers/boxes : 8
Receipt Detail :

Security Seal : Not Available
Temperature : 20.2 - Ice present
No. of samples received / analysed : 7 / 7

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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.

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

- No sample container / preservation non-compliance exists.

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.

Matrix: WATER

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER pH (PCT)	WATER Total Hg	WATER Dissolved	WATER Total Me	WATER Total Cy	WATER Ca, Mg	WATER Total Ni
EP1913212-001	09-Dec-2019 00:00	MW1	✓	✓	✓		✓	✓	✓
EP1913212-002	09-Dec-2019 00:00	MW2	✓	✓	✓		✓	✓	✓
EP1913212-003	09-Dec-2019 00:00	MW3	✓	✓	✓		✓	✓	✓
EP1913212-004	09-Dec-2019 00:00	MW4	✓	✓	✓		✓	✓	✓
EP1913212-005	09-Dec-2019 00:00	MW5	✓	✓	✓		✓	✓	✓
EP1913212-006	10-Dec-2019 00:00	QC15	✓	✓		✓	✓	✓	✓
EP1913212-007	10-Dec-2019 00:00	QC16				✓			

Matrix: WATER

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER Total Metals	WATER 8 metals
EP1913212-007	10-Dec-2019 00:00	QC16	✓	✓

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	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EA005-P: pH by PC Titrator							
MW1	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW2	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW3	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW4	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
MW5	Clear Plastic Bottle - Natural	----	09-Dec-2019	12-Dec-2019	✗	----	----
QC15	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
EK057G: Nitrite as N by Discrete Analyser							

Issue Date : 02-Apr-2020
Page : 3 of 3
Work Order : EP1913212 Amendment 1
Client : SENVERSA PTY LTD



MW1	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW2	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW3	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW4	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----
MW5	Clear Plastic Bottle - Natural	----	11-Dec-2019	12-Dec-2019	✗	----	----

Requested Deliverables

Blaire Coleman

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

Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.au
u

CERTIFICATE OF ANALYSIS

Work Order : EP1913212 Amendment : 1 Client : SENVERSA PTY LTD Contact : Blaire Coleman Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000 Telephone : +61 08 6557 8881 Project : P17302 Bulong DSI Order number : ---- C-O-C number : ---- Sampler : Matthew Hunt/Brandon Henry Site : ---- Quote number : EP/382/19 V3 No. of samples received : 7 No. of samples analysed : 7	Page : 1 of 6 Laboratory : Environmental Division Perth Contact : Lauren Biagioni Address : 26 Rigali Way Wangara WA Australia 6065 Telephone : 08 9406 1307 Date Samples Received : 12-Dec-2019 08:00 Date Analysis Commenced : 12-Dec-2019 Issue Date : 02-Apr-2020 15:36
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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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Amendment (02/04/2020): This report has been amended and re-released to alter the sampling dates. All analysis results are as per the previous report.
- EK028SF; LOR raised for cyanide on particular samples due to possible sample matrix interference.
- EG035F-LL (Dissolved Mercury): LOR raised for EP1913212-1, 2, 3 and 4 due to high TDS content.
- EK061G/EK067G (TKN/TP): LOR for sample EP1913212-001 raised due to the high amount of TDS present.
- EK061G/EK067G (TKN/TP): LOR for sample EP1913212-006 raised due to the high amount of NOx present.
- It is recognised that Total Kjeldahl Nitrogen (EK061G) is less than Ammonia (EK055G) for sample EP1913212-004. However, the difference is within experimental variation of the methods.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Ionic balances were calculated using: major anions - chloride, alkalinity, sulfate and NOx; and major cations - calcium, magnesium, potassium and sodium for #6.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW1	MW2	MW3	MW4	MW5
Client sampling date / time					09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913212-001	EP1913212-002	EP1913212-003	EP1913212-004	EP1913212-005
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.18	7.27	7.14	6.83	7.15
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		18200	13100	18000	31700	9780
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		114	158	121	242	770
Total Alkalinity as CaCO3	----	1	mg/L		114	158	121	242	770
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		5580	4130	5240	18400	3990
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		60000	36100	48300	60000	21200
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		926	694	559	865	340
Magnesium	7439-95-4	1	mg/L		3860	2760	4040	7180	2170
Sodium	7440-23-5	1	mg/L		39600	23200	30800	42100	14500
Potassium	7440-09-7	1	mg/L		310	115	153	345	134
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L		<0.00020	<0.00008	<0.00008	<0.00008	<0.00004
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.040	<0.040	<0.040	<0.040	<0.040
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.11	0.11	0.18	276	0.22
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	0.05	0.10	0.99	0.07
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.40	2.55	5.97	39.7	1.57
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.40	2.60	6.07	40.7	1.64
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.5	0.8	1.5	264	0.6
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		<0.5	3.4	7.6	305	2.2



Analytical Results

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

Client sample ID

				MW1	MW2	MW3	MW4	MW5
Client sampling date / time				09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00	09-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913212-001	EP1913212-002	EP1913212-003	EP1913212-004	EP1913212-005
				Result	Result	Result	Result	Result
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	1810	1110	1470	2080	696
∅ Total Cations	----	0.01	meq/L	2090	1270	1700	2470	830
∅ Ionic Balance	----	0.01	%	7.26	6.99	7.24	8.64	8.73

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC15	QC16	----	----	----
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EP1913212-006	EP1913212-007	-----	-----	-----	
				Result	Result	----	----	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	6.75	----	----	----	----	
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L	16	----	----	----	----	
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	5	----	----	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	5	----	----	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	----	----	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	40	----	----	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----	
Magnesium	7439-95-4	1	mg/L	4	----	----	----	----	
Sodium	7440-23-5	1	mg/L	40	----	----	----	----	
Potassium	7440-09-7	1	mg/L	1	----	----	----	----	
EG020T: Total Metals by ICP-MS									
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	----	----	----	
Cobalt	7440-48-4	0.001	mg/L	----	<0.001	----	----	----	
Nickel	7440-02-0	0.001	mg/L	----	<0.001	----	----	----	
Lead	7439-92-1	0.001	mg/L	----	<0.001	----	----	----	
Zinc	7440-66-6	0.005	mg/L	----	<0.005	----	----	----	
Manganese	7439-96-5	0.001	mg/L	----	<0.001	----	----	----	
Selenium	7782-49-2	0.01	mg/L	----	<0.01	----	----	----	
Iron	7439-89-6	0.05	mg/L	----	<0.05	----	----	----	
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L	<0.00004	----	----	----	----	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	----	<0.0001	----	----	----	
EK026SF: Total CN by Segmented Flow Analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC15	QC16	----	----	----
Client sampling date / time					10-Dec-2019 00:00	10-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EP1913212-006	EP1913212-007	-----	-----	-----
					Result	Result	----	----	----
EK026SF: Total CN by Segmented Flow Analyser - Continued									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.02	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		6.61	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		6.61	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.5	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		6.6	----	----	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		1.87	----	----	----	----
∅ Total Cations	----	0.01	meq/L		2.09	----	----	----	----
∅ Ionic Balance	----	0.01	%		5.75	----	----	----	----

QUALITY CONTROL REPORT

Work Order : **EP1913212**

Page : 1 of 7

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Perth

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 26 Rigali Way Wangara WA Australia 6065

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 12-Dec-2019

Order number : ----

Date Analysis Commenced : 12-Dec-2019

C-O-C number : ----

Issue Date : 02-Apr-2020

Sampler : Matthew Hunt/Brandon Henry

Site : ----

Quote number : EP/382/19 V3

No. of samples received : 7

No. of samples analysed : 7



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. 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
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Titrator (QC Lot: 2776014)									
EP1913212-002	MW2	EA005-P: pH Value	----	0.01	pH Unit	7.27	7.27	0.00	0% - 20%
EP1913213-005	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.69	6.68	0.150	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2776015)									
EP1913212-002	MW2	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	158	158	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	158	158	0.00	0% - 20%
EP1913213-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	16	16	0.00	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	16	0.00	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2762197)									
EP1913212-002	MW2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4130	3650	12.4	0% - 20%
EP1913213-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10500	10200	3.23	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2762198)									
EP1913212-002	MW2	ED045G: Chloride	16887-00-6	1	mg/L	36100	37200	2.99	0% - 20%
EP1913213-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	116000	114000	1.68	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2763610)									
EP1913212-001	MW1	ED093F: Calcium	7440-70-2	1	mg/L	926	955	3.06	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	3860	4020	4.03	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	39600	41000	3.47	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	310	327	5.53	0% - 20%
EP1913213-005	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	1290	1250	3.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	8340	8140	2.44	0% - 20%



Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 2763610) - continued									
EP1913213-005	Anonymous	ED093F: Sodium	7440-23-5	1	mg/L	90500	88400	2.37	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	418	408	2.26	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 2771255)									
EP1913212-007	QC16	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EP1913322-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.876	0.886	1.15	0% - 20%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.011	0.010	13.1	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.310	0.316	1.68	0% - 20%
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.471	0.474	0.622	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	3.06	3.09	1.02	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	6.05	6.38	5.36	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.028	0.030	5.07	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	82.1	84.5	2.89	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	0.06	0.06	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.25	<0.25	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2764162)									
EP1912987-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EP1913161-005	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Mercury by FIMS (QC Lot: 2764312)									
EP1913212-006	QC15	EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2771249)									
EP1913213-009	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913322-003	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2764069)									
EP1913212-001	MW1	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EP1913213-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762211)									
EP1913212-002	MW2	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.11	0.10	14.1	0% - 50%
EP1913213-005	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	51.6	50.1	3.03	0% - 20%

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 Work Order : EP1913212 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196)									
EP1913212-002	MW2	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.05	0.05	0.00	No Limit
EP1913213-005	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2762212)									
EP1913212-002	MW2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.60	2.57	1.14	0% - 20%
EP1913213-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	31.7	32.5	2.62	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768184)									
EP1913195-012	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	392	404	2.98	0% - 20%
EP1913322-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	4.4	4.4	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 2776014)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98.5	102
				----	7 pH Unit	100	98.5	102
ED037P: Alkalinity by PC Titrator (QCLot: 2776015)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	103	81.2	126
				<1	200 mg/L	97.7	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.2	87.7	113
				<1	100 mg/L	102	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.6	87.9	114
				<1	1000 mg/L	97.3	87.9	114
ED093F: Dissolved Major Cations (QCLot: 2763610)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.6	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	105	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	105	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	106	89.7	108
EG020T: Total Metals by ICP-MS (QCLot: 2771255)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.3	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.0	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	96.5	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.7	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.3	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	103	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	89.9	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.3	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	97.0	87.1	120
EG035F: Dissolved Mercury by FIMS (QCLot: 2764162)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	103	87.6	115



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG035T: Total Mercury by FIMS (QCLot: 2764312)								
EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	99.1	89.0	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.7	85.1	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	105	75.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	95.8	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.5	93.7	108
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768184)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	80.3	75.8	100

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)							
EP1913212-001	MW1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)							
EP1913212-001	MW1	ED045G: Chloride	16887-00-6	1000 mg/L	# Not Determined	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 2771255)							
EP1913213-006	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	99.7	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	109	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	108	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	103	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	107	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	110	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	109	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	105	70.0	130



Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 2764162)							
EP1913160-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.01 mg/L	113	70.0	130
EG035T: Total Mercury by FIMS (QCLot: 2764312)							
EP1913212-007	QC16	EG035T-LL: Mercury	7439-97-6	0.01 mg/L	118	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)							
EP1913284-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	97.4	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)							
EP1913212-002	MW2	EK026SF: Total Cyanide	57-12-5	2 mg/L	96.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)							
EP1913212-001	MW1	EK055G: Ammonia as N	7664-41-7	1 mg/L	129	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)							
EP1913212-001	MW1	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	96.5	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)							
EP1913212-001	MW1	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	79.3	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768184)							
EP1913195-012	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	# Not Determined	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913212	Page	: 1 of 8
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 02-Apr-2020
Sampler	: Matthew Hunt/Brandon Henry	No. of samples received	: 7
Order number	: ----	No. of samples analysed	: 7

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : 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							
ED041G: Sulfate (Turbidimetric) as SO ₄ 2- by DA	EP1913212--001	MW1	Sulfate as SO ₄ - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	EP1913212--001	MW1	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser	EP1913195--012	Anonymous	Total Kjeldahl Nitrogen as N	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
MW1, MW3, MW5	MW2, MW4,	----	----	----	19-Dec-2019	09-Dec-2019	10
Clear Plastic Bottle - Natural							
QC15		----	----	----	19-Dec-2019	10-Dec-2019	9
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
MW1, MW3, MW5	MW2, MW4,	----	----	----	12-Dec-2019	11-Dec-2019	1

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P)								
MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	19-Dec-2019	09-Dec-2019	✘
Clear Plastic Bottle - Natural (EA005-P)								
QC15		10-Dec-2019	----	----	----	19-Dec-2019	10-Dec-2019	✘
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	19-Dec-2019	23-Dec-2019	✔
Clear Plastic Bottle - Natural (ED037-P)								
QC15		10-Dec-2019	----	----	----	19-Dec-2019	24-Dec-2019	✔
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✔
Clear Plastic Bottle - Natural (ED041G)								
QC15		10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✔
Clear Plastic Bottle - Natural (ED045G)								
QC15		10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F)								
MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	17-Dec-2019	06-Jan-2020	✔
Clear Plastic Bottle - Natural (ED093F)								
QC15		10-Dec-2019	----	----	----	17-Dec-2019	17-Dec-2019	✔
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T)								
QC16		10-Dec-2019	17-Dec-2019	07-Jun-2020	✔	17-Dec-2019	07-Jun-2020	✔
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F-LL)								
MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	13-Dec-2019	06-Jan-2020	✔



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035T: Total Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T-LL) QC15		10-Dec-2019	----	----	----	13-Dec-2019	07-Jan-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC16		10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
White Plastic Bottle-NaOH (EK026SF) MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	13-Dec-2019	23-Dec-2019	✓
White Plastic Bottle-NaOH (EK026SF) QC15		10-Dec-2019	----	----	----	13-Dec-2019	24-Dec-2019	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) QC15		10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	12-Dec-2019	11-Dec-2019	✗
Clear Plastic Bottle - Natural (EK057G) QC15		10-Dec-2019	----	----	----	12-Dec-2019	12-Dec-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	----	----	----	12-Dec-2019	06-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) QC15		10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) MW1, MW3, MW5	MW2, MW4,	09-Dec-2019	18-Dec-2019	06-Jan-2020	✓	18-Dec-2019	06-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) QC15		10-Dec-2019	18-Dec-2019	07-Jan-2020	✓	18-Dec-2019	07-Jan-2020	✓



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 PC Titrator	ED037-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	15	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 PC Titrator	ED037-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Alkalinity by PC Titrator	ED037-P	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	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	
Method Blanks (MB) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 by PC 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 (2013) Schedule B(3)
Hardness as CaCO ₃	EA065	WATER	In house: Referenced to APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ ²⁻ by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ ²⁻ concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS - Low Level	EG035T-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO ₂ - B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO _x) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Combined oxidised Nitrogen (NO ₂ +NO ₃) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO ₃ -. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) Schedule B(3)



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ABN 89 132 231 380

Chain of Custody Documentation

Laboratory: ALS WA
Address: 28 Rigall Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Information						Analysis Required										
Job Number: P17302			Purchase Order:			Analysis Required										
Project Name: Bulong DSI			Quote No: EP-382-19 (V2)			Analysis Required										
Sampled By: Matthew Hunt/Brandon Henry			Turn Around Time: Standard			Analysis Required										
Project Manager: Blaire Coleman			Page: of			Analysis Required										
Email Report To: blaire.coleman@senversa.com.au			Phone/Mobile: +61 409 296 017			Analysis Required										
Sample Information					Container Information		Analysis Required									
Lab ID	Sample ID	Matrix *	Date	Time	Type / Code	Total Bottles	Total Hardness as CaCO3	pH (PCT)	Total Nitrogen + NO2 + NO3 + NH3	Dissolved Mercury - Low Level	Ca, Mg, Na, K, Cl, SO4, Alkalinity	Total Cyanide by Segmented Flow Analyser	8 metals (Total): As, Cd, Cr, Cu, Pb, Ni, Zn, Hg	Total Metals by ICP/MS: Se, Co, Mn, Fe	Comments: e.g. Highly contaminated sample, hazardous materials present, trace LORs etc.	
1	BMH01	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
2	BMH02A	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
3	BMH04	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
4	BMH08	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
5	BMH11A	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
6	QC06	Water	8/12/2019	-	1N	1	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
7	QC07	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
8	QC08	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	FWD to Eurofins	
9	QC13	Water	8/12/2019	-	1N, 1P, 1 preserved, 1 cya	4	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
9	QC14	Water	8/12/2019	-	1N	1	X	X	X	X	X	X	*	*	*Fwd to NMI for metals analysis	
Total						34	10	10	10	10	10	10				

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name: Matthew Hunt/ Brandon Henry Signature:

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's Iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Environmental Division
Perth
Work Order Reference
EP1913213



Telephone : +61-8-9406 1301

2/12/2019

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913213

Amendment : 1

Client : **SENVERSA PTY LTD**
 Contact : Blaire Coleman
 Address : LEVEL 25, 108 ST GEORGES
 TERRACE
 PERTH 6000

Laboratory : Environmental Division Perth
 Contact : Lauren Biagioni
 Address : 26 Rigali Way Wangara WA Australia
 6065

E-mail : blaire.coleman@senversa.com.au
 Telephone : +61 08 6557 8881
 Facsimile : +61 03 9606 0074

E-mail : Lauren.biagioni@alsglobal.com
 Telephone : 08 9406 1307
 Facsimile : +61-8-9406 1399

Project : P17302 Bulong DSI
 Order number : ----
 C-O-C number : ----
 Site : ----
 Sampler : Matthew Hunt/Brandon Henry

Page : 1 of 3
 Quote number : EP2019SENVVER0005 (EP/382/19 V3)
 QC Level : NEPM 2013 B3 & ALS QC Standard

Dates

Date Samples Received : 12-Dec-2019 08:00
 Client Requested Due : 19-Dec-2019
 Date

Issue Date : 02-Apr-2020
 Scheduled Reporting Date : **19-Dec-2019**

Delivery Details

Mode of Delivery : Carrier
 No. of coolers/boxes : 8
 Receipt Detail :

Security Seal : Not Available
 Temperature : 20.2 - Ice present
 No. of samples received / analysed : 9 / 9

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 see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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	Client sampling date / time	Client sample ID	WATER - EA005P pH (PCT)	WATER - EA065 Total Hardness as CaCO3	WATER - EG035F-LL Dissolved Mercury - Low Level	WATER - EG035T-LL Total Mercury - Low Level	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-07 Total Nitrogen + NO2 + NO3 + NH3
EP1913213-001	08-Dec-2019 00:00	BMH01	✓	✓	✓		✓	✓	✓
EP1913213-002	08-Dec-2019 00:00	BMH02A	✓	✓	✓		✓	✓	✓
EP1913213-003	08-Dec-2019 00:00	BMH04	✓	✓	✓		✓	✓	✓
EP1913213-004	08-Dec-2019 00:00	BMH08	✓	✓	✓		✓	✓	✓
EP1913213-005	08-Dec-2019 00:00	BMH11A	✓	✓	✓		✓	✓	✓
EP1913213-006	10-Dec-2019 00:00	QC06				✓			
EP1913213-007	10-Dec-2019 00:00	QC07	✓	✓	✓	✓	✓	✓	✓
EP1913213-008	10-Dec-2019 00:00	QC13	✓	✓		✓	✓	✓	✓
EP1913213-009	10-Dec-2019 00:00	QC14				✓			

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020T Total Metals by ICP/MS (including digestion)	WATER - W-02T 8 metals (Total)
EP1913213-006	10-Dec-2019 00:00	QC06	✓	✓
EP1913213-009	10-Dec-2019 00:00	QC14	✓	✓

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		Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
Client Sample ID(s)	Container						
EA005-P: pH by PC Titrator							
BMH01	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
BMH02A	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
BMH04	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
BMH08	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----

Issue Date : 02-Apr-2020
Page : 3 of 3
Work Order : EP1913213 Amendment 1
Client : SENVERSA PTY LTD



BMH11A	Clear Plastic Bottle - Natural	----	08-Dec-2019	12-Dec-2019	✗	----	----
QC07	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
QC13	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
EK057G: Nitrite as N by Discrete Analyser							
BMH01	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH02A	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH04	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH08	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----
BMH11A	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----	----

Requested Deliverables

Blaire Coleman

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

Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.au

CERTIFICATE OF ANALYSIS

Work Order : EP1913213 Amendment : 1 Client : SENVERSA PTY LTD Contact : Blaire Coleman Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000 Telephone : +61 08 6557 8881 Project : P17302 Bulong DSI Order number : ---- C-O-C number : ---- Sampler : Matthew Hunt/Brandon Henry Site : ---- Quote number : EP/382/19 V3 No. of samples received : 9 No. of samples analysed : 9	Page : 1 of 6 Laboratory : Environmental Division Perth Contact : Lauren Biagioni Address : 26 Rigali Way Wangara WA Australia 6065 Telephone : 08 9406 1307 Date Samples Received : 12-Dec-2019 08:00 Date Analysis Commenced : 12-Dec-2019 Issue Date : 02-Apr-2020 16:13
--	--



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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Amendment (02/04/2020): This report has been amended and re-released to alter the sampling dates. All analysis results are as per the previous report.
- EK028SF; LOR raised for cyanide on particular samples due to possible sample matrix interference.
- EG35F-LL (Dissolved Mercury): LOR was raised for sample #1, 2, 3, 4, 5 and 7 due to high TDS content.
- Ionic Balance out of acceptable limits for sample #2, #3, #4, #5 and #7 due to analytes not quantified in this report. Major anions (ED041/45G) and major cations (ED093F) confirmed by re-preparation and re-analysis.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	BMH01	BMH02A	BMH04	BMH08	BMH11A
Client sampling date / time					08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EP1913213-001	EP1913213-002	EP1913213-003	EP1913213-004	EP1913213-005
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		5.76	6.63	7.12	7.01	6.69
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		17500	46200	22900	32200	37600
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		2	194	34	38	16
Total Alkalinity as CaCO3	----	1	mg/L		2	194	34	38	16
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		5320	26300	4750	6520	10500
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		47400	65600	57000	91700	116000
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		1210	694	1140	959	1290
Magnesium	7439-95-4	1	mg/L		3510	10800	4870	7240	8340
Sodium	7440-23-5	1	mg/L		32300	49700	39500	74300	90500
Potassium	7440-09-7	1	mg/L		104	247	104	344	418
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.040	<0.040	<0.040	<0.040	<0.040
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.15	1100	0.47	0.15	51.6
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	0.31	<0.01	<0.01	0.02
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.45	17.1	17.4	13.8	31.7
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.45	17.4	17.4	13.8	31.7
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.4	1140	4.0	1.4	52.9
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.8	1160	21.4	15.2	84.6



Analytical Results

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

Client sample ID

				BMH01	BMH02A	BMH04	BMH08	BMH11A
Client sampling date / time				08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913213-001	EP1913213-002	EP1913213-003	EP1913213-004	EP1913213-005
				Result	Result	Result	Result	Result
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	1450	2400	1710	2720	3490
∅ Total Cations	----	0.01	meq/L	1760	3090	2180	3880	4700
∅ Ionic Balance	----	0.01	%	9.64	12.6	12.1	17.6	14.7

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC06	QC07	QC13	QC14	----
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	----	
Compound	CAS Number	LOR	Unit	EP1913213-006	EP1913213-007	EP1913213-008	EP1913213-009	-----	
				Result	Result	Result	Result	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	----	6.67	5.89	----	----	
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L	----	46200	<1	----	----	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	<1	<1	----	----	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	<1	<1	----	----	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	199	<1	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	----	199	<1	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	27400	<1	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	----	66200	<1	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	----	692	<1	----	----	
Magnesium	7439-95-4	1	mg/L	----	10800	<1	----	----	
Sodium	7440-23-5	1	mg/L	----	50600	<1	----	----	
Potassium	7440-09-7	1	mg/L	----	256	<1	----	----	
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	<0.001	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	<0.0001	----	
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	<0.001	----	
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	<0.001	----	
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	<0.001	----	
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	<0.001	----	
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	<0.001	----	
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	<0.005	----	
Manganese	7439-96-5	0.001	mg/L	<0.001	----	----	<0.001	----	
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	<0.01	----	
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	<0.05	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L	----	<0.00020	----	----	----	
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.00004	mg/L	----	----	<0.00004	----	----	
EG035T: Total Recoverable Mercury by FIMS									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC06	QC07	QC13	QC14	----
Client sampling date / time					10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	----
Compound	CAS Number	LOR	Unit		EP1913213-006	EP1913213-007	EP1913213-008	EP1913213-009	-----
					Result	Result	Result	Result	----
EG035T: Total Recoverable Mercury by FIMS - Continued									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	<0.0001	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		----	<0.040	<0.004	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	1060	<0.01	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		----	0.22	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	16.9	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	17.1	<0.01	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	1120	<0.1	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		----	1140	<0.1	----	----
EN055: Ionic Balance									
∅ Total Anions	----	0.01	meq/L		----	2440	<0.01	----	----
∅ Total Cations	----	0.01	meq/L		----	3130	<0.01	----	----
∅ Ionic Balance	----	0.01	%		----	12.4	----	----	----

QUALITY CONTROL REPORT

Work Order : **EP1913213**

Page : 1 of 7

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Perth

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 26 Rigali Way Wangara WA Australia 6065

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 12-Dec-2019

Order number : ----

Date Analysis Commenced : 12-Dec-2019

C-O-C number : ----

Issue Date : 02-Apr-2020

Sampler : Matthew Hunt/Brandon Henry

Site : ----

Quote number : EP/382/19 V3

No. of samples received : 9

No. of samples analysed : 9



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. 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

Canhuang Ke

Inorganics Supervisor

Perth Inorganics, Wangara, WA

Chris Lemaitre

Laboratory Manager (Perth)

Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Titrator (QC Lot: 2776014)									
EP1913212-002	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.27	7.27	0.00	0% - 20%
EP1913213-005	BMH11A	EA005-P: pH Value	----	0.01	pH Unit	6.69	6.68	0.150	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2776015)									
EP1913212-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	158	158	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	158	158	0.00	0% - 20%
EP1913213-005	BMH11A	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	16	16	0.00	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	16	0.00	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2762197)									
EP1913212-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4130	3650	12.4	0% - 20%
EP1913213-005	BMH11A	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10500	10200	3.23	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2762198)									
EP1913212-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	36100	37200	2.99	0% - 20%
EP1913213-005	BMH11A	ED045G: Chloride	16887-00-6	1	mg/L	116000	114000	1.68	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2763610)									
EP1913212-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	926	955	3.06	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	3860	4020	4.03	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	39600	41000	3.47	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	310	327	5.53	0% - 20%
EP1913213-005	BMH11A	ED093F: Calcium	7440-70-2	1	mg/L	1290	1250	3.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	8340	8140	2.44	0% - 20%

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 2763610) - continued									
EP1913213-005	BMH11A	ED093F: Sodium	7440-23-5	1	mg/L	90500	88400	2.37	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	418	408	2.26	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 2771255)									
EP1913212-007	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1913322-001	Anonymous	EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.876	0.886	1.15	0% - 20%
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.011	0.010	13.1	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.310	0.316	1.68	0% - 20%
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.471	0.474	0.622	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	3.06	3.09	1.02	0% - 20%
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	6.05	6.38	5.36	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.028	0.030	5.07	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	82.1	84.5	2.89	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	0.06	0.06	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.25	<0.25	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2764163)									
EP1913213-001	BMH01	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00020	<0.00020	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2767899)									
EP1913265-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EP1913265-007	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Mercury by FIMS (QC Lot: 2764312)									
EP1913212-006	Anonymous	EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2771249)									
EP1913213-009	QC14	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913322-003	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2764069)									
EP1913212-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EP1913213-005	BMH11A	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762211)									

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 Work Order : EP1913213 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762211) - continued									
EP1913212-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.11	0.10	14.1	0% - 50%
EP1913213-005	BMH11A	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	51.6	50.1	3.03	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196)									
EP1913212-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.05	0.05	0.00	No Limit
EP1913213-005	BMH11A	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2762212)									
EP1913212-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.60	2.57	1.14	0% - 20%
EP1913213-005	BMH11A	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	31.7	32.5	2.62	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768204)									
EP1913230-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.9	97.6	No Limit
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.4	0.2	36.2	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA005P: pH by PC Titrator (QCLot: 2776014)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98.5	102
				----	7 pH Unit	100	98.5	102
ED037P: Alkalinity by PC Titrator (QCLot: 2776015)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	103	81.2	126
				<1	200 mg/L	97.7	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.2	87.7	113
				<1	100 mg/L	102	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.6	87.9	114
				<1	1000 mg/L	97.3	87.9	114
ED093F: Dissolved Major Cations (QCLot: 2763610)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.6	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	105	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	105	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	106	89.7	108
EG020T: Total Metals by ICP-MS (QCLot: 2771255)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.3	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	102	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	101	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.0	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	96.5	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.7	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	99.3	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	103	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	89.9	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.3	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	97.0	87.1	120
EG035F: Dissolved Mercury by FIMS (QCLot: 2764163)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	98.2	87.6	115



Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result			Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	101	87.6	115
EG035T: Total Mercury by FIMS (QCLot: 2764312)								
EG035T-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	99.1	89.0	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.7	85.1	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	105	75.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	95.8	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.5	93.7	108
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	84.7	75.8	100

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)							
EP1913212-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)							
EP1913212-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	# Not Determined	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 2771255)							
EP1913213-006	QC06	EG020A-T: Arsenic	7440-38-2	1 mg/L	99.7	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	109	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	108	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	104	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	103	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	107	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	110	70.0	130



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2771255) - continued							
EP1913213-006	QC06	EG020A-T: Nickel	7440-02-0	1 mg/L	109	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	105	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2764163)							
EP1913213-002	BMH02A	EG035F-LL: Mercury	7439-97-6	0.05 mg/L	84.9	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)							
EP1913265-002	Anonymous	EG035F-LL: Mercury	7439-97-6	0.01 mg/L	105	70.0	130
EG035T: Total Mercury by FIMS (QCLot: 2764312)							
EP1913212-007	Anonymous	EG035T-LL: Mercury	7439-97-6	0.01 mg/L	118	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2771249)							
EP1913284-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	97.4	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)							
EP1913212-002	Anonymous	EK026SF: Total Cyanide	57-12-5	2 mg/L	96.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762211)							
EP1913212-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	129	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)							
EP1913212-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	96.5	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762212)							
EP1913212-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	79.3	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)							
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	79.5	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913213	Page	: 1 of 9
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 02-Apr-2020
Sampler	: Matthew Hunt/Brandon Henry	No. of samples received	: 9
Order number	: ----	No. of samples analysed	: 9

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : 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							
ED041G: Sulfate (Turbidimetric) as SO ₄ 2- by DA	EP1913212--001	Anonymous	Sulfate as SO ₄ - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	EP1913212--001	Anonymous	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
BMH01, BMH04, BMH11A	BMH02A, BMH08,	----	----	----	19-Dec-2019	08-Dec-2019	11
Clear Plastic Bottle - Natural							
QC07,	QC13	----	----	----	19-Dec-2019	10-Dec-2019	9
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
BMH01, BMH04, BMH11A	BMH02A, BMH08,	----	----	----	12-Dec-2019	10-Dec-2019	2

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation



Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	19-Dec-2019	08-Dec-2019	✘
Clear Plastic Bottle - Natural (EA005-P) QC07,	QC13	10-Dec-2019	----	----	----	19-Dec-2019	10-Dec-2019	✘
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	19-Dec-2019	22-Dec-2019	✔
Clear Plastic Bottle - Natural (ED037-P) QC07,	QC13	10-Dec-2019	----	----	----	19-Dec-2019	24-Dec-2019	✔
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✔
Clear Plastic Bottle - Natural (ED041G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✔
Clear Plastic Bottle - Natural (ED045G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✔
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	17-Dec-2019	05-Jan-2020	✔
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F) QC07		10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✔
Clear Plastic Bottle - Natural (ED093F) QC13		10-Dec-2019	----	----	----	17-Dec-2019	17-Dec-2019	✔
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) QC06,	QC14	10-Dec-2019	17-Dec-2019	07-Jun-2020	✔	17-Dec-2019	07-Jun-2020	✔



Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F-LL) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	13-Dec-2019	05-Jan-2020	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F-LL) QC07		10-Dec-2019	----	----	----	16-Dec-2019	07-Jan-2020	✓
EG035T: Total Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T-LL) QC13		10-Dec-2019	----	----	----	13-Dec-2019	07-Jan-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC06,	QC14	10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
White Plastic Bottle-NaOH (EK026SF) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	13-Dec-2019	22-Dec-2019	✓
White Plastic Bottle-NaOH (EK026SF) QC07,	QC13	10-Dec-2019	----	----	----	13-Dec-2019	24-Dec-2019	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	10-Dec-2019	✗
Clear Plastic Bottle - Natural (EK057G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	12-Dec-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	----	----	----	12-Dec-2019	05-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) QC07,	QC13	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓

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 Work Order : EP1913213 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		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) BMH01, BMH04, BMH11A	BMH02A, BMH08,	08-Dec-2019	19-Dec-2019	05-Jan-2020	✓	19-Dec-2019	05-Jan-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) QC07,	QC13	10-Dec-2019	19-Dec-2019	07-Jan-2020	✓	19-Dec-2019	07-Jan-2020	✓



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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	3	22	13.64	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	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	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 PC Titrator	ED037-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	22	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	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	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Alkalinity by PC Titrator	ED037-P	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	22	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	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	
Method Blanks (MB) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	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	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	22	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	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	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS - Low Level	EG035T-LL	1	3	33.33	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 by PC 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 (2013) Schedule B(3)
Hardness as CaCO ₃	EA065	WATER	In house: Referenced to APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ ²⁻ by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ ²⁻ concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS - Low Level	EG035T-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO ₂ - B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO _x) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Combined oxidised Nitrogen (NO ₂ +NO ₃) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO ₃ -. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) Schedule B(3)

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@sensversa.com.au	Phone/Mobile:	+61 409 295 017

[illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:	Sampler Name: Matthew Hunt / Brandon Henry	Signature:	Date: 10/12/2019
---	---	------------	------------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Date:	
Of:	Time:	Date/Time:	Of:	Time:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugol's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1913247

<p>Client : SENVERSA PTY LTD</p> <p>Contact : Blaire Coleman</p> <p>Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000</p> <p>E-mail : blaire.coleman@senversa.com.au</p> <p>Telephone : +61 08 6557 8881</p> <p>Facsimile : +61 03 9606 0074</p> <p>Project : P17302 Bulong DSI</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : Brandon Henry, MATTHEW HUNT</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Lauren Biagioni</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : Lauren.biagioni@alsglobal.com</p> <p>Telephone : 08 9406 1307</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2019SENV0005 (EP/382/19 V2)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 12-Dec-2019 10:00	Issue Date : 12-Dec-2019
Client Requested Due Date : 19-Dec-2019	Scheduled Reporting Date : 19-Dec-2019

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 4	Temperature : 9.0 - Ice present
Receipt Detail :	No. of samples received / analysed : 5 / 5

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
- Some sample IDs do not match the COC; these bottle IDs are written as the sample description.
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- 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	Client sampling date / time	Client sample ID	WATER - EA005P pH (PCT)	WATER - EA065 Total Hardness as CaCO3	WATER - EG035F-LL Dissolved Mercury - Low Level	WATER - EK026SF Total Cyanide by Segmented Flow Analyser	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO4, Alkalinity	WATER - NT-07 Total Nitrogen + NO2 + NO3 + NH3	WATER - W-02T 8 metals (Total)
EP1913247-001	10-Dec-2019 00:00	BMH06 BMH06A	✓	✓	✓	✓	✓	✓	
EP1913247-002	10-Dec-2019 00:00	BMH09	✓	✓	✓	✓	✓	✓	
EP1913247-003	10-Dec-2019 00:00	BMH12A	✓	✓	✓	✓	✓	✓	
EP1913247-004	10-Dec-2019 00:00	QC17 QC16	✓	✓	✓	✓	✓	✓	
EP1913247-005	10-Dec-2019 00:00	QC18 QC17							✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EG020T Total Metals by ICP/MS (including digestion)
EP1913247-005	10-Dec-2019 00:00	QC18 QC17	✓

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	Due for extraction	Due for analysis	Samples Received		Instructions Received	
Client Sample ID(s)	Container		Date	Evaluation	Date	Evaluation
EA005-P: pH by PC Titrator						
BMH06	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----
BMH09	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----
BMH12A	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----
QC17	Clear Plastic Bottle - Natural	----	10-Dec-2019	12-Dec-2019	✗	----



Requested Deliverables

Blaire Coleman

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

Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au
Email	blaire.coleman@senversa.com.au

JUSTIN LUMSDEN

- *AU Certificate of Analysis - NATA (COA)
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)
- EDI Format - XTab (XTAB)

Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au
Email	justin.lumsden@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order : EP1913247 Amendment : 1 Client : SENVERSA PTY LTD Contact : Blaire Coleman Address : LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000 Telephone : +61 08 6557 8881 Project : P17302 Bulong DSI Order number : ---- C-O-C number : ---- Sampler : Brandon Henry, MATTHEW HUNT Site : ---- Quote number : EP/382/19 V3 No. of samples received : 5 No. of samples analysed : 5	Page : 1 of 4 Laboratory : Environmental Division Perth Contact : Lauren Biagioni Address : 26 Rigali Way Wangara WA Australia 6065 Telephone : 08 9406 1307 Date Samples Received : 12-Dec-2019 10:00 Date Analysis Commenced : 12-Dec-2019 Issue Date : 02-Apr-2020 16:15
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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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Some sample IDs do not match the COC; these bottle IDs are written as the sample description.
- EK028SF; LOR raised for cyanide on particular samples due to possible sample matrix interference.
- (EG035F-LL): LOR for EP1913247-1 to 3 was raised due to high salinity.
- Ionic Balance out of acceptable limits for sample #2 due to analytes not quantified in this report. Major anions (ED041/45G) and major cations (ED093F) have been confirmed by re-preparation and re-analysis.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				BMH06 BMH06A	BMH09	BMH12A	QC17 QC16	QC18 QC17
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913247-001	EP1913247-002	EP1913247-003	EP1913247-004	EP1913247-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.53	6.73	6.91	5.78	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	46200	61400	35200	<1	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	12	139	44	<1	----
Total Alkalinity as CaCO3	----	1	mg/L	12	139	44	<1	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5670	42700	12400	<1	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	118000	71600	105000	<1	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	1500	663	809	<1	----
Magnesium	7439-95-4	1	mg/L	10300	14500	8070	<1	----
Sodium	7440-23-5	1	mg/L	73500	57700	66700	<1	----
Potassium	7440-09-7	1	mg/L	184	450	255	<1	----
EG020T: Total Metals by ICP-MS								
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
Cobalt	7440-48-4	0.001	mg/L	----	----	----	----	<0.001
Nickel	7440-02-0	0.001	mg/L	----	----	----	----	<0.001
Lead	7439-92-1	0.001	mg/L	----	----	----	----	<0.001
Zinc	7440-66-6	0.005	mg/L	----	----	----	----	<0.005
Manganese	7439-96-5	0.001	mg/L	----	----	----	----	<0.001
Selenium	7782-49-2	0.01	mg/L	----	----	----	----	<0.01
Iron	7439-89-6	0.05	mg/L	----	----	----	----	<0.05
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.00004	mg/L	<0.00020	<0.00020	<0.00020	<0.00004	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	----	----	----	<0.0001



Analytical Results

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

Client sample ID

				BMH06 BMH06A	BMH09	BMH12A	QC17 QC16	QC18 QC17
Client sampling date / time				10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00	10-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EP1913247-001	EP1913247-002	EP1913247-003	EP1913247-004	EP1913247-005
				Result	Result	Result	Result	Result
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	<0.040	<0.004	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	13.2	1870	216	<0.01	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.58	5.33	<0.01	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	185	19.5	22.6	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	185	20.1	27.9	<0.01	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	422	2060	237	<0.1	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	607	2080	265	<0.1	----
EN055: Ionic Balance								
∅ Total Anions	----	0.01	meq/L	3450	2910	3220	<0.01	----
∅ Total Cations	----	0.01	meq/L	4120	3750	3610	<0.01	----
∅ Ionic Balance	----	0.01	%	8.95	12.6	5.73	----	----

QUALITY CONTROL REPORT

Work Order : **EP1913247**

Page : 1 of 7

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Perth

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 26 Rigali Way Wangara WA Australia 6065

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 12-Dec-2019

Order number : ----

Date Analysis Commenced : 12-Dec-2019

C-O-C number : ----

Issue Date : 02-Apr-2020

Sampler : Brandon Henry, MATTHEW HUNT

Site : ----

Quote number : EP/382/19 V3

No. of samples received : 5

No. of samples analysed : 5



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. 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
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA



General Comments

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

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

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

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**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Titrator (QC Lot: 2776014)									
EP1913212-002	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.27	7.27	0.00	0% - 20%
EP1913213-005	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.69	6.68	0.150	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2776015)									
EP1913212-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	158	158	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	158	158	0.00	0% - 20%
EP1913213-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	16	16	0.00	0% - 50%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	16	0.00	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2762197)									
EP1913212-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4130	3650	12.4	0% - 20%
EP1913213-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10500	10200	3.23	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 2762198)									
EP1913212-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	36100	37200	2.99	0% - 20%
EP1913213-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	116000	114000	1.68	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2763618)									
EP1913232-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	20	20	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	5	5	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	148	151	2.07	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	5	5	0.00	No Limit
EP1913247-003	BMH12A	ED093F: Calcium	7440-70-2	1	mg/L	809	832	2.88	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	8070	8320	3.12	0% - 20%



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 2763618) - continued									
EP1913247-003	BMH12A	ED093F: Sodium	7440-23-5	1	mg/L	66700	68800	3.04	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	255	268	5.26	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 2767585)									
EP1913124-013	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EP1913175-009	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	0.0001	0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.082	0.089	7.95	0% - 50%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.05	<0.05	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2767899)									
EP1913265-001	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EP1913265-007	Anonymous	EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	<0.00004	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2767708)									
EP1913124-012	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP1913262-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2764069)									
EP1913212-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EP1913213-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2762406)									
EP1913247-002	BMH09	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	1870	2000	6.83	0% - 20%
EP1913253-005	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.06	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196)									
EP1913212-002	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.05	0.05	0.00	No Limit

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 Work Order : EP1913247 Amendment 1
 Client : SENVERSA PTY LTD
 Project : P17302 Bulong DSI



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2762196) - continued									
EP1913213-005	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2762407)									
EP1913247-002	BMH09	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	20.1	19.6	2.72	0% - 20%
EP1913253-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768204)									
EP1913230-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.9	97.6	No Limit
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.4	0.2	36.2	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2768205)									
EP1913260-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.7	0.6	19.5	No Limit
EP1913260-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.8	0.8	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
EA005P: pH by PC Titrator (QCLot: 2776014)								
EA005-P: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	98.5	102
				----	7 pH Unit	100	98.5	102
ED037P: Alkalinity by PC Titrator (QCLot: 2776015)								
ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-00 1	1	mg/L	<1	----	----	----	----
ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	20 mg/L	103	81.2	126
				<1	200 mg/L	97.7	90.0	110
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	97.2	87.7	113
				<1	100 mg/L	102	87.7	113
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.6	87.9	114
				<1	1000 mg/L	97.3	87.9	114
ED093F: Dissolved Major Cations (QCLot: 2763618)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	97.8	85.9	113
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	97.0	88.0	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	101	87.3	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	102	89.7	108
EG020T: Total Metals by ICP-MS (QCLot: 2767585)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	103	89.6	118
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	111	89.2	116
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	106	87.8	114
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	104	89.0	115
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	104	85.8	115
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	102	88.4	111
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	104	88.5	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	102	87.4	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	98.6	87.6	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	111	88.1	120
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	110	87.1	120
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)								
EG035F-LL: Mercury	7439-97-6	0.00004	mg/L	<0.00004	0.01 mg/L	101	87.6	115



Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2767708)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.5	85.1	115
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	105	75.0	127
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762406)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	99.8	86.2	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.5	93.7	108
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762407)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.0	90.5	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	84.7	75.8	100
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768205)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	78.4	75.8	100

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%) Low High	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number				
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2762197)							
EP1913212-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	100 mg/L	# Not Determined	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 2762198)							
EP1913212-001	Anonymous	ED045G: Chloride	16887-00-6	1000 mg/L	# Not Determined	70.0	130
EG020T: Total Metals by ICP-MS (QCLot: 2767585)							
EP1913124-014	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	106	70.0	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	116	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	103	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	100	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	110	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	107	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	112	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	110	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	112	70.0	130



Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 2767899)							
EP1913265-002	Anonymous	EG035F-LL: Mercury	7439-97-6	0.01 mg/L	105	70.0	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2767708)							
EP1913175-011	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	94.1	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2764069)							
EP1913212-002	Anonymous	EK026SF: Total Cyanide	57-12-5	2 mg/L	96.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2762406)							
EP1913247-001	BMH06 BMH06A	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2762196)							
EP1913212-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	96.5	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2762407)							
EP1913247-001	BMH06 BMH06A	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768204)							
EP1913039-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	79.5	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2768205)							
EP1913260-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	10 mg/L	79.7	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1913247	Page	: 1 of 8
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Perth
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 02-Apr-2020
Sampler	: Brandon Henry, MATTHEW HUNT	No. of samples received	: 5
Order number	: ----	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- 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 : 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							
ED041G: Sulfate (Turbidimetric) as SO ₄ 2- by DA	EP1913212--001	Anonymous	Sulfate as SO ₄ - Turbidimetric	14808-79-8	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
ED045G: Chloride by Discrete Analyser	EP1913212--001	Anonymous	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK055G: Ammonia as N by Discrete Analyser	EP1913247--001	BMH06 BMH06A	Ammonia as N	7664-41-7	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.
EK059G: Nitrite plus Nitrate as N (NO _x) by Discrete Ar	EP1913247--001	BMH06 BMH06A	Nitrite + Nitrate as N	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	----	----	----	19-Dec-2019	10-Dec-2019	9

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P)								
BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	19-Dec-2019	10-Dec-2019	✖



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) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	19-Dec-2019	24-Dec-2019	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
ED093F: Dissolved Major Cations								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	17-Dec-2019	07-Jan-2020	✓
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) QC18 - QC17		10-Dec-2019	16-Dec-2019	07-Jun-2020	✓	16-Dec-2019	07-Jun-2020	✓
EG035F: Dissolved Mercury by FIMS								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F-LL) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	16-Dec-2019	07-Jan-2020	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) QC18 - QC17		10-Dec-2019	----	----	----	16-Dec-2019	07-Jan-2020	✓
EK026SF: Total CN by Segmented Flow Analyser								
White Plastic Bottle-NaOH (EK026SF) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	13-Dec-2019	24-Dec-2019	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	12-Dec-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	----	----	----	12-Dec-2019	07-Jan-2020	✓



Matrix: WATER

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

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		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)								
BMH06 - BMH06A, BMH12A,	BMH09, QC17 - QC16	10-Dec-2019	19-Dec-2019	07-Jan-2020	✔	19-Dec-2019	07-Jan-2020	✔



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 PC Titrator	ED037-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	16	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	33	12.12	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	19	10.53	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 PC Titrator	ED037-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	16	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	6.06	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	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)							
Alkalinity by PC Titrator	ED037-P	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	16	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	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	
Method Blanks (MB) - Continued							
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	6.06	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	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)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS - Low Level	EG035F-LL	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	6.06	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	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 by PC 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 (2013) Schedule B(3)
Hardness as CaCO ₃	EA065	WATER	In house: Referenced to APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
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 (2013) 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 (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS - Low Level	EG035F-LL	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl ₂)(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 SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) 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 (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) 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 (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) 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 (2013) 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 (2013) Schedule B(3)

Robert Johnston

To: Blaire Coleman
Subject: RE: Bulong DSI (17302) - samples received without a COC

From: Blaire Coleman [<mailto:blaire.coleman@senversa.com.au>]
Sent: Wednesday, 18 December 2019 8:53 AM
To: Robert Johnston
Cc: Justin Lumsden
Subject: FW: Bulong DSI (17302) - samples received without a COC

My apologies Rob! I didn't realise that this email hadn't gone through to you on Monday. Please see attached, and let me or Justin know if you have any queries.

Cheers,
Blaire

Blaire Coleman
Associate Geoscientist

From: Georgia Hefron <Georgia.Hefron@senversa.com.au>
Sent: Monday, 16 December 2019 4:59 PM
To: Blaire Coleman <blaire.coleman@senversa.com.au>
Subject: FW: Bulong DSI (17302) - samples received without a COC

Just check 😊

Hi Rob,

Please see attached COC for the below QC samples.

Thanks,

Georgia Hefron
Project Environmental Scientist



Senversa Pty Ltd
Level 17, 140 St Georges Terrace, Perth WA 6000

m: +61 403 309 654 | e: georgia.hefron@senversa.com.au
t: +61 8 6324 0200 | w: www.senversa.com.au

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Please consider the environment before printing this email. Senversa is a carbon neutral company.

Rob Johnston 18/12/19 Eurofin 694415



Date/Time: 18/12/19 8:53
Chilled: Yes/No
Temp: 17.5
12.5
13.1
Correction: +3.5
Final Temp: 17.9°C

From: EnviroSampleWA@eurofins.com <EnviroSampleWA@eurofins.com>

Sent: Friday, 13 December 2019 3:28 PM

To: Blaire Coleman <blaire.coleman@sensversa.com.au>

Subject: Bulong DSI (17302) - samples received without a COC

Hi Blaire,

We have received samples QC05, QC08, QC10, QC12 and QC20 for this project, but without a COC (sample dates 3-11/12). Can you please provide us a COC?

Kind Regards,
Rob

Eurofins | Environment Testing

Unit 2, 91 Leach Highway

KEWDALE WA 6105

Australia

Phone : +61 8 9251 9692

Email : EnviroSampleWA@eurofins.com

Rob Johnston 18/12/19 Eurofin 694415

Laboratory: Eurofins WA
Address: 2/91 Leach Hwy, Kewdale WA 6105
Contact: Rob Johnson / Analytical Services Manager
Phone: 08 9251 9692

Job Number:	P17302	Purchase Order:	
Project Name:	Bulong DSI	Quote No:	
Sampled By:	Matthew Hunt / Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

[illegible]

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples:

Sampler Name:	Matthew Hunt / Brandon Henry
----------------------	---------------------------------

Signature: _____

Date: 11/12/2019

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	Rob Johnston	Date: 18/12/19
Of:	Time:	Date/Time:	Of:	Eurofins	Time: 8:53
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		Date:
Of:	Time:	Date/Time:	Of:		Date:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		Date:
Of:	Time:	Date/Time:	Of:		Date:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Val Hydrochloric Acid (HCl) Preserved; VSA = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=Lugo's iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

Completed by: _____
Checked by: _____

Melbourne

6 Monterey Road
Dandenong South Vic 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney

Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane

1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth

2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 23736

ABN – 50 005 085 521

e.mail : EnviroSales@eurofins.com

web : www.eurofins.com.au

Sample Receipt Advice

Company name: **Senversa Pty Ltd WA**
Contact name: **Blaire Coleman**
Project name: **BULONG DSI**
Project ID: **P17302**
COC number: **Not provided**
Turn around time: **5 Day**
Date/Time received: **Dec 18, 2019 8:53 AM**
Eurofins reference: **694415**

Sample information

- ☒ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☒ All samples have been received as described on the above COC.
- ☒ COC has been completed correctly.
- ☒ Attempt to chill was evident.
- ☒ Appropriately preserved sample containers have been used.
- ☒ All samples were received in good condition.
- ☒ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☒ Appropriate sample containers have been used.
- N/A Sample containers for volatile analysis received with zero headspace.
- ☒ Split sample sent to requested external lab.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Robert Johnston on Phone : or by e.mail: RobertJohnston@eurofins.com

Results will be delivered electronically via e.mail to Blaire Coleman - Blaire.Coleman@senversa.com.au.

Senversa Pty Ltd WA
Level 17, 140 St Georges Terrace
Perth
WA 6000



NATA Accredited
Accreditation Number 1261
Site Number 23736

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

Attention: **Blaire Coleman**

Report **694415-W**
 Project name **BULONG DSI**
 Project ID **P17302**
 Received Date **Dec 18, 2019**

Client Sample ID			QC08
Sample Matrix			Water
Eurofins Sample No.			P19-De26030
Date Sampled			Dec 03, 2019
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic (filtered)	0.001	mg/L	< 0.01
Cadmium (filtered)	0.0002	mg/L	0.0059
Chromium (filtered)	0.001	mg/L	< 0.01
Cobalt (filtered)	0.001	mg/L	< 0.01
Copper (filtered)	0.001	mg/L	< 0.01
Iron (filtered)	0.05	mg/L	< 0.5
Lead (filtered)	0.001	mg/L	< 0.01
Manganese (filtered)	0.005	mg/L	1.2
Mercury (filtered)	0.0001	mg/L	< 0.001
Nickel (filtered)	0.001	mg/L	0.15
Selenium (filtered)	0.001	mg/L	0.023
Zinc (filtered)	0.005	mg/L	< 0.05

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description

Heavy Metals (filtered)

- Method: HEAVY METALS

Mobil Metals : Metals M15

- Method:

Testing Site

Perth

Perth

Extracted

Dec 18, 2019

Dec 18, 2019

Holding Time

180 Days

28 Days

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

New Zealand

Auckland
35 O'Rourke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

ABN – 50 005 085 521

web : www.eurofins.com.au

e.mail : EnviroSales@eurofins.com

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Project Name: BULONG DSI
Project ID: P17302

Eurofins Analytical Services Manager : Robert Johnston

Sample Detail							Moisture Set																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

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

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

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

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

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

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

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NC	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

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

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

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

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Heavy Metals									
Arsenic (filtered)			mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)			mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)			mg/L	< 0.001			0.001	Pass	
Cobalt (filtered)			mg/L	< 0.001			0.001	Pass	
Copper (filtered)			mg/L	< 0.001			0.001	Pass	
Iron (filtered)			mg/L	< 0.05			0.05	Pass	
Lead (filtered)			mg/L	< 0.001			0.001	Pass	
Manganese (filtered)			mg/L	< 0.005			0.005	Pass	
Mercury (filtered)			mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)			mg/L	< 0.001			0.001	Pass	
Selenium (filtered)			mg/L	< 0.001			0.001	Pass	
Zinc (filtered)			mg/L	< 0.005			0.005	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic (filtered)			%	98			80-120	Pass	
Cadmium (filtered)			%	96			80-120	Pass	
Chromium (filtered)			%	96			80-120	Pass	
Cobalt (filtered)			%	98			80-120	Pass	
Copper (filtered)			%	87			80-120	Pass	
Iron (filtered)			%	96			80-120	Pass	
Lead (filtered)			%	98			80-120	Pass	
Manganese (filtered)			%	95			80-120	Pass	
Mercury (filtered)			%	92			70-130	Pass	
Nickel (filtered)			%	96			80-120	Pass	
Selenium (filtered)			%	99			80-120	Pass	
Zinc (filtered)			%	95			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	P19-De26990	NCP	%	109			70-130	Pass	
Cadmium (filtered)	P19-De26990	NCP	%	106			70-130	Pass	
Chromium (filtered)	P19-De26990	NCP	%	102			70-130	Pass	
Cobalt (filtered)	P19-De26990	NCP	%	103			75-125	Pass	
Copper (filtered)	P19-De26990	NCP	%	94			70-130	Pass	
Iron (filtered)	P19-De26990	NCP	%	100			70-130	Pass	
Lead (filtered)	P19-De26990	NCP	%	104			70-130	Pass	
Manganese (filtered)	P19-De26990	NCP	%	101			70-130	Pass	
Mercury (filtered)	P19-De26990	NCP	%	95			70-130	Pass	
Nickel (filtered)	P19-De26990	NCP	%	100			70-130	Pass	
Selenium (filtered)	P19-De26990	NCP	%	111			70-130	Pass	
Zinc (filtered)	P19-De26990	NCP	%	102			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	P19-De26991	NCP	mg/L	0.002	0.002	1.0	30%	Pass	
Cadmium (filtered)	P19-De26991	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	P19-De26991	NCP	mg/L	< 0.001	0.001	11	30%	Pass	
Cobalt (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Iron (filtered)	P19-De26991	NCP	mg/L	2.6	2.6	3.0	30%	Pass	
Lead (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Manganese (filtered)	P19-De26991	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Mercury (filtered)	P19-De26991	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	P19-De26991	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Selenium (filtered)	P19-De26991	NCP	mg/L	0.009	0.008	9.0	30%	Pass	
Zinc (filtered)	P19-De26991	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Comments

Sample Integrity

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

Authorised By

Robert Johnston	Analytical Services Manager
Elden Garrett	Senior Analyst-Metal (WA)



Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please [click here](#).

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

Company Name: Senversa Pty Ltd WA
Address: Level 17, 140 St Georges Terrace
Perth
WA 6000

Order No.:
Report #: 694415
Phone: 0437 472 990
Fax:

Received: Dec 18, 2019 8:53 AM
Due: Dec 27, 2019
Priority: 5 Day
Contact Name: Blaire Coleman

Project Name: BULONG DSI
Project ID: P17302

Eurofins Analytical Services Manager : Robert Johnston

[illegible]

NMI CHAIN OF CUSTODY (SAMPLE SUBMISSION) FORM

ENVIRONMENTAL SAMPLES to be submitted to:

NMI: 105 Delhi Rd, North Ryde NSW 2113 Ph: 1300 722 845 email: customerservice@measurement.gov.au

SENT FROM:		Internal use only	
Company Name:	SENVESA PTY LTD	NMI Quote Number:	SENVXXA-RW1911N Valid until: February 29, 2020
Address:	LEVEL 17, 140 ST GEORGES TERRACE, PERTH WA 6000.	UMS Reference:	QT-D2018 D
Contact:	Blaire Coleman	TURN AROUND TIME REQUESTED (Working days):	
Phone:	+61 8 6324 0200 / +61 403 309 654	24 hrs 48 hrs 3-4 7-10 30 other (please specify)	
ABN:	89 132 231 380	100% 50% 25% Standard dioxins	
Contact email:	blaire.coleman@senversa.com.au	*Fast TATs are not available for all tests and MUST be agreed to prior to sample submission	

Additional email(s) for report: **SENV93/191216**
 Email for invoice (if required): **Due 7/1/2020**

If a PO number is required on your invoice, it must be provided at sample submission. PO's received after sample submission will not appear on final invoice Purchase order required: Y / N PO Number: _____

NMI LRN (NMI USE ONLY - please do not write in this column)	Hard Copy of Invoice & Report required Y/N		SAMPLE MATRIX (water / soil / biota)	TESTS REQUIRED (Please list all tests required here and tick required tests against samples)	COMMENTS
	SAMPLE REFERENCE (Sample ID / Description / Number)	DATE & TIME SAMPLED			
N19/032847	BMH01	8/12/2019	water	x	
N19/032848	BMH02A	8/12/2019	water	x	
N19/032849	BMH04	8/12/2019	water	x	
N19/032850	BMH08	8/12/2019	water	x	
N19/032851	BHM11A	8/12/2019	water	x	
N19/032852	QC06	8/12/2019	water	x	not received
	QC07	8/12/2019	water	x	
	QC13	8/12/2019	water	x	not received
	QC14	8/12/2019	water	x	
N19/032853	MW1	8/12/2019	water	x	
N19/032854	MW2	8/12/2019	water	x	
N19/032855	MW3	8/12/2019	water	x	
N19/032856	MW4	8/12/2019	water	x	

Relinquished by:	Matt Hunt	Received at NMI laboratory by:	
Print Name:	Matt Hunt	Print Name:	
Date & Time:	16 / 12 / 19	Date & Time:	
Signature:	MH	Signature:	

PAGE No: _____ of _____ PAGES

If multiple pages, ensure ALL pages are stapled together

received Cyanide bottle (for Cr VI)
 for all samples
 SN 17/12/19

RECEIVED
 16 DEC 2019
 BY: 1091635
 SN

Lab triplicate samples sent via ALS Environmental Wangara

Sent to: NMI.

Client: Senversa

~~_____~~ soil / _____ water samples + empty bottles.

Project: P17302

Contact Name:

blaire.coleman@senversa.com.au

Lab triplicate samples sent via ALS Environmental Wangara

Sent to: NMI

Client: Senversa

_____ soil / _____ water samples + empty bottles.

Project: P17302

Contact Name:

blaire.coleman@senversa.com.au



SAMPLE RECEIPT NOTIFICATION

CUSTOMER DETAILS

Attention: BLAIRE COLEMAN
Customer: Senversa Pty Ltd
Address: Level 17, 140 St Georges Terrace
Perth WA 6000
Email: blaire.coleman@senversa.com.au
Telephone:
Fax:

LABORATORY DETAILS

Lab: National Measurement Institute
Contact: Susanne Neuman
Address: 105 Delhi Road, North Ryde, NSW
NSW 2113
Email: Susanne.Neuman@measurement.gov.au
Telephone: 02 9449 0181
Fax:

SAMPLE DETAILS

NMI Job Name: SENV03/191216

Total No. of Samples: 15

LRNs	Customer Sample ID	Lab Sample Description
N19/032847	BMH01	WATER PROJECT: P17302
N19/032848	BMH02A	WATER PROJECT: P17302
N19/032849	BMH04	WATER PROJECT: P17302
N19/032850	BMH08	WATER PROJECT: P17302
N19/032851	BHM11A	WATER PROJECT: P17302
N19/032852	QC07	WATER PROJECT: P17302
N19/032853	MW1	WATER PROJECT: P17302
N19/032854	MW2	WATER PROJECT: P17302
N19/032855	MW3	WATER PROJECT: P17302
N19/032856	MW4	WATER PROJECT: P17302
N19/032857	MW5	WATER PROJECT: P17302

N19/032858	QC08	WATER PROJECT: P17302
N19/032859	BMH06A	WATER PROJECT: P17302
N19/032860	BMH09	WATER PROJECT: P17302
N19/032861	BM12A	WATER PROJECT: P17302

SAMPLE RECEIVED CONDITION

Date samples received: 16-DEC-2019

Sample received in good order: Yes

NMI Quotation no. provided:

Client purchase order number:

Temperature of samples: Room Temperature

Comments: ALL OK

Estimated report date: 7-JAN-2020

Mode of Delivery: Courier

Additional Terms and Conditions

Incomplete / unclear information about samples or required testing will delay the start of the analysis work

If you require your Purchase Order (PO) number to be included on our invoice, please provide the number during sample submission and before the completion of work to avoid unnecessary delays and/or additional processing/handling fees.

The lodgement of an order or receipt of samples for NMI services referenced in this Sample Receipt Notification constitutes an acceptance of the current version of NMI Terms and Conditions or other applicable Terms referenced in the NMI Quotation. NMI Terms and Conditions are available on the web at <http://www.measurement.gov.au/Services/EnvironmentalTesting/Pages/Terms-and-Conditions.aspx>



QUALITY ASSURANCE REPORT

Client: SENVERSA PTY LTD

NMI QA Report No: SENV03/191216 T1

Sample Matrix: Water

Analyte	Method	LOR	Blank	Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		ug/L	ug/L	mg/L	mg/L	%	%	%
Inorganics Section				N19/032857				N19/032857
Arsenic Total	NT2.47	1	<1	<1	<1	NA	92	NA
Cadmium Total	NT2.47	0.1	<0.1	1.3	1.4	7.4	101	105
Chromium Total	NT2.47	1	<1	1.6	1.6	0.0	87	NA
Cobalt Total	NT2.47	1	<1	42	42	0.0	91	118
Copper Total	NT2.47	1	<1	9.7	9.7	0.0	94	105
Iron Total	NT2.47	5	<5	77	79	2.6	92	#
Lead Total	NT2.47	1	<1	<1	<1	NA	96	102
Manganese Total	NT2.47	1	<1	15800	15900	0.6	88	93
Mercury - Total	NT2.47	0.1	<0.1	<0.1	<0.1	NA	103	112
Nickel Total	NT2.47	1	<1	87	87	0.0	93	111
Selenium Total	NT2.47	1	<1	4.3	4.3	0.0	95	#
Zinc Total	NT2.47	1	<1	19	19	0.0	92	114

Filename =

K:\Inorganics\Quality System\QA Reports\TE\QAR2020\Water\

Legend:

Acceptable recovery is 75-120%.

Acceptable RPDs on duplicates is 44% at concentrations >5 times LOR. Greater RPD may be expected at <5 times LOR.

LOR = Limit Of Reporting

ND = Not Determined

RPD = Relative Percent Difference

NA = Not Applicable

LCS = Laboratory Control Sample.

#: Spike level is less than 50% of the sample's concentration, hence the recovery data is not reliable.

Comments:

Results greater than ten times LOR have been rounded to two significant figures.

This report shall not be reproduced except in full.

Signed:

Dr Andrew Evans
Inorganics , NMI-North Ryde
7/01/2020

Date:



REPORT OF ANALYSIS

Page: 1 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000	Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :	Phone : (02) 94490161

Lab Reg No.	Sample Ref	Sample Description
N19/032847	BMH01	WATER PROJECT: P17302
N19/032848	BMH02A	WATER PROJECT: P17302
N19/032849	BMH04	WATER PROJECT: P17302
N19/032850	BMH08	WATER PROJECT: P17302

Lab Reg No.		N19/032847	N19/032848	N19/032849	N19/032850	
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BMH01	BMH02A	BMH04	BMH08	
	Units					Method
Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	2.4	< 1	5.0	21	NT2_47
Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.9	2.1	1.4	1.5	NT2_47
Cadmium Total	ug/L	1.3	5.5	3.6	2.4	NT2_47
Chromium Total	ug/L	9.4	1.9	11	110	NT2_47
Cobalt Total	ug/L	21	< 1	< 1	< 1	NT2_47
Copper Total	ug/L	7.5	3.8	50	31	NT2_47
Iron Total	ug/L	9.6	48	< 5	65	NT2_47
Lead Total	ug/L	2.4	< 1	1.5	5.9	NT2_47
Manganese Total	ug/L	1100	1770	12	8.7	NT2_47
Nickel Total	ug/L	410	200	21	15	NT2_47
Selenium Total	ug/L	6.8	6.4	7.6	14	NT2_47
Zinc Total	ug/L	100	18	290	120	NT2_47
Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	

N19/032847

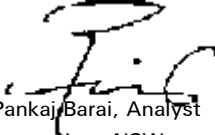
- N19/032861

Chromium Trivalent result is calculated by the difference between Chromium Total and Chromium Hexavalent

REPORT OF ANALYSIS

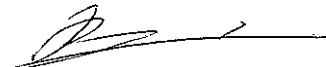
Page: 2 of 8
Report No. RN1258403

Lab Reg No.	Units	N19/032847	N19/032848	N19/032849	N19/032850	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BMH01	BMH02A	BMH04	BMH08	


Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

Lab Reg No.	Units	N19/032847	N19/032848	N19/032849	N19/032850	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BMH01	BMH02A	BMH04	BMH08	
Miscellaneous						
Chromium - Hexavalent	mg/L	0.007	0.002	0.006	0.089	NW D2


Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

REPORT OF ANALYSIS

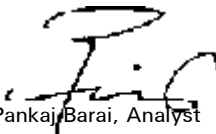
Page: 3 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000	Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :	Phone : (02) 94490161

Lab Reg No.	Sample Ref	Sample Description
N19/032851	BHM11A	WATER PROJECT: P17302
N19/032852	QC07	WATER PROJECT: P17302
N19/032853	MW1	WATER PROJECT: P17302
N19/032854	MW2	WATER PROJECT: P17302

Lab Reg No.		N19/032851	N19/032852	N19/032853	N19/032854	
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BHM11A	QC07	MW1	MW2	
	Units					Method
Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	5.0	< 1	3.4	< 1	NT2_47
Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.7	1.4	< 1	< 1	NT2_47
Cadmium Total	ug/L	2.7	5.9	1.3	1.9	NT2_47
Chromium Total	ug/L	10	2	3.4	2.9	NT2_47
Cobalt Total	ug/L	< 1	< 1	16	18	NT2_47
Copper Total	ug/L	7.1	2.3	10	18	NT2_47
Iron Total	ug/L	31	48	24	< 5	NT2_47
Lead Total	ug/L	1	< 1	< 1	< 1	NT2_47
Manganese Total	ug/L	63	1820	10600	8880	NT2_47
Nickel Total	ug/L	7.6	210	52	130	NT2_47
Selenium Total	ug/L	3.3	6.1	4.1	8.3	NT2_47
Zinc Total	ug/L	19	14	34	7.5	NT2_47
Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	


 Pankaj Barai, Analyst
 Inorganics - NSW
 Accreditation No. 198

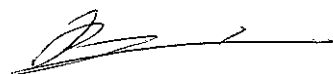
07-JAN-2020

REPORT OF ANALYSIS

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Report No. RN1258403

Lab Reg No.	Units	N19/032851	N19/032852	N19/032853	N19/032854	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		BHM11A	QC07	MW1	MW2	
Miscellaneous						
Chromium - Hexavalent	mg/L	0.005	0.002	<0.001	0.002	NW D2



Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

REPORT OF ANALYSIS

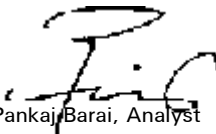
Page: 5 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000	Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :	Phone : (02) 94490161

Lab Reg No.	Sample Ref	Sample Description
N19/032855	MW3	WATER PROJECT: P17302
N19/032856	MW4	WATER PROJECT: P17302
N19/032857	MW5	WATER PROJECT: P17302
N19/032858	QC08	WATER PROJECT: P17302

Lab Reg No.		N19/032855	N19/032856	N19/032857	N19/032858	
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		MW3	MW4	MW5	QC08	
	Units					Method
Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	1.6	1.5	1.6	< 1	NT2_47
Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.2	1	< 1	1.1	NT2_47
Cadmium Total	ug/L	2.1	4.4	1.4	5.8	NT2_47
Chromium Total	ug/L	1.6	1.5	1.6	1.5	NT2_47
Cobalt Total	ug/L	12	68	42	< 1	NT2_47
Copper Total	ug/L	46	41	9.7	5.4	NT2_47
Iron Total	ug/L	74	130	78	32	NT2_47
Lead Total	ug/L	< 1	< 1	< 1	< 1	NT2_47
Manganese Total	ug/L	3090	26800	15900	1730	NT2_47
Nickel Total	ug/L	120	430	87	200	NT2_47
Selenium Total	ug/L	6.8	13	4.3	6.4	NT2_47
Zinc Total	ug/L	12	40	19	25	NT2_47
Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020	6-JAN-2020	


 Pankaj Barai, Analyst
 Inorganics - NSW
 Accreditation No. 198

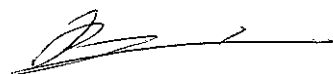
07-JAN-2020

REPORT OF ANALYSIS

Page: 6 of 8

Report No. RN1258403

Lab Reg No.	Units	N19/032855	N19/032856	N19/032857	N19/032858	Method
Date Sampled		08-DEC-2019	08-DEC-2019	08-DEC-2019	08-DEC-2019	
Sample Reference		MW3	MW4	MW5	QC08	
Miscellaneous						
Chromium - Hexavalent	mg/L	<0.001	<0.001	<0.001	0.002	NW D2



Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

REPORT OF ANALYSIS

Page: 7 of 8

Report No. RN1258403

Client : Senversa Pty Ltd Level 17, 140 St Georges Terrace Perth WA 6000	Job No. : SENV03/191216 Quote No. : QT-02018 Order No. : Date Received : 16-DEC-2019 Sampled By : CLIENT
Attention : GEORGIA HEFRON Project Name : P17302 Your Client Services Manager :	Phone : (02) 94490161

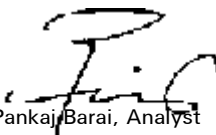
Lab Reg No.	Sample Ref	Sample Description
N19/032859	BMH06A	WATER PROJECT: P17302
N19/032860	BMH09	WATER PROJECT: P17302
N19/032861	BM12A	WATER PROJECT: P17302

Lab Reg No.		N19/032859	N19/032860	N19/032861		
Date Sampled		10-DEC-2019	10-DEC-2019	10-DEC-2019		
Sample Reference		BMH06A	BMH09	BM12A		
	Units					Method

Filtered Trace Elements by ICP						
Chromium Trivalent	ug/L	8.0	< 1	< 1		NT2_47

Total Recoverable Trace Elements by ICP						
Arsenic Total	ug/L	1.4	2.4	1.5		NT2_47
Cadmium Total	ug/L	1.9	5.6	5.6		NT2_47
Chromium Total	ug/L	24	< 1	1.5		NT2_47
Cobalt Total	ug/L	1.5	19	17		NT2_47
Copper Total	ug/L	8.3	3.1	2		NT2_47
Iron Total	ug/L	11	9.2	< 5		NT2_47
Lead Total	ug/L	1.5	< 1	< 1		NT2_47
Manganese Total	ug/L	390	69700	4110		NT2_47
Nickel Total	ug/L	29	4090	990		NT2_47
Selenium Total	ug/L	14	4.2	2.9		NT2_47
Zinc Total	ug/L	74	69	22		NT2_47

Dates						
Date extracted		6-JAN-2020	6-JAN-2020	6-JAN-2020		
Date analysed		6-JAN-2020	6-JAN-2020	6-JAN-2020		


 Pankaj Barai, Analyst
 Inorganics - NSW
 Accreditation No. 198

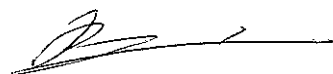
07-JAN-2020

REPORT OF ANALYSIS

Page: 8 of 8
Report No. RN1258403

Report for NW1200400

Lab Reg No.	Units	N19/032859	N19/032860	N19/032861		Method
Date Sampled		10-DEC-2019	10-DEC-2019	10-DEC-2019		
Sample Reference		BMH06A	BMH09	BM12A		
Miscellaneous						
Chromium - Hexavalent	mg/L	0.016	0.001	0.002		NW D2



Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-JAN-2020

Total = acid extractable elements



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This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

This Report supersedes reports: *RN1258365* *RN1258401*

Measurement Uncertainty is available upon request.

Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EN1908941**

Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: blaire.coleman@senversa.com.au	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Facsimile	: +61 03 9606 0074	Facsimile	: +61 2 4967 7382
Project	: P17302 Bulong DSI	Page	: 1 of 2
Order number	: ----	Quote number	: EP2019SENV0005 (EP/382/19 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Brandon Henry, MATTHEW HUNT		

Dates

Date Samples Received	: 17-Dec-2019 12:00	Issue Date	: 17-Dec-2019
Client Requested Due Date	: 24-Dec-2019	Scheduled Reporting Date	: 24-Dec-2019

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 5 / 5

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
- 5 samples for As, Cd, Cr, Cu, Co, Mn, Ni, Zn, Fe, Pb, Se & Hg conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- 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.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EN1908941-001 : [05-Dec-2019] : PVC2515042 - PVC2515042
EN1908941-002 : [09-Dec-2019] : PVC2515043 - PVC2515043
EN1908941-003 : [11-Dec-2019] : PVC2515044 - PVC2515044
EN1908941-004 : [10-Dec-2019] : PVC2515045 - PVC2515045
EN1908941-005 : [08-Dec-2019] : PVC2515046 - PVC2515046

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: **AIR**

Laboratory sample ID	Client sampling date / time	Client sample ID	AIR - EA143-OC-TSP Total Suspended Particulates - 25mm Filters	AIR - EA144-AES-OH Particulate Metals by ICPAES (Mass per volume)	AIR - EA144-HG-OH Particulate Mercury on Occupational Air Filters by
EN1908941-001	05-Dec-2019 00:00	PVC2515042 PVC25150...	✓	✓	✓
EN1908941-002	09-Dec-2019 00:00	PVC2515043 PVC25150...	✓	✓	✓
EN1908941-003	11-Dec-2019 00:00	PVC2515044 PVC25150...	✓	✓	✓
EN1908941-004	10-Dec-2019 00:00	PVC2515045 PVC25150...	✓	✓	✓
EN1908941-005	08-Dec-2019 00:00	PVC2515046 PVC25150...	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

INVOICES

- A4 - AU Tax Invoice (INV)	Email	accounts@senversa.com.au
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SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)	Email	supplieraccounts@senversa.com.au
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CERTIFICATE OF ANALYSIS

Work Order	: EN1908941	Page	: 1 of 3
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 17-Dec-2019 12:00
Order number	: ----	Date Analysis Commenced	: 20-Dec-2019
C-O-C number	: ----	Issue Date	: 29-Jan-2020 15:35
Sampler	: Brandon Henry, MATTHEW HUNT		
Site	: ----		
Quote number	: EP/382/19 V2		
No. of samples received	: 5		
No. of samples analysed	: 5		



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. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Jennifer Targett	Laboratory Technician	Newcastle, Mayfield West, NSW
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- 5 samples for As, Cd, Cr, Cu, Co, Mn, Ni, Zn, Fe, Pb, Se & Hg conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EA143-OC: Results for sample 005 will bias low as filter was recieved with significant damage.
- EA144: NATA accreditation covers the standard 8 metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg)
- Inhalable Dust and Respirable Dust analysed and reported in accordance with Airborne Dust Licence no. MLA 201800893 under the NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 where applicable.
- Amendment (28/01/2020): This report has been amended and re-released to allow the reporting of additional analytical data.
- NATA accreditation is not held for results reported in µg/m³. Concentration in µg/m³ is calculated from air volume data provided by the client.
- EA144: The metal concentration in the filter is reported in µg/filter on a total filter basis calculated up from the proportion of the filter analysed.
- EA143-OC: Sampling was not conducted by ALS and may not fall under accredited methods for sampling of inhalable and respirable dusts. Particulates outside the inhalable and respirable dust definitions under AS3640 and AS2985 respectively have the potential to introduce a bias. Results should be scrutinised accordingly.



Analytical Results

Sub-Matrix: FILTER
 (Matrix: AIR)

Client sample ID

				PVC2515042 PVC2515042	PVC2515043 PVC2515043	PVC2515044 PVC2515044	PVC2515045 PVC2515045	PVC2515046 PVC2515046
Client sampling date / time				05-Dec-2019 00:00	09-Dec-2019 00:00	11-Dec-2019 00:00	10-Dec-2019 00:00	08-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EN1908941-001	EN1908941-002	EN1908941-003	EN1908941-004	EN1908941-005
				Result	Result	Result	Result	Result
EA143: Particulates in Air								
Inhalable Dust	----	10	µg/filter	277	198	257	76	139
ø Inhalable Dust	----	10	µg/m³	289	179	207	70	134
EA144: Particulate Base Metals (Calc Conc)								
ø Arsenic	7440-38-2	10	µg/m³	<10	<10	<10	<10	<10
ø Cadmium	7440-43-9	5	µg/m³	<5	<5	<5	<5	<5
ø Chromium	7440-47-3	5	µg/m³	<5	<5	<5	<5	<5
ø Cobalt	7440-48-4	5	µg/m³	<5	<5	<5	<5	<5
ø Copper	7440-50-8	5	µg/m³	<5	<5	<5	<5	<5
ø Manganese	7439-96-5	5	µg/m³	<5	<5	<5	<5	<5
ø Nickel	7440-02-0	5	µg/m³	<5	<5	<5	<5	<5
ø Zinc	7440-66-6	5	µg/m³	<5	<5	<5	<5	<5
ø Iron	7439-89-6	10	µg/m³	11	<10	<10	<10	<10
ø Lead	7439-92-1	10	µg/m³	<10	<10	<10	<10	<10
ø Selenium	7782-49-2	10	µg/m³	<10	<10	<10	<10	<10
ø Mercury	7439-97-6	0.5	µg/m³	<0.5	<0.5	<0.5	<0.5	<0.5
EA144: Particulate Base Metals in Filter Papers								
Arsenic	7440-38-2	10	µg/filter	<10	<10	<10	<10	<10
Cadmium	7440-43-9	5	µg/filter	<5	<5	<5	<5	<5
Chromium	7440-47-3	5	µg/filter	<5	<5	<5	<5	<5
Cobalt	7440-48-4	5	µg/filter	<5	<5	<5	<5	<5
Copper	7440-50-8	5	µg/filter	<5	<5	<5	<5	<5
Manganese	7439-96-5	5	µg/filter	<5	<5	<5	<5	<5
Nickel	7440-02-0	5	µg/filter	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/filter	<5	<5	<5	<5	<5
Iron	7439-89-6	10	µg/filter	11	<10	<10	<10	<10
Lead	7439-92-1	10	µg/filter	<10	<10	<10	<10	<10
Selenium	7782-49-2	10	µg/filter	<10	<10	<10	<10	<10
Mercury	7439-97-6	0.5	µg/filter paper	<0.5	<0.5	<0.5	<0.5	<0.5
OHAS: Occupational Air Sampling								
ø Volume	----	1	L	958	1100	1240	1090	1030

QUALITY CONTROL REPORT

Work Order : **EN1908941**

Page : 1 of 3

Amendment : **1**

Client : **SENVERSA PTY LTD**

Laboratory : Environmental Division Newcastle

Contact : Blaire Coleman

Contact : Lauren Biagioni

Address : LEVEL 25, 108 ST GEORGES TERRACE
PERTH 6000

Address : 5/585 Maitland Road Mayfield West NSW Australia 2304

Telephone : +61 08 6557 8881

Telephone : 08 9406 1307

Project : P17302 Bulong DSI

Date Samples Received : 17-Dec-2019

Order number : ----

Date Analysis Commenced : 20-Dec-2019

C-O-C number : ----

Issue Date : 29-Jan-2020

Sampler : Brandon Henry, MATTHEW HUNT

Site : ----

Quote number : EP/382/19 V2

No. of samples received : 5

No. of samples analysed : 5



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. 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
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Jennifer Targett	Laboratory Technician	Newcastle, Mayfield West, NSW
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

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

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



Method Blank (MB) and Laboratory Control Spike (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 Spike (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: AIR				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low
EA144: Particulate Base Metals in Filter Papers (QCLot: 2780910)								
EA144-Hg: Mercury	7439-97-6	0.5	µg/filter paper	<0.5	----	----	----	----
EA144: Particulate Base Metals in Filter Papers (QCLot: 2780911)								
EA144-AES: Arsenic	7440-38-2	10	µg/filter	<10	----	----	----	----
EA144-AES: Cadmium	7440-43-9	5	µg/filter	<5	----	----	----	----
EA144-AES: Chromium	7440-47-3	5	µg/filter	<5	----	----	----	----
EA144-AES: Cobalt	7440-48-4	5	µg/filter	<5	----	----	----	----
EA144-AES: Copper	7440-50-8	5	µg/filter	<5	----	----	----	----
EA144-AES: Manganese	7439-96-5	5	µg/filter	<5	----	----	----	----
EA144-AES: Nickel	7440-02-0	5	µg/filter	<5	----	----	----	----
EA144-AES: Zinc	7440-66-6	5	µg/filter	<5	----	----	----	----
EA144-AES: Iron	7439-89-6	10	µg/filter	<10	----	----	----	----
EA144-AES: Lead	7439-92-1	10	µg/filter	<10	----	----	----	----
EA144-AES: Selenium	7782-49-2	10	µg/filter	<10	----	----	----	----

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	: EN1908941	Page	: 1 of 4
Amendment	: 1		
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 17-Dec-2019
Site	: ----	Issue Date	: 29-Jan-2020
Sampler	: Brandon Henry, MATTHEW HUNT	No. of samples received	: 5
Order number	: ----	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

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

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

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

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

Matrix: **AIR**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA144: Particulate Base Metals in Filter Papers							
PVC Filter (EA144-Hg) PVC2515042 - PVC2515042	05-Dec-2019	23-Dec-2019	02-Jun-2020	✓	23-Dec-2019	02-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515046 - PVC2515046	08-Dec-2019	23-Dec-2019	05-Jun-2020	✓	23-Dec-2019	05-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515043 - PVC2515043	09-Dec-2019	23-Dec-2019	06-Jun-2020	✓	23-Dec-2019	06-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515045 - PVC2515045	10-Dec-2019	23-Dec-2019	07-Jun-2020	✓	23-Dec-2019	07-Jun-2020	✓
PVC Filter (EA144-Hg) PVC2515044 - PVC2515044	11-Dec-2019	23-Dec-2019	08-Jun-2020	✓	23-Dec-2019	08-Jun-2020	✓
OHAS: Occupational Air Sampling							
PVC Filter (OHAS-001) PVC2515042 - PVC2515042	05-Dec-2019	----	----	----	29-Jan-2020	04-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515046 - PVC2515046	08-Dec-2019	----	----	----	29-Jan-2020	07-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515043 - PVC2515043	09-Dec-2019	----	----	----	29-Jan-2020	08-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515045 - PVC2515045	10-Dec-2019	----	----	----	29-Jan-2020	09-Dec-2020	✓
PVC Filter (OHAS-001) PVC2515044 - PVC2515044	11-Dec-2019	----	----	----	29-Jan-2020	10-Dec-2020	✓



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: **AIR** 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	
Method Blanks (MB)							
Filter paper analysis by FIMS	EA144-Hg	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Filter paper analysis by ICP AES	EA144-AES	1	5	20.00	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
Inhalable and Respirable Dust	EA143-OC	AIR	In house: Referenced to AS 2985-2009: Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust In house: Referenced to AS 3640-2009: Workplace atmospheres - Method for sampling and gravimetric determination of inhalable dust
Inhalable and Respirable Dust (mass/volume)	* EA143O-MV	AIR	In house: Referenced to AS 2985-2009: Workplace atmospheres - Method for sampling and gravimetric determination of respirable dust In house: Referenced to AS 3640-2009: Workplace atmospheres - Method for sampling and gravimetric determination of inhalable dust Default LORs are based on a sample volume of 1000L (approx 2L/min for 8hr)
Filter paper analysis by ICP AES	EA144-AES	AIR	In house: Referenced to USEPA Method IO-3.2. Residue in air from either High Volume samplers or personal OH&S papers are digested in Nitric acid and analyzed for metals.
Particulate Base Metals - Occupational Samples	* EA144-AES-OH	AIR	In house: Referenced to NIOSH 7303 Particulate Metals in Air. Occupational air filters are digested in Nitric acid and analyzed by ICP-AES for metals. This method calculates metals as mass per unit air volume based on inputs from ICPAES and the air volume sampled. Default LORs are based on a sample volume of 1000L (approx 2L/min for 8hr)
Filter paper analysis by FIMS	EA144-Hg	AIR	In house: Referenced to USEPA Method IO-3.2 Residue in air from either High or Low Volume samplers are digested in Nitric acid and analyzed for metals. In house: Referenced to OSHA ID-145 Particulate Mercury in Workplace Atmospheres
Particulate Mercury on Occupational Air Filters by FIMS (Cal	* EA144-HG-OH	AIR	In house: Referenced to OSHA ID-145 Particulate Mercury in Workplace Atmospheres Residue in air from occupational air samples are digested in Nitric acid and analyzed for metals. This method calculates metals as mass per unit air volume based on inputs from FIMS and the air volume sampled. Default LORs are based on a sample volume of 1000L (approx 2L/min for 8hr)
Occupational Air Sampling - Particulates	* OHAS-001	AIR	Active Sampling of Air for Particulates in Occupational Environments
Preparation Methods	Method	Matrix	Method Descriptions
Particulate Base Metals - HVS	EA144	AIR	In house: Referenced to AS2800-1985 Residue in air from either High Volume samplers or personal OH&S papers are digested in Nitric acid and analyzed for metals.

STARTRACK: 3HIG200003706

Chain of Custody Documentation

Laboratory: ALS WA
Address: 26 Rigali Way, Wangara WA 6065
Contact: Lauren Biagioni / Client Services Coordinator
Phone: 08 9406 1301

Job Number:	P17302	Purchase Order:	
Project Name:	Bulung DSI	Quote No:	EP-382-19 (V2)
Sampled By:	Brandon Henry	Turn Around Time:	Standard
Project Manager:	Blaire Coleman	Page:	of
Email Report To:	blaire.coleman@senversa.com.au	Phone/Mobile:	+61 409 296 017

[illegible]

Environmental Division
Newcastle
Work Order Reference
EN2001788



Telephone : + 61 2 4014 2500

Date:	11/12/2019
-------	------------

Relinquished By:		Method of Shipment (if applicable):		Received by:	
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:	11/3/2020	Date:
Of:	Time:	Date/Time:	Of:		Time:
Name/Signature: <i>ALB BERTH</i>	Date:	Carrier / Reference #:	Name/Signature: <i>ALB</i>	11/3/20	Date:
Of:	Time: 12/3/2020	Date/Time:	Of:	11:00	Time:
Name/Signature:	Date:	Carrier / Reference #:	Name/Signature:		Date:
Of:	Time:	Date/Time:	Of:		Time:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VA = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; SH = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; UA = Unpreserved Amber Glass; L=LuGlu's Iodine preserved white plastic bottle; SW= sulfuric acid preserved wide mouth glass jar

COC 11March_dust



Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EN2001788**

Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES
TERRACE
PERTH 6000**

Laboratory : **Environmental Division Newcastle**
Contact : **Lauren Biagioni**
Address : **5/585 Maitland Road Mayfield West
NSW Australia 2304**

E-mail : **blaire.coleman@senversa.com.au**
Telephone : **+61 08 6557 8881**
Facsimile : **+61 03 9606 0074**

E-mail : **Lauren.biagioni@alsglobal.com**
Telephone : **08 9406 1307**
Facsimile : **+61 2 4967 7382**

Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Site : **----**
Sampler : **Brandon Henry**

Page : **1 of 2**
Quote number : **EP2019SENV0005 (EP/382/19 V3)**
QC Level : **NEPM 2013 B3 & ALS QC Standard**

Dates

Date Samples Received : **17-Mar-2020 11:00**
Client Requested Due Date : **27-Mar-2020**

Issue Date : **19-Mar-2020**
Scheduled Reporting Date : **27-Mar-2020**

Delivery Details

Mode of Delivery : **Carrier**
No. of coolers/boxes : **----**
Receipt Detail :

Security Seal : **Not Available**
Temperature : **----**
No. of samples received / analysed : **4 / 4**

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
- Metals analysis conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- 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.

Method Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
Calculated Rainfall : EA130		
DG2 04/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG3 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG5 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG6 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
Total Solids (TS) : EA142		
DG2 04/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG3 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG5 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate
DG6 03/12/19 - 24/02/20	- Dust Gauge - Unpreserved	- Dust Gauge - Copper Sulfate

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EN2001788-001 : [24-Feb-2020] : DG2 - 04/12/19 - 24/02/20
EN2001788-002 : [24-Feb-2020] : DG3 - 03/12/19 - 24/02/20
EN2001788-003 : [24-Feb-2020] : DG5 - 03/12/19 - 24/02/20
EN2001788-004 : [24-Feb-2020] : DG6 - 03/12/19 - 24/02/20

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: AIR

Laboratory sample ID	Client sampling date / time	Client sample ID	AIR - EA130-Vol Volume	AIR - EA142 Total Solids (TS)	AIR - EG020T Total Metals by ICP/MS (including digestion)
EN2001788-001	24-Feb-2020 00:00	DG2 04/12/19 - 24/0...	✓	✓	✓
EN2001788-002	24-Feb-2020 00:00	DG3 03/12/19 - 24/0...	✓	✓	✓
EN2001788-003	24-Feb-2020 00:00	DG5 03/12/19 - 24/0...	✓	✓	✓
EN2001788-004	24-Feb-2020 00:00	DG6 03/12/19 - 24/0...	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Blaire Coleman

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

Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au
Email blaire.coleman@senversa.com.au

SUPPLIER ACCOUNTS

- A4 - AU Tax Invoice (INV)

Email supplieraccounts@senversa.com.a
u

CERTIFICATE OF ANALYSIS

Work Order : **EN2001788**
Client : **SENVERSA PTY LTD**
Contact : **Blaire Coleman**
Address : **LEVEL 25, 108 ST GEORGES TERRACE**
PERTH 6000
Telephone : **+61 08 6557 8881**
Project : **P17302 Bulong DSI**
Order number : **----**
C-O-C number : **----**
Sampler : **Brandon Henry**
Site : **----**
Quote number : **EP/382/19 V3**
No. of samples received : **4**
No. of samples analysed : **4**

Page : 1 of 4
Laboratory : Environmental Division Newcastle
Contact : Lauren Biagioni
Address : 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone : 08 9406 1307
Date Samples Received : 17-Mar-2020 11:00
Date Analysis Commenced : 23-Mar-2020
Issue Date : 25-Mar-2020 13:00



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	Position	Accreditation Category
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Quality Coordinator	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Metals analysis conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 82 days for sample #001 and 83 days for samples #002, 003 and 004 which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- No copper sulfate correction was applied to samples.



Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST**
 (Matrix: **AIR**)

Client sample ID

				DG2 04/12/19 - 24/02/20	DG3 03/12/19 - 24/02/20	DG5 03/12/19 - 24/02/20	DG6 03/12/19 - 24/02/20	----
Client sampling date / time				24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----
Compound	CAS Number	LOR	Unit	EN2001788-001	EN2001788-002	EN2001788-003	EN2001788-004	-----
				Result	Result	Result	Result	----
EA130: Volume								
Volume	----	1	mL	1100	1190	1380	790	----
EA142: Total Solids								
Total Solids	----	0.1	g/m ² .month	2.7	1.6	2.1	6.3	----
Total Solids (mg)	----	1	mg	129	80	105	310	----



Analytical Results

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

Client sample ID

				DG2 04/12/19 - 24/02/20	DG3 03/12/19 - 24/02/20	DG5 03/12/19 - 24/02/20	DG6 03/12/19 - 24/02/20	----
Client sampling date / time				24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	24-Feb-2020 00:00	----
Compound	CAS Number	LOR	Unit	EN2001788-001	EN2001788-002	EN2001788-003	EN2001788-004	-----
				Result	Result	Result	Result	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Chromium	7440-47-3	0.001	mg/L	0.005	0.002	0.001	0.023	----
Cobalt	7440-48-4	0.001	mg/L	0.001	<0.001	<0.001	0.006	----
Copper	7440-50-8	0.001	mg/L	0.009	0.006	0.006	0.017	----
Lead	7439-92-1	0.001	mg/L	0.003	0.002	0.002	0.015	----
Manganese	7439-96-5	0.001	mg/L	0.026	0.020	0.030	0.074	----
Nickel	7440-02-0	0.001	mg/L	0.015	0.004	0.004	0.058	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L	1.23	1.36	0.978	1.73	----
Iron	7439-89-6	0.05	mg/L	0.58	0.36	0.34	2.55	----

QUALITY CONTROL REPORT

Work Order	: EN2001788	Page	: 1 of 3
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Contact	: Lauren Biagioni
Address	: LEVEL 25, 108 ST GEORGES TERRACE PERTH 6000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 08 6557 8881	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 17-Mar-2020
Order number	: ----	Date Analysis Commenced	: 23-Mar-2020
C-O-C number	: ----	Issue Date	: 25-Mar-2020
Sampler	: Brandon Henry		
Site	: ----		
Quote number	: EP/382/19 V3		
No. of samples received	: 4		
No. of samples analysed	: 4		



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

This Quality Control Report contains the following information:

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

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Jennifer Targett	Quality Coordinator	Newcastle - Inorganics, Mayfield West, NSW



General Comments

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

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

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

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	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020T: Total Metals by ICP-MS (QC Lot: 2933137)									
EN2001788-001	DG2 04/12/19 - 24/02/20	EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.009	0.010	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.026	0.026	0.00	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.015	0.015	0.00	0% - 50%
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	1.23	1.26	2.24	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.58	0.57	0.00	0% - 50%
ES2009747-001	Anonymous	EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.206	0.232	11.8	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	1.99	2.23	11.2	0% - 20%



Method Blank (MB) and Laboratory Control Spike (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 Spike (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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020T: Total Metals by ICP-MS (QCLot: 2933137)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	91.4	82.0	114
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	93.0	86.0	116
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	88.8	84.0	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	90.0	83.0	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	89.4	85.0	115
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	92.3	85.0	113
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	88.3	84.0	116
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	88.0	68.0	126
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.1	79.0	117
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	93.6	85.0	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**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number		MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2933137)							
EN2001788-002	DG3 03/12/19 - 24/02/20	EG020A-T: Arsenic	7440-38-2	1 mg/L	90.8	70.0	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	101	70.0	130
		EG020A-T: Cobalt	7440-48-4	1 mg/L	90.6	70.0	130
		EG020A-T: Copper	7440-50-8	1 mg/L	89.4	70.0	130
		EG020A-T: Lead	7439-92-1	1 mg/L	93.3	70.0	130
		EG020A-T: Manganese	7439-96-5	1 mg/L	99.9	70.0	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	90.8	70.0	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	92.5	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EN2001788	Page	: 1 of 4
Client	: SENVERSA PTY LTD	Laboratory	: Environmental Division Newcastle
Contact	: Blaire Coleman	Telephone	: 08 9406 1307
Project	: P17302 Bulong DSI	Date Samples Received	: 17-Mar-2020
Site	: ----	Issue Date	: 25-Mar-2020
Sampler	: Brandon Henry	No. of samples received	: 4
Order number	: ----	No. of samples analysed	: 4

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

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

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

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

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

Matrix: **AIR**

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

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA130: Volume								
Dust Gauge - Unpreserved (EA130)		24-Feb-2020	----	----	----	23-Mar-2020	22-Aug-2020	✔
DG2 - 04/12/19 - 24/02/20,	DG3 - 03/12/19 - 24/02/20,							
DG5 - 03/12/19 - 24/02/20,	DG6 - 03/12/19 - 24/02/20							
EA142: Total Solids								
Dust Gauge - Unpreserved (EA142)		24-Feb-2020	----	----	----	23-Mar-2020	22-Aug-2020	✔
DG2 - 04/12/19 - 24/02/20,	DG3 - 03/12/19 - 24/02/20,							
DG5 - 03/12/19 - 24/02/20,	DG6 - 03/12/19 - 24/02/20							

Matrix: **WATER**

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

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020T: Total Metals by ICP-MS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG020A-T)							
DG2 - 04/12/19 - 24/02/20, DG3 - 03/12/19 - 24/02/20,	24-Feb-2020	24-Mar-2020	22-Aug-2020	✔	24-Mar-2020	22-Aug-2020	✔
DG5 - 03/12/19 - 24/02/20, DG6 - 03/12/19 - 24/02/20							



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)							
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)							
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
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
Calculated Rainfall	EA130	AIR	In house: Referenced to AS 3580.10.1. A volumetric determination of total rainfall in the period.
Total Solids (TS)	EA142	AIR	In house: Referenced to AS 3580.10.1. A gravimetric procedure reporting Total Solids in deposited dust.
Total Metals by ICP-MS - Suite A	EG020A-T	AIR	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.

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	AIR	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 (2013) Schedule B(3)



Appendix I: EIL Calculation Spreadsheets

Inputs	
Select contaminant from list below	
Cr_III	
Below needed to calculate fresh and aged ACLs	
Enter % clay (values from 0 to 100%)	
7.5	
Below needed to calculate fresh and aged ABCs	
Measured background concentration (mg/kg). Leave blank if no measured value	
210	
or for fresh ABCs only	
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration	
or for aged ABCs only	
Enter State (or closest State)	
SA	
Enter traffic volume (high or low)	
low	

Outputs		
Land use	Cr III soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	260	330
Urban residential and open public spaces	350	570
Commercial and industrial	450	810

Inputs	
Select contaminant from list below	
Cu	
Below needed to calculate fresh and aged ACLs	
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)	
13.3	
Enter soil pH (calcium chloride method) (values from 1 to 14)	
7.5	
Enter organic carbon content (%OC) (values from 0 to 50%)	
0.3	
Below needed to calculate fresh and aged ABCs	
Measured background concentration (mg/kg). Leave blank if no measured value	
26	
or for fresh ABCs only	
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration	
7	
or for aged ABCs only	
Enter State (or closest State)	
SA	
Enter traffic volume (high or low)	
low	

Outputs		
Land use	Cu soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	65	80
Urban residential and open public spaces	110	190
Commercial and industrial	150	260

Inputs	
Select contaminant from list below	
Ni	
Below needed to calculate fresh and aged ACLs	
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)	
13.3	
Below needed to calculate fresh and aged ABCs	
Measured background concentration (mg/kg). Leave blank if no measured value	
180	
or for fresh ABCs only	
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration	
or for aged ABCs only	
Enter State (or closest State)	
SA	
Enter traffic volume (high or low)	
low	

Outputs		
Land use	Ni soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	190	210
Urban residential and open public spaces	240	380
Commercial and industrial	310	530

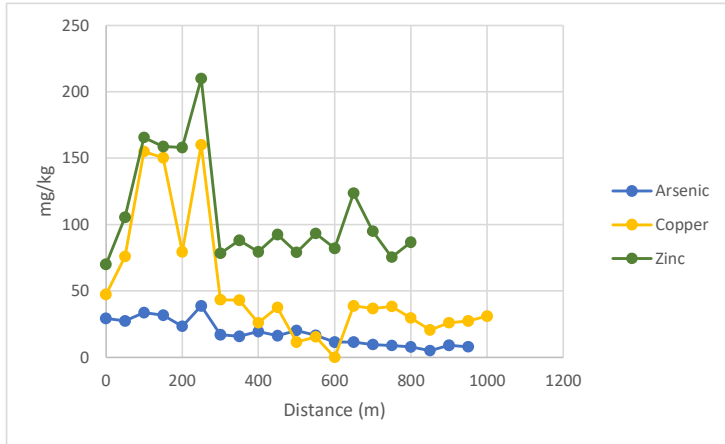
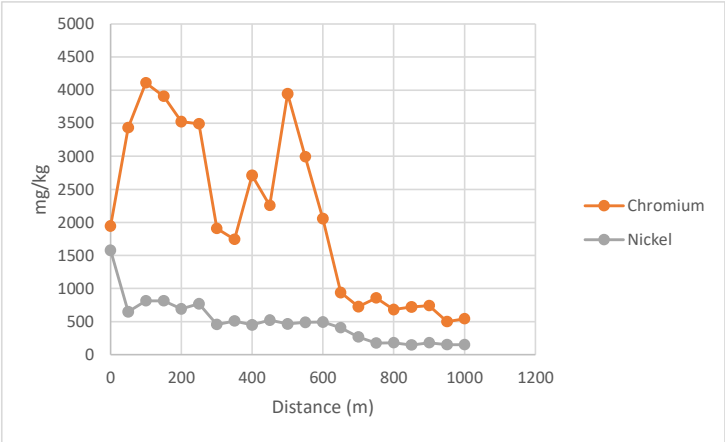
Inputs	
Select contaminant from list below	
Zn	
Below needed to calculate fresh and aged ACLs	
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)	
13.3	
Enter soil pH (calcium chloride method) (values from 1 to 14)	
7.5	
Below needed to calculate fresh and aged ABCs	
Measured background concentration (mg/kg). Leave blank if no measured value	
or for fresh ABCs only	
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration	
or for aged ABCs only	
Enter State (or closest State)	
SA	
Enter traffic volume (high or low)	
low	

Outputs		
Land use	Zn soil-specific EILs	
	(mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	#NUM!	170
Urban residential and open public spaces	#NUM!	560
Commercial and industrial	#NUM!	840



Appendix J: XRF Data

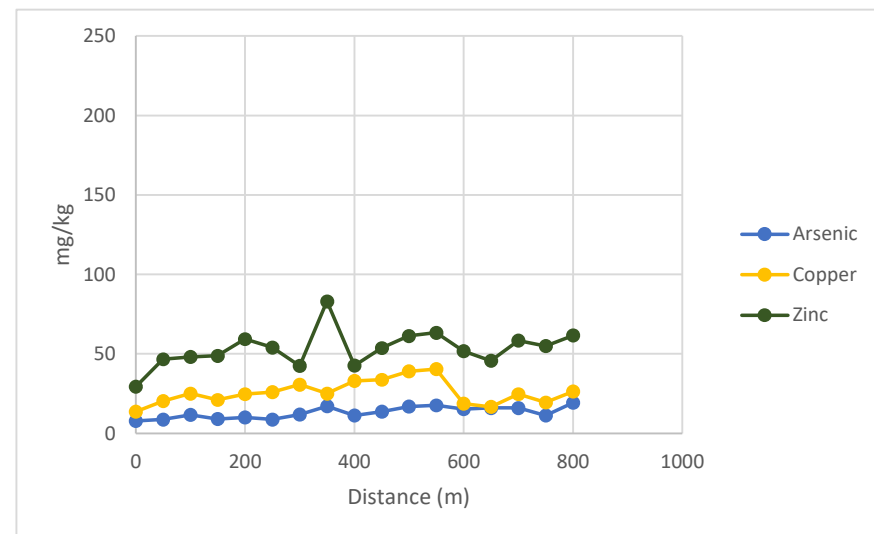
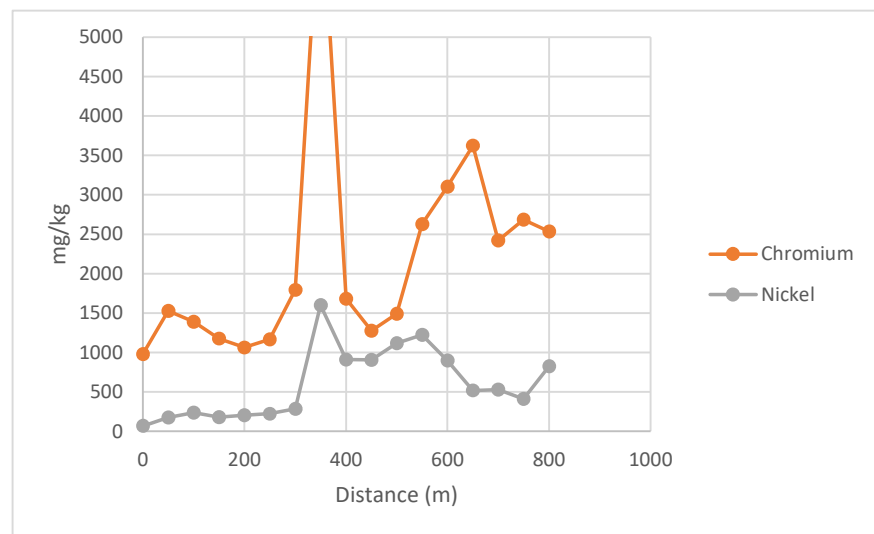
Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T1-01	Arsenic	0	27	31	30	29	13
T1-02	Arsenic	50	28	25	29	27	12
T1-03	Arsenic	100	38	34	29	34	15
T1-04	Arsenic	150	28	39	28	32	14
T1-05	Arsenic	200	37	33	0	23	10
T1-06	Arsenic	250	33	42	41	39	17
T1-07	Arsenic	300	16	18	17	17	7
T1-08	Arsenic	350	14	15	18	16	7
T1-09	Arsenic	400	21	21	16	19	8
T1-10	Arsenic	450	20	14	15	16	7
T1-11	Arsenic	500	21	18	22	20	9
T1-12	Arsenic	550	13	18	19	17	7
T1-13	Arsenic	600	14	0	20	11	5
T1-14	Arsenic	650	13	11	10	11	5
T1-15	Arsenic	700	8	11	10	10	4
T1-16	Arsenic	750	7.2	10.2	9	9	4
T1-17	Arsenic	800	7.3	8	8	8	3
T1-18	Arsenic	850	0	8	7	5	2
T1-19	Arsenic	900	8	8	11	9	4
T1-20	Arsenic	950	8.9	7.3	7.8	8	3
T1-21	Arsenic	1000	6.8	6.5	7.5	7	3
T1-01	Chromium	0	1839	2188	1812	1946	513
T1-02	Chromium	50	3160	3001	4134	3432	651
T1-03	Chromium	100	4251	4638	3443	4111	714
T1-04	Chromium	150	3997	4237	3487	3907	695
T1-05	Chromium	200	4306	3527	2740	3524	659
T1-06	Chromium	250	3455	2800	4223	3493	656
T1-07	Chromium	300	2223	1925	1575	1908	510
T1-08	Chromium	350	1624	1721	1886	1744	495
T1-09	Chromium	400	2968	2526	2633	2709	584
T1-10	Chromium	450	2106	2095	2566	2256	542
T1-11	Chromium	500	3284	3747	4803	3945	698
T1-12	Chromium	550	2688	3645	2643	2992	610
T1-13	Chromium	600	2318	2144	1712	2058	524
T1-14	Chromium	650	985	837	1000	941	420
T1-15	Chromium	700	683	720	772	725	400
T1-16	Chromium	750	889	1039	647	858	413
T1-17	Chromium	800	794	786	466	682	396
T1-18	Chromium	850	881	492	791	721	400
T1-19	Chromium	900	443	1169	613	742	402
T1-20	Chromium	950	674	399	430	501	380
T1-21	Chromium	1000	669	480	483	544	384



Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T1-01	Copper	0	41	48	53	47	
T1-02	Copper	50	31	89	108	76	
T1-03	Copper	100	140	178	147	155	
T1-04	Copper	150	191	161	99	150	
T1-05	Copper	200	0	134	104	79	
T1-06	Copper	250	166	181	133	160	
T1-07	Copper	300	37	48	45	43	
T1-08	Copper	350	45	52	32	43	
T1-09	Copper	400	37	0	41	26	
T1-10	Copper	450	30	39	44	38	
T1-11	Copper	500	34	0	0	11	
T1-12	Copper	550	21	0	25	15	
T1-13	Copper	600	0	0	0	0	
T1-14	Copper	650	39	43	34	39	
T1-15	Copper	700	44	37	29	37	
T1-16	Copper	750	33	38	44	38	
T1-17	Copper	800	19	35	35	30	
T1-18	Copper	850	0	29	33	21	
T1-19	Copper	900	25	28	25	26	
T1-20	Copper	950	22	27	33	27	
T1-21	Copper	1000	29	33	31	31	
T1-01	Lead	0	13	0	0	4	
T1-02	Lead	50	14	44	35	31	
T1-03	Lead	100	52	73	69	65	
T1-04	Lead	150	75	65	46	62	
T1-05	Lead	200	33	52	54	46	
T1-06	Lead	250	79	66	52	66	
T1-07	Lead	300	15	12	16	14	
T1-08	Lead	350	16	15	12	14	
T1-09	Lead	400	11	10	17	13	
T1-10	Lead	450	0	16	14	10	
T1-11	Lead	500	0	0	0	0	
T1-12	Lead	550	19	0	0	6	
T1-13	Lead	600	0	20	0	7	
T1-14	Lead	650	10	12	13	12	
T1-15	Lead	700	11	8	11	10	
T1-16	Lead	750	9	0	9	6	
T1-17	Lead	800	8	14	0	7	
T1-18	Lead	850	0	8	13	7	
T1-19	Lead	900	9	15	8	11	
T1-20	Lead	950	7	10	12	10	
T1-21	Lead	1000	8	12	9	10	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T1-01	Nickel	0	1665	1512	1558	1578	468
T1-02	Nickel	50	642	656	652	650	276
T1-03	Nickel	100	831	874	738	814	310
T1-04	Nickel	150	704	899	840	814	310
T1-05	Nickel	200	729	767	576	691	284
T1-06	Nickel	250	917	837	547	767	300
T1-07	Nickel	300	496	372	500	456	236
T1-08	Nickel	350	507	506	514	509	247
T1-09	Nickel	400	456	435	451	447	234
T1-10	Nickel	450	437	573	555	522	249
T1-11	Nickel	500	533	412	446	464	237
T1-12	Nickel	550	535	441	493	490	243
T1-13	Nickel	600	514	392	567	491	243
T1-14	Nickel	650	452	365	413	410	226
T1-15	Nickel	700	280	244	274	266	196
T1-16	Nickel	750	178	141	206	175	177
T1-17	Nickel	800	191	179	170	180	178
T1-18	Nickel	850	100	144	200	148	172
T1-19	Nickel	900	167	188	183	179	178
T1-20	Nickel	950	166	147	143	152	173
T1-21	Nickel	1000	153	154	144	150	172
T1-01	Zinc	0	67	77	66	70	
T1-02	Zinc	50	93	101	122	105	
T1-03	Zinc	100	170	178	149	166	
T1-04	Zinc	150	163	186	127	159	
T1-05	Zinc	200	143	160	171	158	
T1-06	Zinc	250	203	228	199	210	
T1-07	Zinc	300	85	79	71	78	
T1-08	Zinc	350	79	85	100	88	
T1-09	Zinc	400	99	69	70	79	
T1-10	Zinc	450	84	97	96	92	
T1-11	Zinc	500	87	69	81	79	
T1-12	Zinc	550	101	72	107	93	
T1-13	Zinc	600	78	72	96	82	
T1-14	Zinc	650	124	112	135	124	
T1-15	Zinc	700	112	79	94	95	
T1-16	Zinc	750	74	60	92	75	
T1-17	Zinc	800	85	94	81	87	
T1-18	Zinc	850	82	81	96	86	
T1-19	Zinc	900	80	78	89	82	
T1-20	Zinc	950	92	93	87	91	
T1-21	Zinc	1000	87	91	87	88	

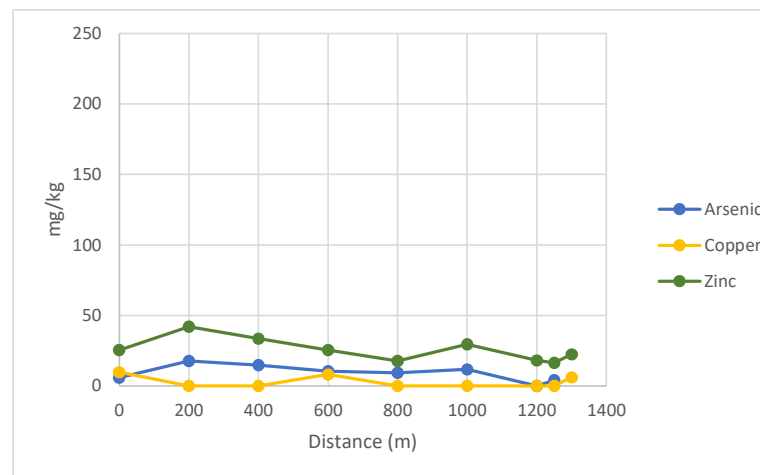
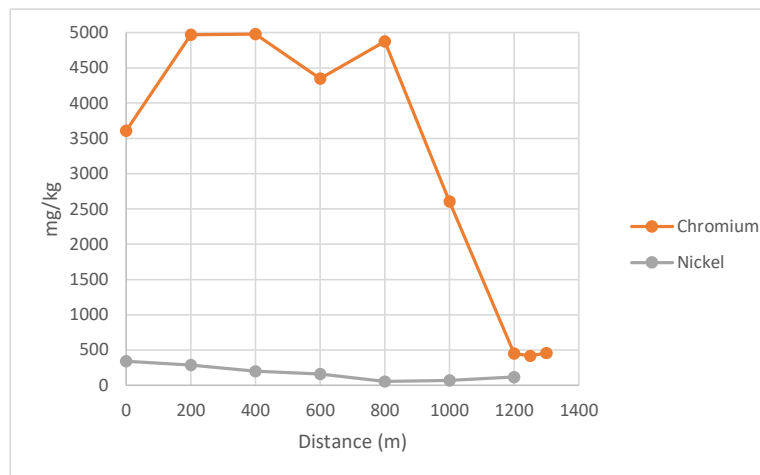
Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T10-01	Arsenic	0	7.5	8.8	7	8	3
T10-02	Arsenic	50	11.2	7.6	7.4	9	4
T10-03	Arsenic	100	13.9	8.5	12.4	12	5
T10-04	Arsenic	150	8.9	9.2	8.8	9	4
T10-05	Arsenic	200	11.3	8.2	10.6	10	4
T10-06	Arsenic	250	10.2	8.2	7.9	9	4
T10-07	Arsenic	300	10.5	16.6	8.4	12	5
T10-08	Arsenic	350	19	14.3	18	17	7
T10-09	Arsenic	400	10.4	10.8	12.4	11	5
T10-10	Arsenic	450	15.4	13	12.4	14	6
T10-11	Arsenic	500	18.1	19.8	12.7	17	7
T10-12	Arsenic	550	18.4	18.5	15.8	18	8
T10-13	Arsenic	600	15.3	16.1	14.3	15	7
T10-14	Arsenic	650	16.4	15.8	15.7	16	7
T10-15	Arsenic	700	17.7	15.3	14.6	16	7
T10-16	Arsenic	750	12.7	10.7	10.2	11	5
T10-17	Arsenic	800	13.5	22	22	19	335
T10-01	Chromium	0	980	1055	904	980	424
T10-02	Chromium	50	1760	1437	1381	1526	474
T10-03	Chromium	100	1264	1273	1632	1390	462
T10-04	Chromium	150	1079	1373	1076	1176	442
T10-05	Chromium	200	867	1228	1093	1063	432
T10-06	Chromium	250	1426	853	1219	1166	441
T10-07	Chromium	300	843	2531	2006	1793	499
T10-08	Chromium	350	7245	4810	8964	7006	981
T10-09	Chromium	400	2262	1692	1093	1682	489
T10-10	Chromium	450	1290	1289	1244	1274	451
T10-11	Chromium	500	1476	1908	1090	1491	471
T10-12	Chromium	550	2574	2931	2380	2628	576
T10-13	Chromium	600	3701	2720	2883	3101	620
T10-14	Chromium	650	4196	3639	3043	3626	669
T10-15	Chromium	700	2393	2797	2076	2422	557
T10-16	Chromium	750	2898	2544	2618	2687	582
T10-17	Chromium	800	1915	2748	2948	2537	568



Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T10-01	Copper	0	15	12	14	14	
T10-02	Copper	50	27	15	19	20	
T10-03	Copper	100	24	26	25	25	
T10-04	Copper	150	22	21	20	21	
T10-05	Copper	200	23	32	19	25	
T10-06	Copper	250	27	27	24	26	
T10-07	Copper	300	33	23	36	31	
T10-08	Copper	350	24	28	23	25	
T10-09	Copper	400	23	31	45	33	
T10-10	Copper	450	41	31	29	34	
T10-11	Copper	500	40	48	29	39	
T10-12	Copper	550	40	42	39	40	
T10-13	Copper	600	34	0	22	19	
T10-14	Copper	650	20	15	15	17	
T10-15	Copper	700	26	22	26	25	
T10-16	Copper	750	24	12	22	19	
T10-17	Copper	800	33	22	24	26	
T10-01	Lead	0	3.9	4.3	5	4	
T10-02	Lead	50	6.5	5.1	7.4	6	
T10-03	Lead	100	9	8.4	4.8	7	
T10-04	Lead	150	5.8	5.7	8.1	7	
T10-05	Lead	200	6.3	12.9	4.9	8	
T10-06	Lead	250	6.2	7.6	4.5	6	
T10-07	Lead	300	3.1	0	8.4	4	
T10-08	Lead	350	7	0	0	2	
T10-09	Lead	400	7	4.7	0	4	
T10-10	Lead	450	0	3.7	7.3	4	
T10-11	Lead	500	0	0	4.4	1	
T10-12	Lead	550	5.9	9	5.6	7	
T10-13	Lead	600	4.4	0	0	1	
T10-14	Lead	650	0	0	6	2	
T10-15	Lead	700	0	5	9	5	
T10-16	Lead	750	6	8.5	10	8	
T10-17	Lead	800	10	0	0	3	

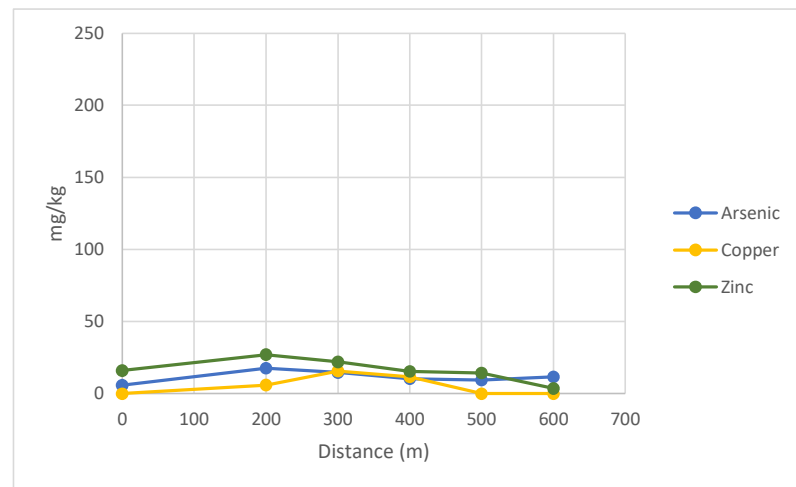
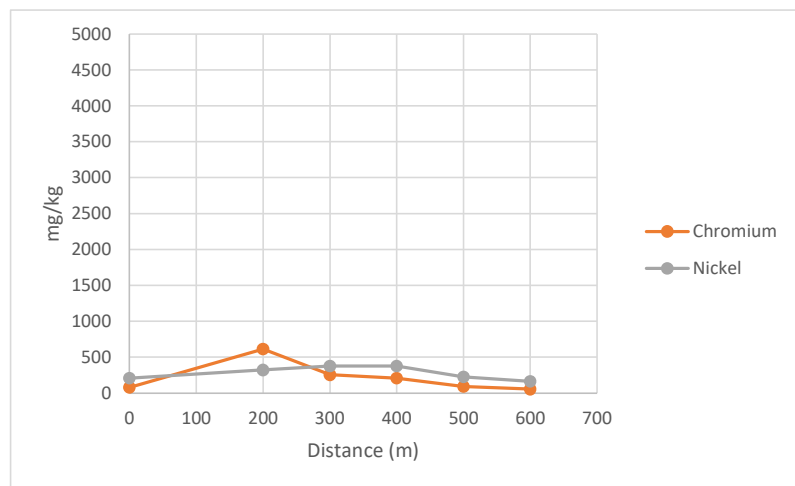
Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T10-01	Nickel	0	62	42	102	69	155
T10-02	Nickel	50	209	141	174	175	177
T10-03	Nickel	100	228	233	250	237	190
T10-04	Nickel	150	162	166	210	179	178
T10-05	Nickel	200	176	226	208	203	183
T10-06	Nickel	250	244	237	192	224	188
T10-07	Nickel	300	282	309	263	285	200
T10-08	Nickel	350	1834	1156	1812	1601	473
T10-09	Nickel	400	860	985	889	911	330
T10-10	Nickel	450	924	898	897	906	329
T10-11	Nickel	500	1208	1249	898	1118	373
T10-12	Nickel	550	1268	1241	1165	1225	395
T10-13	Nickel	600	1032	724	939	898	327
T10-14	Nickel	650	536	406	613	518	249
T10-15	Nickel	700	482	501	608	530	251
T10-16	Nickel	750	577	327	336	413	227
T10-17	Nickel	800	543	967	972	827	313
T10-01	Zinc	0	30	31	27	29	
T10-02	Zinc	50	55	42	43	47	
T10-03	Zinc	100	50	46	48	48	
T10-04	Zinc	150	46	48	52	49	
T10-05	Zinc	200	54	73	51	59	
T10-06	Zinc	250	54	56	52	54	
T10-07	Zinc	300	38	43	46	42	
T10-08	Zinc	350	105	61	83	83	
T10-09	Zinc	400	37	50	41	43	
T10-10	Zinc	450	54	57	50	54	
T10-11	Zinc	500	64	59	61	61	
T10-12	Zinc	550	59	66	65	63	
T10-13	Zinc	600	56	46	53	52	
T10-14	Zinc	650	53	37	47	46	
T10-15	Zinc	700	54	62	59	58	
T10-16	Zinc	750	53	53	59	55	
T10-17	Zinc	800	78	53	54	62	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T16-01	Arsenic	0	0	9	8.3	6	2
T16-02	Arsenic	200	11	23	19	18	8
T16-03	Arsenic	400	22	14	8	15	6
T16-04	Arsenic	600	7.1	12	12	10	4
T16-05	Arsenic	800	18	0	10	9	4
T16-06	Arsenic	1000	19	9	7	12	5
T16-07	Arsenic	1200	0	0	0	0	0
T16-08	Arsenic	1250	0	7.5	4.7	4	1
T16-09	Arsenic	1300	5	7.9	8.5	7	3
T16-01	Chromium	0	2491	5674	2661	3609	667
T16-02	Chromium	200	2465	6303	6148	4972	793
T16-03	Chromium	400	6282	5374	3286	4981	794
T16-04	Chromium	600	1665	5095	6294	4351	736
T16-05	Chromium	800	5232	4597	4795	4875	784
T16-06	Chromium	1000	4197	779	2840	2605	574
T16-07	Chromium	1200	574	356	426	452	375
T16-08	Chromium	1250	428	516	308	417	372
T16-09	Chromium	1300	629	401	339	456	375
T16-01	Copper	0	0	29	0	10	
T16-02	Copper	200	0	0	0	0	
T16-03	Copper	400	0	0	0	0	
T16-04	Copper	600	0	24	0	8	
T16-05	Copper	800	0	0	0	0	
T16-06	Copper	1000	0	0	0	0	
T16-07	Copper	1200	0	0	0	0	
T16-08	Copper	1250	0	0	0	0	
T16-09	Copper	1300	0	18	0	6	
T16-01	Lead	0	0	0	0	0	
T16-02	Lead	200	0	0	0	0	
T16-03	Lead	400	0	0	0	0	
T16-04	Lead	600	0	13	0	4	
T16-05	Lead	800	0	0	0	0	
T16-06	Lead	1000	0	0	0	0	
T16-07	Lead	1200	0	6.2	0	2	
T16-08	Lead	1250	6.5	0	0	2	
T16-09	Lead	1300	0	0	0	0	
T16-01	Nickel	0	278	318	217	271	197
T16-02	Nickel	200	831	671	655	719	290
T16-03	Nickel	400	638	212	170	340	212



Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T16-04	Nickel	600	206	374	284	288	201
T16-05	Nickel	800	195	193	212	200	183
T16-06	Nickel	1000	180	157	140	159	174
T16-07	Nickel	1200	60	52	52	55	152
T16-08	Nickel	1250	57	70	75	67	155
T16-09	Nickel	1300	118	120	108	115	165
T16-01	Zinc	0	21	31	24	25	
T16-02	Zinc	200	23	51	52	42	
T16-03	Zinc	400	58	20	22	33	
T16-04	Zinc	600	18	41	17	25	
T16-05	Zinc	800	15	21	17	18	
T16-06	Zinc	1000	45	23	20	29	
T16-07	Zinc	1200	15	25	14	18	
T16-08	Zinc	1250	14	21	14	16	
T16-09	Zinc	1300	18	29	20	22	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T20-01	Arsenic	0	0	9.5	6.1	5	2
T20-02	Arsenic	200	8.5	11	9	10	4
T20-03	Arsenic	300	8.3	6.6	6.6	7	3
T20-04	Arsenic	400	9.2	6.7	0	5	2
T20-05	Arsenic	500	4.9	0	0	2	0
T20-06	Arsenic	600	0	0	0	0	0
T20-01	Chromium	0	58	47	138	81	341
T20-02	Chromium	200	366	1049	426	614	390
T20-03	Chromium	300	322	221	229	257	357
T20-04	Chromium	400	206	277	148	210	353
T20-05	Chromium	500	162	41	68	90	342
T20-06	Chromium	600	0	0	164	55	338
T20-01	Copper	0	0	0	0	0	
T20-02	Copper	200	18	0	0	6	
T20-03	Copper	300	0	21	26	16	
T20-04	Copper	400	19	0	16	12	
T20-05	Copper	500	0	0	0	0	
T20-06	Copper	600	0	0	0	0	
T20-01	Lead	0	8	0	7	5	
T20-02	Lead	200	0	9	0	3	
T20-03	Lead	300	0	0	0	0	
T20-04	Lead	400	0	0	0	0	
T20-05	Lead	500	0	0	0	0	
T20-06	Lead	600	5.1	0	0	2	
T20-01	Nickel	0	187	228	216	210	185
T20-02	Nickel	200	325	331	311	322	208
T20-03	Nickel	300	305	374	453	377	219
T20-04	Nickel	400	472	326	329	376	219
T20-05	Nickel	500	321	158	199	226	188
T20-06	Nickel	600	133	0	360	164	175
T20-01	Zinc	0	15	16	17	16	
T20-02	Zinc	200	28	30	23	27	
T20-03	Zinc	300	25	18	23	22	
T20-04	Zinc	400	19	13	14	15	
T20-05	Zinc	500	15	10	18	14	
T20-06	Zinc	600	11	0	0	4	



Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) raw	mg/kg (corrected)
T4-01	Arsenic	0	19	18	17	18	8
T4-02	Arsenic	50	14	20	15	16	7
T4-03	Arsenic	100	10	12	13	12	5
T4-04	Arsenic	150	14	14	14	14	6
T4-05	Arsenic	200	16	22	10	16	7
T4-06	Arsenic	250	14	13	15	14	6
T4-07	Arsenic	300	16	17	17	17	7
T4-08	Arsenic	350	14	15	20	16	7
T4-09	Arsenic	400	13	31	11	18	8
T4-10	Arsenic	450	18	20	15	18	8
T4-11	Arsenic	500	16	16	16	16	7
T4-12	Arsenic	550	18	20	22	20	9
T4-13	Arsenic	600	23	19	31	24	11
T4-14	Arsenic	650	16	17	25	19	8
T4-15	Arsenic	700	11	11	22	15	6
T4-16	Arsenic	750	17	23	17	19	8
T4-17	Arsenic	800	16	15	21	17	8
T4-18	Arsenic	850	25	19	21	22	10
T4-19	Arsenic	900	22	15	25	21	9
T4-20	Arsenic	950	23	25	21	23	10
T4-01	Chromium	0	1819	2208	3309	2445	559
T4-02	Chromium	50	1921	1411	1524	1619	483
T4-03	Chromium	100	1582	1217	2146	1648	486
T4-04	Chromium	150	2645	1759	1927	2110	528
T4-05	Chromium	200	1786	1844	1843	1824	502
T4-06	Chromium	250	1356	1554	1670	1527	474
T4-07	Chromium	300	2682	1878	1891	2150	532
T4-08	Chromium	350	1420	1836	2997	2084	526
T4-09	Chromium	400	2171	1998	1735	1968	515
T4-10	Chromium	450	1515	1807	2081	1801	500
T4-11	Chromium	500	1004	1009	724	912	418
T4-12	Chromium	550	953	1085	1296	1111	436
T4-13	Chromium	600	1777	1725	1943	1815	501
T4-14	Chromium	650	1720	1984	1479	1728	493
T4-15	Chromium	700	1528	1234	1510	1424	465
T4-16	Chromium	750	981	1482	1710	1391	462
T4-17	Chromium	800	1469	1838	2708	2005	519
T4-18	Chromium	850	2707	3031	3668	3135	623
T4-19	Chromium	900	3675	2966	6391	4344	735
T4-20	Chromium	950	4879	5658	6466	5668	858
T4-01	Copper	0	0	28	30	19	
T4-02	Copper	50	20	32	24	25	
T4-03	Copper	100	36	37	23	32	
T4-04	Copper	150	21	27	25	24	
T4-05	Copper	200	19	42	39	33	
T4-06	Copper	250	23	21	40	28	
T4-07	Copper	300	32	40	35	36	
T4-08	Copper	350	37	39	23	33	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) raw	mg/kg (corrected)
T4-09	Copper	400	42	34	44	40	
T4-10	Copper	450	41	32	40	38	
T4-11	Copper	500	26	29	24	26	
T4-12	Copper	550	76	83	94	84	
T4-13	Copper	600	60	38	33	44	
T4-14	Copper	650	74	59	71	68	
T4-15	Copper	700	63	66	79	69	
T4-16	Copper	750	54	70	79	68	
T4-17	Copper	800	79	68	47	65	
T4-18	Copper	850	65	36	41	47	
T4-19	Copper	900	24	34	32	30	
T4-20	Copper	950	28	46	35	36	
T4-01	Lead	0	0	0	0	0	
T4-02	Lead	50	0	0	0	0	
T4-03	Lead	100	12	11	0	8	
T4-04	Lead	150	11	10	0	7	
T4-05	Lead	200	10	14	12	12	
T4-06	Lead	250	0	0	13	4	
T4-07	Lead	300	0	11	11	7	
T4-08	Lead	350	0	0	0	0	
T4-09	Lead	400	10	20	0	10	
T4-10	Lead	450	11	14	11	12	
T4-11	Lead	500	0	0	14	5	
T4-12	Lead	550	8	0	9	6	
T4-13	Lead	600	17	0	14	10	
T4-14	Lead	650	9	20	11	13	
T4-15	Lead	700	13	15	0	9	
T4-16	Lead	750	8	10	13	10	
T4-17	Lead	800	13	15	0	9	
T4-18	Lead	850	12	10	0	7	
T4-19	Lead	900	0	13	0	4	
T4-20	Lead	950	0	11	23	11	
T4-01	Nickel	0	0	215	222	146	171
T4-02	Nickel	50	227	238	219	228	188
T4-03	Nickel	100	268	244	265	259	195
T4-04	Nickel	150	277	246	343	289	201
T4-05	Nickel	200	369	385	237	330	210
T4-06	Nickel	250	175	215	476	289	201
T4-07	Nickel	300	476	471	365	437	232
T4-08	Nickel	350	353	273	347	324	208
T4-09	Nickel	400	367	422	358	382	220
T4-10	Nickel	450	261	227	246	245	192
T4-11	Nickel	500	167	184	178	176	178
T4-12	Nickel	550	193	236	209	213	185
T4-13	Nickel	600	362	246	338	315	206
T4-14	Nickel	650	317	375	384	359	215
T4-15	Nickel	700	343	328	420	364	217
T4-16	Nickel	750	322	377	445	381	220

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) raw	mg/kg (corrected)
T4-17	Nickel	800	473	398	573	481	241
T4-18	Nickel	850	700	496	1063	753	297
T4-19	Nickel	900	954	945	1685	1195	389
T4-20	Nickel	950	1430	1376	1228	1345	420
T4-01	Zinc	0	22	48	46	39	
T4-02	Zinc	50	54	64	65	61	
T4-03	Zinc	100	70	66	58	65	
T4-04	Zinc	150	52	56	68	59	
T4-05	Zinc	200	72	88	52	71	
T4-06	Zinc	250	56	58	86	67	
T4-07	Zinc	300	87	88	102	92	
T4-08	Zinc	350	85	84	61	77	
T4-09	Zinc	400	58	64	55	59	
T4-10	Zinc	450	104	105	93	101	
T4-11	Zinc	500	65	42	63	57	
T4-12	Zinc	550	71	72	67	70	
T4-13	Zinc	600	75	38	66	60	
T4-14	Zinc	650	78	76	71	75	
T4-15	Zinc	700	67	83	96	82	
T4-16	Zinc	750	82	90	91	88	
T4-17	Zinc	800	88	70	68	75	
T4-18	Zinc	850	68	69	52	63	
T4-19	Zinc	900	48	47	65	53	
T4-20	Zinc	950	53	63	42	53	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T5-02	Arsenic	50	7.8	18	29	18	8
T5-03	Arsenic	100	19	13	18	17	7
T5-04	Arsenic	150	16	10	0	9	4
T5-05	Arsenic	200	12	13	11	12	5
T5-06	Arsenic	250	7.8	7.3	19	11	5
T5-01	Arsenic		62	40	36	46	21
T5-01	Chromium	0	12600	5229	5628	7819	1057
T5-02	Chromium	50	3824	3923	4222	3990	702
T5-03	Chromium	100	4263	1763	2919	2982	609
T5-04	Chromium	150	2646	1460	605	1570	479
T5-05	Chromium	200	659	918	1083	887	415
T5-06	Chromium	250	1065	834	1114	1004	426
T5-01	Copper	0	0	0	0	0	
T5-02	Copper	50	26	29	43	33	
T5-03	Copper	100	34	49	51	45	
T5-04	Copper	150	27	27	0	18	
T5-05	Copper	200	37	30	28	32	
T5-06	Copper	250	27	33	31	30	
T5-01	Lead	0	43	0	0	14	
T5-02	Lead	50	0	0	0	0	
T5-03	Lead	100	0	0	12	4	
T5-04	Lead	150	0	8	13	7	
T5-05	Lead	200	8	0	9	6	
T5-06	Lead	250	9	0	0	3	
T5-01	Nickel	0	599	367	290	419	228
T5-02	Nickel	50	136	251	277	221	187
T5-03	Nickel	100	450	608	507	522	249
T5-04	Nickel	150	671	526	275	491	243
T5-05	Nickel	200	493	508	493	498	244
T5-06	Nickel	250	545	568	380	498	244
T5-01	Zinc	0	55	48	46	50	
T5-02	Zinc	50	50	38	74	54	
T5-03	Zinc	100	64	50	67	60	
T5-04	Zinc	150	67	56	33	52	
T5-05	Zinc	200	56	55	57	56	
T5-06	Zinc	250	41	4.8	46	31	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T6-02	Arsenic	200	11	17	21	16	7
T6-03	Arsenic	400	12	14	18	15	6
T6-04	Arsenic	600	16	26	22	21	9
T6-05	Arsenic	700	16	13	11	13	6
T6-06	Arsenic	800	18	12	13.6	15	6
T6-07	Arsenic	850	10	13	7.4	10	4
T6-08	Arsenic	900	52	58	61	57	26
T6-09	Arsenic	950	16	14	12	14	6
T6-10	Arsenic	1000	13	16	18	16	7
T6-01	Arsenic	c	12	18	11	14	6
T6-01	Chromium	0	2481	820	1280	1527	475
T6-02	Chromium	200	802	935	2287	1341	457
T6-03	Chromium	400	1583	1317	986	1295	453
T6-04	Chromium	600	1207	1200	2068	1492	471
T6-05	Chromium	700	1105	807	732	881	415
T6-06	Chromium	800	1156	546	589	764	404
T6-07	Chromium	850	812	1133	243	729	401
T6-08	Chromium	900	3097	3287	4031	3472	654
T6-09	Chromium	950	1789	1610	1650	1683	489
T6-10	Chromium	1000	1541	1369	1810	1573	479
T6-01	Copper	0	22	0	27	16	
T6-02	Copper	200	32	50	46	43	
T6-03	Copper	400	51	51	52	51	
T6-04	Copper	600	56	49	57	54	
T6-05	Copper	700	36	65	65	55	
T6-06	Copper	800	72	60	45	59	
T6-07	Copper	850	36	45	31	37	
T6-08	Copper	900	33	54	48	45	
T6-09	Copper	950	34	0	0	11	
T6-10	Copper	1000	0	32	0	11	
T6-01	Lead	0	0	0	0	0	
T6-02	Lead	200	8	9	0	6	
T6-03	Lead	400	8	0	0	3	
T6-04	Lead	600	0	0	11	4	
T6-05	Lead	700	0	0	0	0	
T6-06	Lead	800	0	0	0	0	
T6-07	Lead	850	9	0	0	3	
T6-08	Lead	900	0	0	0	0	
T6-09	Lead	950	0	0	0	0	
T6-10	Lead	1000	0	8	10	6	
T6-01	Nickel	0	580	472	514	522	249
T6-02	Nickel	200	565	869	1051	828	313
T6-03	Nickel	400	819	1438	1235	1164	382
T6-04	Nickel	600	1678	1356	1515	1516	455
T6-05	Nickel	700	925	583	656	721	291
T6-06	Nickel	800	691	426	339	485	242
T6-07	Nickel	850	355	481	249	362	216
T6-08	Nickel	900	3041	2971	2993	3002	763

T6-09	Nickel	950	2711	2530	2637	2626	685
T6-10	Nickel	1000	2321	2370	2287	2326	623
T6-01	Zinc	0	56	64	63	61	
T6-02	Zinc	200	75	83	91	83	
T6-03	Zinc	400	71	87	70	76	
T6-04	Zinc	600	116	61	80	86	
T6-05	Zinc	700	58	124	150	111	
T6-06	Zinc	800	150	94	91	112	
T6-07	Zinc	850	86	94	78	86	
T6-08	Zinc	900	47	49	59	52	
T6-09	Zinc	950	38	38	51	42	
T6-10	Zinc	1000	46	44	52	47	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T8-01	Arsenic	0	19	7.5	9.9	12	5
T8-02	Arsenic	50	13.5	10.2	11.4	12	5
T8-03	Arsenic	100	22	15	12.7	17	7
T8-04	Arsenic	150	12	10	11.4	11	5
T8-05	Arsenic	200	10.7	8.6	16.1	12	5
T8-06	Arsenic	250	14	11.2	14	13	6
T8-07	Arsenic	450	15	20	15	17	7
T8-08	Arsenic	650	8	5.7	11	8	3
T8-09	Arsenic	850	8	10	8	9	4
T8-10	Arsenic	1150	12	14	9	12	5
T8-11	Arsenic	1450	9	9	10	9	4
T8-12	Arsenic	1750	12.2	8.2	14	11	5
T8-13	Arsenic	2050	14.2	12	7	11	5
T8-14	Arsenic	2350	14.4	13	14	14	6
T8-01	Chromium	0	3307	1748	1582	2212	538
T8-02	Chromium	50	2345	1455	1054	1618	483
T8-03	Chromium	100	2851	2201	2132	2395	555
T8-04	Chromium	150	1691	2120	1862	1891	508
T8-05	Chromium	200	2248	1833	2222	2101	528
T8-06	Chromium	250	2599	2087	1621	2102	528
T8-07	Chromium	450	1519	2356	1590	1822	502
T8-08	Chromium	650	1053	972	944	990	425
T8-09	Chromium	850	1152	2433	1489	1691	490
T8-10	Chromium	1150	1982	1893	1888	1921	511
T8-11	Chromium	1450	1193	1365	888	1149	440
T8-12	Chromium	1750	770	951	938	886	415
T8-13	Chromium	2050	932	1242	1001	1058	431
T8-14	Chromium	2350	1026	963	1621	1203	445
T8-01	Copper	0	0	0	18	6	
T8-02	Copper	50	38	27	26	30	
T8-03	Copper	100	39	26	38	34	
T8-04	Copper	150	30	29	21	27	
T8-05	Copper	200	23	33	35	30	
T8-06	Copper	250	44	31	33	36	
T8-07	Copper	450	60	37	43	47	
T8-08	Copper	650	24	17	0	14	
T8-09	Copper	850	16	0	24	13	
T8-10	Copper	1150	30	32	39	34	
T8-11	Copper	1450	0	45	25	23	
T8-12	Copper	1750	40	43	28	37	
T8-13	Copper	2050	24	37	16	26	
T8-14	Copper	2350	39	37	18	31	
T8-01	Lead	0	0	5.2	0	2	
T8-02	Lead	50	6.3	7.9	10.2	8	
T8-03	Lead	100	12	9.3	7.9	10	
T8-04	Lead	150	3.4	7.6	5.1	5	
T8-05	Lead	200	5	8.1	6	6	
T8-06	Lead	250	9	10	7	9	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T8-07	Lead	450	6	0	7	4	
T8-08	Lead	650	0	9	0	3	
T8-09	Lead	850	0	0	11	4	
T8-10	Lead	1150	9	0	6	5	
T8-11	Lead	1450	0	0	0	0	
T8-12	Lead	1750	5	5	0	3	
T8-13	Lead	2050	2	8	4	5	
T8-14	Lead	2350	0	6	0	2	
T8-01	Nickel	0	664	252	456	457	236
T8-02	Nickel	50	411	433	404	416	227
T8-03	Nickel	100	928	550	438	639	274
T8-04	Nickel	150	463	447	386	432	231
T8-05	Nickel	200	436	440	520	465	238
T8-06	Nickel	250	597	668	704	656	277
T8-07	Nickel	450	1310	1086	1005	1134	376
T8-08	Nickel	650	236	211	222	223	187
T8-09	Nickel	850	191	238	263	231	189
T8-10	Nickel	1150	613	550	804	656	277
T8-11	Nickel	1450	867	1010	1277	1051	359
T8-12	Nickel	1750	926	1082	1626	1211	392
T8-13	Nickel	2050	555	1011	945	837	315
T8-14	Nickel	2350	649	636	863	716	290
T8-01	Zinc	0	45	40	24	36	
T8-02	Zinc	50	76	62	74	71	
T8-03	Zinc	100	84	73	75	77	
T8-04	Zinc	150	64	67	55	62	
T8-05	Zinc	200	53	57	78	63	
T8-06	Zinc	250	56	55	76	62	
T8-07	Zinc	450	60	64	42	55	
T8-08	Zinc	650	39	38	32	36	
T8-09	Zinc	850	57	52	53	54	
T8-10	Zinc	1150	52	44	39	45	
T8-11	Zinc	1450	49	63	39	50	
T8-12	Zinc	1750	39	40	48	42	
T8-13	Zinc	2050	51	51	43	48	
T8-14	Zinc	2350	36	42	36	38	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T9-01	Arsenic	0	15.6	12	17	15	6
T9-02	Arsenic	50	14.7	13.9	16.4	15	6
T9-03	Arsenic	100	13.8	15.7	13.3	14	6
T9-04	Arsenic	150	14.6	13.7	19.2	16	7
T9-05	Arsenic	200	17.9	17.5	14.9	17	7
T9-06	Arsenic	250	10.2	10.2	13.9	11	5
T9-07	Arsenic	300	17.2	17	14.3	16	7
T9-08	Arsenic	350	12	11.7	14.9	13	6
T9-09	Arsenic	400	20	17	17	18	8
T9-10	Arsenic	450	20	21	21	21	9
T9-11	Arsenic	500	19	23	22	21	9
T9-12	Arsenic	550	14	15.4	14.6	15	6
T9-13	Arsenic	600	12.4	18.3	15.2	15	7
T9-14	Arsenic	650	16.5	16	13.7	15	7
T9-15	Arsenic	700	11.1	19	15	15	7
T9-01	Chromium	0	2355	1691	1978	2008	519
T9-02	Chromium	50	2218	1969	2036	2074	525
T9-03	Chromium	100	2072	2866	2134	2357	551
T9-04	Chromium	150	2056	2191	2293	2180	535
T9-05	Chromium	200	2842	2256	2648	2582	572
T9-06	Chromium	250	3709	3609	1914	3077	618
T9-07	Chromium	300	2152	5950	2281	3461	653
T9-08	Chromium	350	3333	3789	2934	3352	643
T9-09	Chromium	400	3547	2657	3058	3087	619
T9-10	Chromium	450	2099	3301	2189	2530	567
T9-11	Chromium	500	3318	4438	4612	4123	715
T9-12	Chromium	550	2006	2012	2425	2148	532
T9-13	Chromium	600	2363	1958	2062	2128	530
T9-14	Chromium	650	2296	4549	2731	3192	629
T9-15	Chromium	700	1785	3802	3786	3124	622
T9-01	Copper	0	39	40	32	37	
T9-02	Copper	50	40	29	36	35	
T9-03	Copper	100	43	22	29	31	
T9-04	Copper	150	26	30	37	31	
T9-05	Copper	200	26	24	19	23	
T9-06	Copper	250	19	31	35	28	
T9-07	Copper	300	44	40	35	40	
T9-08	Copper	350	0	36	25	20	
T9-09	Copper	400	0	0	0	0	
T9-10	Copper	450	0	0	0	0	
T9-11	Copper	500	0	0	0	0	
T9-12	Copper	550	0	31	33	21	
T9-13	Copper	600	0	28	28	19	
T9-14	Copper	650	35	0	26	20	
T9-15	Copper	700	0	0	0	0	
T9-01	Lead	0	0	7.6	0	3	
T9-02	Lead	50	0	6.4	0	2	
T9-03	Lead	100	6	0	0	2	

T9-04	Lead	150	8.3	8.1	6.2	8	
T9-05	Lead	200	9.2	0	0	3	
T9-06	Lead	250	7.2	7.3	7.4	7	
T9-07	Lead	300	6.8	9	0	5	
T9-08	Lead	350	8.9	8	0	6	
T9-09	Lead	400	0	0	0	0	
T9-10	Lead	450	0	0	0	0	
T9-11	Lead	500	0	0	0	0	
T9-12	Lead	550	0	0	0	0	
T9-13	Lead	600	6.5	0	7.1	5	
T9-14	Lead	650	9	0	10	6	
T9-15	Lead	700	8	11	9	9	
T9-01	Nickel	0	1061	1290	1276	1209	392
T9-02	Nickel	50	1202	1222	1266	1230	396
T9-03	Nickel	100	1053	879	1039	990	346
T9-04	Nickel	150	1248	1136	1147	1177	385
T9-05	Nickel	200	1072	1026	1199	1099	369
T9-06	Nickel	250	980	1149	1247	1125	374
T9-07	Nickel	300	1224	1682	1123	1343	420
T9-08	Nickel	350	1007	1132	1107	1082	365
T9-09	Nickel	400	1232	1260	1211	1234	397
T9-10	Nickel	450	1296	1154	1453	1301	411
T9-11	Nickel	500	711	920	930	854	318
T9-12	Nickel	550	1095	1104	1015	1071	363
T9-13	Nickel	600	845	880	824	850	317
T9-14	Nickel	650	940	620	728	763	299
T9-15	Nickel	700	499	1187	1106	931	334
T9-01	Zinc	0	52	51	60	54	
T9-02	Zinc	50	54	54	58	55	
T9-03	Zinc	100	62	57	62	60	
T9-04	Zinc	150	59	47	46	51	
T9-05	Zinc	200	47	36	44	42	
T9-06	Zinc	250	45	39	47	44	
T9-07	Zinc	300	46	78	47	57	
T9-08	Zinc	350	50	54	44	49	
T9-09	Zinc	400	57	51	51	53	
T9-10	Zinc	450	51	58	57	55	
T9-11	Zinc	500	46	55	53	51	
T9-12	Zinc	550	53	62	63	59	
T9-13	Zinc	600	56	48	48	51	
T9-14	Zinc	650	60	70	73	68	
T9-15	Zinc	700	83	42	46	57	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T11-01	Arsenic	0	12	17	0	10	4
T11-02	Arsenic	100	9.8	11.4	6	9	4
T11-03	Arsenic	200	8	13	7.6	10	4
T11-04	Arsenic	300	21	14	18	18	8
T11-05	Arsenic	400	12	14	15	14	6
T11-06	Arsenic	500	12	17	11	13	6
T11-07	Arsenic	600	9.9	18	10.8	13	6
T11-08	Arsenic	700	8	12	7	9	4
T11-09	Arsenic	800	14	0	9	8	3
T11-01	Chromium	0	4331	4551	7656	5513	843
T11-02	Chromium	100	795	453	435	561	385
T11-03	Chromium	200	1230	1680	1112	1341	457
T11-04	Chromium	300	1404	1449	1453	1435	466
T11-05	Chromium	400	1781	1486	1213	1493	471
T11-06	Chromium	500	1572	2003	1980	1852	505
T11-07	Chromium	600	1491	1837	2122	1817	501
T11-08	Chromium	700	717	1202	574	831	410
T11-09	Chromium	800	2716	3179	4207	3367	645
T11-01	Copper	0	34	43	47	41	
T11-02	Copper	100	25	21	0	15	
T11-03	Copper	200	30	0	0	10	
T11-04	Copper	300	39	40	46	42	
T11-05	Copper	400	42	37	33	37	
T11-06	Copper	500	22	42	25	30	
T11-07	Copper	600	33	22	0	18	
T11-08	Copper	700	0	0	42	14	
T11-09	Copper	800	26	0	32	19	
T11-01	Lead	0	16	20	21	19	
T11-02	Lead	100	0	0	10	3	
T11-03	Lead	200	0	0	0	0	
T11-04	Lead	300	0	0	0	0	
T11-05	Lead	400	9	0	0	3	
T11-06	Lead	500	0	0	9	3	
T11-07	Lead	600	0	0	0	0	
T11-08	Lead	700	0	0	0	0	
T11-09	Lead	800	0	0	0	0	
T11-01	Nickel	0	495	410	468	458	236
T11-02	Nickel	100	286	287	303	292	202
T11-03	Nickel	200	577	685	628	630	272
T11-04	Nickel	300	1197	1194	1214	1202	390
T11-05	Nickel	400	1040	1171	1067	1093	368
T11-06	Nickel	500	787	1007	836	877	323
T11-07	Nickel	600	1335	1207	1382	1308	412
T11-08	Nickel	700	456	663	448	522	249
T11-09	Nickel	800	2233	1038	1018	1430	437
T11-01	Zinc	0	58	70	57	62	
T11-02	Zinc	100	24	17	20	20	
T11-03	Zinc	200	38	47	39	41	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T11-04	Zinc	300	64	63	65	64	
T11-05	Zinc	400	68	74	67	70	
T11-06	Zinc	500	52	64	56	57	
T11-07	Zinc	600	30	34	37	34	
T11-08	Zinc	700	27	40	31	33	
T11-09	Zinc	800	43	29	41	38	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T13-01	Arsenic	0	12	14	17	14	6
T13-02	Arsenic	200	13.4	15.3	15.1	15	6
T13-03	Arsenic	400	15	13	15	14	6
T13-04	Arsenic	600	13.9	8.1	10.1	11	5
T13-05	Arsenic	700	7.9	9	11	9	4
T13-06	Arsenic	900	6.8	11	13.7	11	4
T13-07	Arsenic	1200	9.1	12.4	6.8	9	4
T13-08	Arsenic	1400	8.5	0	6.5	5	2
T13-09	Arsenic	1700	9	7.4	5.9	7	3
T13-10	Arsenic	1750	6.3	6	6.3	6	2
T13-11	Arsenic	1800	0	7.5	0	3	1
T13-01	Chromium	0	1383	1798	1923	1701	491
T13-02	Chromium	200	2586	3360	2769	2905	602
T13-03	Chromium	400	2370	2195	3460	2675	581
T13-04	Chromium	600	2314	1044	970	1443	467
T13-05	Chromium	700	720	843	857	807	408
T13-06	Chromium	900	1308	2051	2014	1791	499
T13-07	Chromium	1200	869	764	784	806	408
T13-08	Chromium	1400	1576	1318	1102	1332	456
T13-09	Chromium	1700	587	452	387	475	377
T13-10	Chromium	1750	420	565	603	529	382
T13-11	Chromium	1800	325	452	320	366	367
T13-01	Copper	0	36	27	24	29	
T13-02	Copper	200	0	23	21	15	
T13-03	Copper	400	22	17	16	18	
T13-04	Copper	600	31	21	24	25	
T13-05	Copper	700	20	21	27	23	
T13-06	Copper	900	12	18	20	17	
T13-07	Copper	1200	17	20	12	16	
T13-08	Copper	1400	21	12	14	16	
T13-09	Copper	1700	18	25	27	23	
T13-10	Copper	1750	20	13	26	20	
T13-11	Copper	1800	18	23	17	19	
T13-01	Lead	0	0	0	0	0	
T13-02	Lead	200	8	0	7	5	
T13-03	Lead	400	6	11	0	6	
T13-04	Lead	600	12	10.7	6.6	10	
T13-05	Lead	700	0	7	7	5	
T13-06	Lead	900	5.1	13	0	6	
T13-07	Lead	1200	5	0	11	5	
T13-08	Lead	1400	6.2	11	0	6	
T13-09	Lead	1700	7	0	0	2	
T13-10	Lead	1750	7.4	6.1	11	8	
T13-11	Lead	1800	10.6	6	7	8	
T13-01	Nickel	0	754	738	864	785	304
T13-02	Nickel	200	562	734	453	583	262
T13-03	Nickel	400	171	198	330	233	189
T13-04	Nickel	600	237	203	195	212	185

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T13-05	Nickel	700	80	72	83	78	157
T13-06	Nickel	900	94	129	164	129	168
T13-07	Nickel	1200	100	67	57	75	157
T13-08	Nickel	1400	48	46	49	48	151
T13-09	Nickel	1700	46	45	60	50	152
T13-10	Nickel	1750	49	40	62	50	152
T13-11	Nickel	1800	71	61	0	44	150
T13-01	Zinc	0	64	40	59	54	
T13-02	Zinc	200	55	53	52	53	
T13-03	Zinc	400	42	41	45	43	
T13-04	Zinc	600	67	70	56	64	
T13-05	Zinc	700	19	55	37	37	
T13-06	Zinc	900	32	50	44	42	
T13-07	Zinc	1200	39	32	39	37	
T13-08	Zinc	1400	34	34	20	29	
T13-09	Zinc	1700	27	51	49	42	
T13-10	Zinc	1750	41	41	44	42	
T13-11	Zinc	1800	40	49	39	43	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T17-01	Arsenic	0	8.3	7.2	6.5	7	3
T17-02	Arsenic	200	5.1	4.3	6.2	5	2
T17-03	Arsenic	250	4.3	5.1	0	3	1
T17-04	Arsenic	300	6.9	0	8.3	5	2
T17-05	Arsenic	400	7.6	8.1	7.1	8	3
T17-06	Arsenic	500	7.8	6	5	6	2
T17-07	Arsenic	700	7.4	7.8	6	7	3
T17-08	Arsenic	900	5.3	3.3	6.5	5	2
T17-01	Chromium	0	199	99	210	169	349
T17-02	Chromium	200	256	225	106	196	351
T17-03	Chromium	250	78	97	74	83	341
T17-04	Chromium	300	645	249	758	551	384
T17-05	Chromium	400	321	257	507	362	367
T17-06	Chromium	500	217	260	110	196	351
T17-07	Chromium	700	126	171	196	164	348
T17-08	Chromium	900	135	144	129	136	346
T17-01	Copper	0	18	21	0	13	
T17-02	Copper	200	12	0	12	8	
T17-03	Copper	250	18	14	20	17	
T17-04	Copper	300	18	14	17	16	
T17-05	Copper	400	15	0	15	10	
T17-06	Copper	500	18	0	0	6	
T17-07	Copper	700	15	11	13	13	
T17-08	Copper	900	13	14	15	14	
T17-01	Lead	0	4.6	6.5	4.6	5	
T17-02	Lead	200	6.1	3.6	0	3	
T17-03	Lead	250	5.4	4.5	7.1	6	
T17-04	Lead	300	7	7.8	5.2	7	
T17-05	Lead	400	5.8	0	0	2	
T17-06	Lead	500	4.7	5	4.1	5	
T17-07	Lead	700	4.6	0	4.3	3	
T17-08	Lead	900	4.1	0	0	1	
T17-01	Nickel	0	193	216	206	205	184
T17-02	Nickel	200	164	161	147	157	174
T17-03	Nickel	250	197	227	195	206	184
T17-04	Nickel	300	165	201	200	189	180
T17-05	Nickel	400	220	248	215	228	188
T17-06	Nickel	500	263	335	203	267	196
T17-07	Nickel	700	269	310	305	295	202
T17-08	Nickel	900	262	282	257	267	196
T17-01	Zinc	0	17	20	18	18	
T17-02	Zinc	200	22	13	15	17	
T17-03	Zinc	250	16	15	24	18	
T17-04	Zinc	300	24	20	27	24	
T17-05	Zinc	400	21	20	19	20	
T17-06	Zinc	500	21	22	16	20	
T17-07	Zinc	700	16.6	20.1	14.3	17	
T17-08	Zinc	900	17	15	21	18	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T23-01	Arsenic	50	17.9	20.6	16.7	18	8
T23-02	Arsenic	100	10.8	9.3	13.7	11	5
T23-03	Arsenic	150	16.2	18.8	16.7	17	8
T23-04	Arsenic	200	18.1	15.8	20	18	8
T23-05	Arsenic	250	9.6	12.2	8.4	10	4
T23-06	Arsenic	300	14.3	13.6	10	13	5
T23-07	Arsenic	350	12.1	12.1	9.7	11	5
T23-08	Arsenic	400	9.3	27	26.5	21	9
T23-09	Arsenic	450	26	25	29	27	12
T23-10	Arsenic	500	24	30	25	26	12
T23-11	Arsenic	700	18.2	19.1	13.5	17	7
T23-12	Arsenic	900	15.9	15.2	19.1	17	7
T23-13	Arsenic	1100	14	11.3	11.8	12	5
T23-14	Arsenic	1300	13.2	15.4	13.6	14	6
T23-15	Arsenic	1500	13.6	10.4	12	12	5
T23-16	Arsenic	1700	8.8	12.1	9.4	10	4
T23-17	Arsenic	1900	9.9	7.6	5.1	8	3
T23-18	Arsenic	2100	8.1	7.3	4.8	7	3
T23-01	Chromium	50	1089	1658	1009	1252	449
T23-02	Chromium	100	164	159	288	204	352
T23-03	Chromium	150	1734	3076	976	1929	512
T23-04	Chromium	200	1548	0	0	516	381
T23-05	Chromium	250	699	459	1310	823	409
T23-06	Chromium	300	764	595	801	720	400
T23-07	Chromium	350	636	1363	551	850	412
T23-08	Chromium	400	454	2768	1631	1618	483
T23-09	Chromium	450	1796	6620	6572	4996	795
T23-10	Chromium	500	5220	4847	6492	5520	844
T23-11	Chromium	700	3260	3300	2811	3124	622
T23-12	Chromium	900	2680	2529	3521	2910	602
T23-13	Chromium	1100	3653	3300	4274	3742	679
T23-14	Chromium	1300	3470	3690	3443	3534	660
T23-15	Chromium	1500	3768	2465	5920	4051	708
T23-16	Chromium	1700	2913	2261	2426	2533	568
T23-17	Chromium	1900	1049	761	787	866	413
T23-18	Chromium	2100	595	651	761	669	395
T23-01	Copper	50	34	12	17	21	
T23-02	Copper	100	10	12	19	14	
T23-03	Copper	150	0	0	23	8	
T23-04	Copper	200	23	12	19	18	
T23-05	Copper	250	12	15	0	9	
T23-06	Copper	300	0	16	11	9	
T23-07	Copper	350	0	0	0	0	
T23-08	Copper	400	0	0	21	7	
T23-09	Copper	450	0	0	43	14	
T23-10	Copper	500	40	0	21	20	
T23-11	Copper	700	52	39	45	45	
T23-12	Copper	900	36	34	31	34	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T23-13	Copper	1100	46	36	31	38	
T23-14	Copper	1300	40	45	34	40	
T23-15	Copper	1500	26	30	26	27	
T23-16	Copper	1700	33	39	30	34	
T23-17	Copper	1900	38	19	23	27	
T23-18	Copper	2100	35	31	30	32	
T23-01	Lead	50	9.1	5.7	5.6	7	
T23-02	Lead	100	8.9	12.7	9.3	10	
T23-03	Lead	150	6.8	9	8.1	8	
T23-04	Lead	200	11.2	10.7	10.8	11	
T23-05	Lead	250	6.7	7.5	4.5	6	
T23-06	Lead	300	0	8.1	9.7	6	
T23-07	Lead	350	7	6.1	4.6	6	
T23-08	Lead	400	7.6	7	0	5	
T23-09	Lead	450	7	0	8	5	
T23-10	Lead	500	11	0	5	5	
T23-11	Lead	700	14	11	10	12	
T23-12	Lead	900	0	6.7	0	2	
T23-13	Lead	1100	0	0	7	2	
T23-14	Lead	1300	10	7.5	9	9	
T23-15	Lead	1500	13	13	17	14	
T23-16	Lead	1700	10	11	11	11	
T23-17	Lead	1900	8.5	10.3	13.5	11	
T23-18	Lead	2100	10.2	10.8	9.1	10	
T23-01	Nickel	50	144	181	124	150	172
T23-02	Nickel	100	93	113	109	105	163
T23-03	Nickel	150	203	200	186	196	182
T23-04	Nickel	200	130	83	130	114	165
T23-05	Nickel	250	133	107	104	115	165
T23-06	Nickel	300	119	119	127	122	166
T23-07	Nickel	350	92	125	111	109	164
T23-08	Nickel	400	112	174	136	141	170
T23-09	Nickel	450	133	537	754	475	240
T23-10	Nickel	500	780	725	987	831	313
T23-11	Nickel	700	1094	1003	946	1014	351
T23-12	Nickel	900	1358	1428	1500	1429	437
T23-13	Nickel	1100	2345	2614	2082	2347	628
T23-14	Nickel	1300	1536	1727	1609	1624	478
T23-15	Nickel	1500	752	826	805	794	306
T23-16	Nickel	1700	1103	1096	1049	1083	366
T23-17	Nickel	1900	226	190	203	206	184
T23-18	Nickel	2100	195	204	177	192	181
T23-01	Zinc	50	26	31	29	29	
T23-02	Zinc	100	20	20	20	20	
T23-03	Zinc	150	31	37	32	33	
T23-04	Zinc	200	39	26	29	31	
T23-05	Zinc	250	17.9	18.5	19.6	19	
T23-06	Zinc	300	18.3	17.9	18.3	18	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T23-07	Zinc	350	18	21	19.5	20	
T23-08	Zinc	400	16	32	29	26	
T23-09	Zinc	450	27	90	68	62	
T23-10	Zinc	500	67	52	42	54	
T23-11	Zinc	700	92	99	81	91	
T23-12	Zinc	900	56	54	56	55	
T23-13	Zinc	1100	60	51	60	57	
T23-14	Zinc	1300	62	65	63	63	
T23-15	Zinc	1500	92	84	94	90	
T23-16	Zinc	1700	83	84	79	82	
T23-17	Zinc	1900	72	67	72	70	
T23-18	Zinc	2100	78	86	72	79	

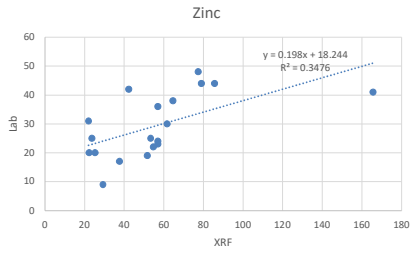
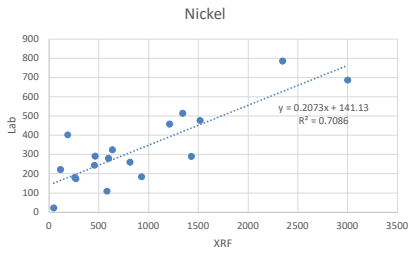
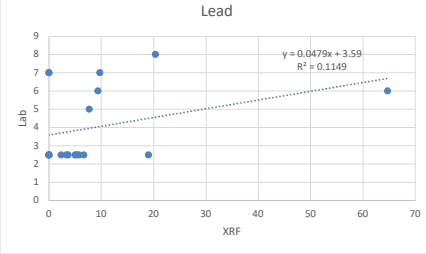
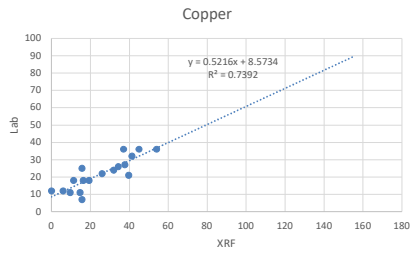
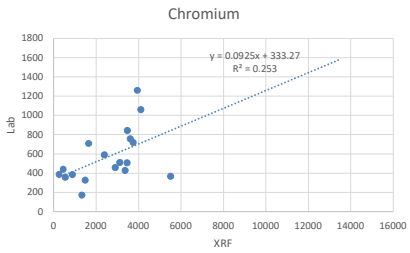
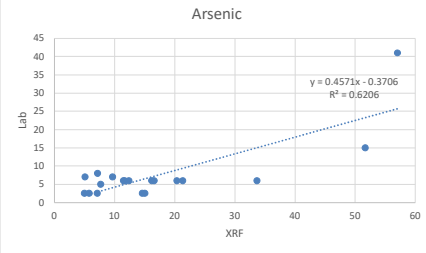
Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T24-01	Arsenic	0	38	36	36	37	16
T24-02	Arsenic	50	41	36	38	38	17
T24-03	Arsenic	100	47	46	45	46	21
T24-04	Arsenic	150	54	56	45	52	23
T24-05	Arsenic	200	26.2	26.4	37	30	13
T24-06	Arsenic	250	35	52	49	45	20
T24-07	Arsenic	300	36	43	0	26	12
T24-08	Arsenic	500	11.6	19.6	19	17	7
T24-09	Arsenic	700	18	19	26	21	9
T24-10	Arsenic	900	18	13	13	15	6
T24-11	Arsenic	1100	9	16	10.6	12	5
T24-12	Arsenic	1300	17	20	23	20	9
T24-13	Arsenic	1500	9	7	11	9	4
T24-14	Arsenic	1700	6.9	10	9	9	4
T24-15	Arsenic	1900	14	18	24	19	8
T24-16	Arsenic	2200	17	16	16	16	7
T24-17	Arsenic	2500	9	10	14	11	5
T24-18	Arsenic	2800	14	9	10	11	5
T24-19	Arsenic	3100	10	10	12	11	5
T24-20	Arsenic	3400	10	8	8	9	4
T24-01	Chromium	0	5999	6933	9895	7609	1037
T24-02	Chromium	50	8332	4880	6096	6436	929
T24-03	Chromium	100	7753	6616	7925	7431	1021
T24-04	Chromium	150	16500	11500	12400	13467	1579
T24-05	Chromium	200	3011	2736	3660	3136	623
T24-06	Chromium	250	5111	17600	13300	12004	1444
T24-07	Chromium	300	5864	6190	0	4018	705
T24-08	Chromium	500	907	2904	2735	2182	535
T24-09	Chromium	700	3840	3347	3914	3700	676
T24-10	Chromium	900	2493	2430	2026	2316	548
T24-11	Chromium	1100	2343	1776	1874	1998	518
T24-12	Chromium	1300	3661	7471	4422	5185	813
T24-13	Chromium	1500	2094	1864	1512	1823	502
T24-14	Chromium	1700	1195	1297	1224	1239	448
T24-15	Chromium	1900	7084	6287	6046	6472	932
T24-16	Chromium	2200	4179	3288	5916	4461	746
T24-17	Chromium	2500	1109	955	734	933	420
T24-18	Chromium	2800	627	631	356	538	383
T24-19	Chromium	3100	1197	1398	1068	1221	446
T24-20	Chromium	3400	1219	858	1014	1030	429
T24-01	Copper	0	12	20	24	19	
T24-02	Copper	50	30	27	16	24	
T24-03	Copper	100	0	29	22	17	
T24-04	Copper	150	0	53	25	26	
T24-05	Copper	200	21	23	18	21	
T24-06	Copper	250	17	0	0	6	
T24-07	Copper	300	18	28	0	15	
T24-08	Copper	500	24	44	0	23	

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T24-09	Copper	700	23	38	47	36	
T24-10	Copper	900	46	36	30	37	
T24-11	Copper	1100	31	35	31	32	
T24-12	Copper	1300	68	58	48	58	
T24-13	Copper	1500	41	40	33	38	
T24-14	Copper	1700	41	31	35	36	
T24-15	Copper	1900	38	25	48	37	
T24-16	Copper	2200	27	29	0	19	
T24-17	Copper	2500	36	42	42	40	
T24-18	Copper	2800	29	41	41	37	
T24-19	Copper	3100	23	25	81	43	
T24-20	Copper	3400	36	22	28	29	
T24-01	Lead	0	12	10	0	7	
T24-02	Lead	50	9	7	10	9	
T24-03	Lead	100	0	8	7	5	
T24-04	Lead	150	24	16	21	20	
T24-05	Lead	200	4.3	4.3	0	3	
T24-06	Lead	250	23	34	23	27	
T24-07	Lead	300	0	0	0	0	
T24-08	Lead	500	5.9	10	0	5	
T24-09	Lead	700	12	10	14	12	
T24-10	Lead	900	14	10	13	12	
T24-11	Lead	1100	9	0	0	3	
T24-12	Lead	1300	12	0	0	4	
T24-13	Lead	1500	7	10	0	6	
T24-14	Lead	1700	5	12	9	9	
T24-15	Lead	1900	8	0	0	3	
T24-16	Lead	2200	0	9	0	3	
T24-17	Lead	2500	8	9	5	7	
T24-18	Lead	2800	7	8	0	5	
T24-19	Lead	3100	0	10	0	3	
T24-20	Lead	3400	10	11	12	11	
T24-01	Nickel	0	743	435	361	513	247
T24-02	Nickel	50	480	415	402	432	231
T24-03	Nickel	100	377	357	430	388	222
T24-04	Nickel	150	583	624	587	598	265
T24-05	Nickel	200	210	160	298	223	187
T24-06	Nickel	250	423	1046	608	692	285
T24-07	Nickel	300	426	409	0	278	199
T24-08	Nickel	500	215	402	367	328	209
T24-09	Nickel	700	467	511	735	571	259
T24-10	Nickel	900	556	513	501	523	250
T24-11	Nickel	1100	1224	1121	1148	1164	382
T24-12	Nickel	1300	1494	1354	1241	1363	424
T24-13	Nickel	1500	297	277	309	294	202
T24-14	Nickel	1700	247	240	224	237	190
T24-15	Nickel	1900	1175	1571	1768	1505	453
T24-16	Nickel	2200	894	1016	954	955	339

Sample ID	Metal	Distance (m)	Reading 1	Reading 2	Reading 3	Average (mg/kg) - raw	mg/kg (corrected)
T24-17	Nickel	2500	189	177	225	197	182
T24-18	Nickel	2800	281	217	140	213	185
T24-19	Nickel	3100	183	251	0	145	171
T24-20	Nickel	3400	223	298	289	270	197
T24-01	Zinc	0	52	38	46	45	
T24-02	Zinc	50	46	39	39	41	
T24-03	Zinc	100	46	42	53	47	
T24-04	Zinc	150	49	55	60	55	
T24-05	Zinc	200	29	20	43	31	
T24-06	Zinc	250	57	101	71	76	
T24-07	Zinc	300	39	36	0	25	
T24-08	Zinc	500	36	81	61	59	
T24-09	Zinc	700	79	63	62	68	
T24-10	Zinc	900	67	69	77	71	
T24-11	Zinc	1100	68	60	52	60	
T24-12	Zinc	1300	66	82	50	66	
T24-13	Zinc	1500	86	79	73	79	
T24-14	Zinc	1700	68	67	66	67	
T24-15	Zinc	1900	76	67	76	73	
T24-16	Zinc	2200	86	73	64	74	
T24-17	Zinc	2500	48	51	63	54	
T24-18	Zinc	2800	73	61	53	62	
T24-19	Zinc	3100	63	65	77	68	
T24-20	Zinc	3400	57	82	70	70	

	T1-03	T1-11	T4-03	T6-04	T6-08	T8-03	T8-12	T9-07	T9-15	T11-01	T11-09	T13-02	T13-08	T16-01	T16-01	T17-04	T20-03	T23-13	T24-04
	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab	Lab
Arsenic	6	6	6	6	41	6	6	6	3	7	5	3	3	3	3	7	8	6	15
Chromium	1060	1260	708	326	843	590	385	507	511	367	429	458	172	758	441	358	386	719	
Copper		18	24	36	36	26	36	21	12	32	18	11	7	11	12	18	25	27	22
Lead	6	7	5	3	3	7	3	3	6	3	3	3	3	7	3	3	3	3	8
Nickel	260	291	180	477	686	324	458	514	184	244	290	109	22	174	221	402		786	280
Zinc	41	44	38	44	19	48	42	23	24	30	17	25	9	20	20	25	31	36	22

	T1-03	T1-11	T4-03	T6-04	T6-08	T8-03	T8-12	T9-07	T9-15	T11-01	T11-09	T13-02	T13-08	T16-01	T16-01	T17-04	T20-03	T23-13	T24-04
	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF
Arsenic	34	20	12	21	57	17	11	16	15	10	8	15	5	6	7	5	7	12	52
Chromium	4111	3945	1648	1492	3472	2395	886	3461	3124	5513	3367	2905	1332	3609	456	551	257	3742	13467
Copper	155	11	32	54	45	34	37	40	0	41	19	15	16	10	6	16	16	38	26
Lead	65	0	8	4	0	10	3	5	9	19	0	5	6	0	0	7	0	2	20
Nickel	814	464	259	1516	3002	639	1211	1343	931	458	1430	583	48	271	115	189	377	2347	598
Zinc	166	79	65	86	52	77	42	57	57	62	38	53	29	25	22	24	22	57	55





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