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ACID SULPHATE SOIL ASSESSMENT

50 Wyllie Road, Kembla Grange NSW

prepared for

Bicorp Pty Ltd

March 2014

DOCUMENT CONTROL REGISTER

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ABBREVIATIONS

AASS	Actual Acid Sulphate Soils
AHD	Above Height Datum
ANC	Acid Neutralising Capacity
ASS	Acid Sulphate Soils
ASSMAC	Acid Sulphate Soils Management Advisory Committee
ASSMP	Acid Sulphate Soils Management Plan
BGL	Below Ground Level
DNR&M	Department of Natural resources and Mines
DO	Dissolved Oxygen
EC	Electric Conductivity
EIL	Ecological Investigation Level
EPA	Environmental Protection Authority
HIL	Health-based Investigation Level
LOR	Limit of reporting
NV	Neutralising Value
PASS	Potential Acid Sulphate Soils
POCAS	Peroxide Oxidation Combined Acidity and Sulphate
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
QASSIT	Queensland Acid Sulphate Soils Investigation Team
SPOCAS	Suspended Peroxide Oxidation Combined Acidity and Sulphate
SPOS	Peroxide Oxidisable
TAA	Total Actual Acidity
TCLP	Toxicity Characteristic Leaching Procedure
TPA	Total Potential Acidity
TSA	Total Sulfidic Acidity
TSS	Total Suspended Solids
VENM	Virgin Excavated Natural Material

1.0 INTRODUCTION

Benviron Group was appointed by Mr Adam Blackwell on behalf of Bicorp Pty Ltd to prepare an Acid Sulphate Soil Assessment (ASS) for the property located at 50 Wyllie Road, Kembla Grange NSW, referred to as 'the site' (see Appendix A – Site plan, Figure 1 – Site location). The site is located in Wollongong City Council municipality.

The site is a currently occupied by a resource recovery facility and vacant land. The proposed development consists of the increase of processing capacities of up to 230,000 tonnes per annum, waste storage and stockpile areas and ancillary structures (i.e plant and equipment). This also includes the construction of a large warehouse for the above described activities.

Based on the proposed development, site disturbances may occur as part of development works and therefore subsurface soils may require management.

The ASS is required as disturbances to Potential Acid Sulphate Soil (PASS) or Actual Acid Sulphate Soils, which may occur during construction and excavation works, can result in the formation of acid. The acid, once formed, could then damage infrastructure or harm ecological systems.

The results of the field parameters from this assessment should only be used as a preliminary study to determine if further investigations are required. If results meet the criteria then no further work, including an ASS Management Plan, will be required.

2.0 OBJECTIVES

The purpose of the ASS Assessment is to determine the presence or absence of ASS at the site. In the absence of ASS it is essential to assess for the presence of Potential Acid Sulphate Soils (PASS). If the results do not meet criteria an Acid Sulphate Soil Management Plan may be required.

This Preliminary Assessment reviewed the presence of ASS / PASS in the portion of the site that may require excavation.

3.0 SCOPE OF WORKS

The scope of works of the Preliminary ASS Assessment included:

- Review of previous environmental assessments;
- Site walkover;
- Targeted soil boring, sampling and testing for ASS at the site;
- Interpretation of field and lab test analysis and findings; and
- Reporting in accordance with relevant assessment guidelines / regulations.

4.0 ASSESSMENT CRITERIA

When assessing ASS at sites in NSW Acid Sulphate Soils Management Advisory Committee (ASSMAC) (1998) Acid Sulphate Soils Assessment Guidelines apply.

The purpose of this report is to determine whether there is a probable risk associated with ASS or PASS and to determine whether these types of soils actually exist on the site.

These maps do not detail the severity of the ASS, but only provide an indication that they may be present. The decision to classify certain areas as ASS is based on a number of geomorphic conditions and site criteria. The following points are used to determine if ASS are likely to exist (extracted from ASSMAC (1998) Acid Sulphate Soils Assessment Guidelines):

- Sediments of recent geological age (Holocene) ~ 10 000 y.o.
- Soil horizons less than 5m AHD (Australian Height Datum).
- Marine or estuarine sediments and tidal lakes.
- In coastal wetlands or back swamp areas; waterlogged or scalded areas; interdune swales or coastal sand dunes.
- In areas where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation.
- In areas identified in geological descriptions or in maps bearing sulphide minerals, coal deposits or former marine shales/sediments.
- Deeper older estuarine sediments >10m below the ground surface, Holocene or Pleistocene age.

Based on the above information in order to determine whether there is a potential for acid sulphate soils to be present within a site, reference was made to the NSW Department of Land & Water Conservation (DLWC) *Acid Sulphate Soil Risk Maps* (Edition Two, December 1997, Scale 1:250,000), in particular Map 98 – "Wollongong". A review of the aforementioned map indicated that there is a "no known occurrence" within the soil profile.

The following soil indicators are used to determine if ASS are actually present on a site:

- field pH ≤4 in soils
- presence of shell
- any jarosite horizons or substantial iron oxide mottling in auger holes, in surface encrustations or in any material dredged or excavated and left exposed. Jarosite is not always found, however, in actual acid sulphate soils.

The following soil indicators are used to determine if PASS are actually present on a site:

- waterlogged soils, unripe muds (soft, buttery, blue grey or dark greenish grey) or estuarine silty sands or sands (mid to dark grey) or bottom sediments of estuaries or tidal lakes (dark grey to black)
- presence of shell
- soil pH usually neutral but may be acid -positive Peroxide Test (see section 7.2 Field pH results).

5.0 SITE INFORMATION

5.1 Site Identification

The site is located at 50 Wyllie Road, Kembla Grange NSW in the Local Government Area of Wollongong City Council municipality. The site is part within of Lot 10 in DP878167. A portion of the site is currently zoned industrial where the remainder of the site is zoned for private recreation.

5.2 Site Description

The site is approximately 21.98 ha in area, and the surrounding lands of the site are mainly used for industrial businesses.

5.3 Topography

Topographic information indicates the site is situated in a sloping area ranging from approximately 15-30 metres above sea level. The majority of the site slopes towards Wyllie Road and also is intersected by an onsite creek. with the surrounding topography being gently undulating. Site stormwater runoff is expected to be either captured for reuse within the onsite-retention dams or is expected to flow via stormwater drains and site surfaces into the onsite creek within the site.

5.4 Local geology, hydrogeology, surface waters

The Geological Map of Wollongong (Geological Series Sheet S1 56-9, Scale 1:250,000, 1966), published by the Department of Mineral Resources indicates the residual soils within the site to be underlain by Shoalhaven Group geological profiles, comprising red, brown and grey lithic sandstone.

Based on a search of the NSW Groundwater Works website database, there were three wells located within a 2.0 kilometre radius of the site. The closest groundwater bore with available information (GW075139) is located to the north of the site. The maximum depth of drilling was 193m, and the standing water level was 15m. The bore was used as a test bore town water supply.

The nearest surface water body an unnamed creek that flows through the central portion of the site from north to south. Stormwater from the local and surrounding areas would flow towards this area.

The closest large body of water is Port Kembla Bay, approximately 7.3km to the east.

5.5 Proposed development

The site is a currently occupied by a resource recovery facility and vacant land. The proposed development consists of the increase of processing capacities of up to 230,000 tonnes per annum, waste storage and stockpile areas and ancillary structures (i.e plant and equipment). This also includes the construction of a large warehouse for the above described activities.

6.0 SOIL BORING AND SAMPLING

A soil sampling and analysis program was used to consolidate the nature and degree of Acid Sulphate Soils present in the surface and subsurface geology. Samples were collected from six boreholes excavated within the site area of proposed development. Boreholes were excavated to a depth of 2.0 m below ground level (The borehole locations are presented in Appendix A – Site plan). Samples were collected at intervals between 0.5m and 2.0 m BGL.

Field analysis was performed on the collected samples for pH_f and pH_{fox} in accordance with the required sampling techniques of the *ASSMAC (1998) Assessment Guidelines* (ASSMAC (1998) Field pH and peroxide test protocol).

6.1 Quality Assurance/Quality Control (QA/QC)

Standard QA/QC procedures were followed. The decontamination of sampling equipment was achieved by washing with phosphate-free detergent and tap water, followed by final rinsing with distilled water. This was conducted after the collection of each sample.

Standard sampling and analysing procedures are in accordance with and set out in the *NSW ASSMAC (1998) "Acid Sulphate Soils Assessment Guidelines".*

7.0 FIELD RESULTS

7.1 Soil observations

Based on information from all boreholes, the surface and sub-surface profile across the site is generalised as follows:

- NATURAL, Silty Sandy Clay, high plasticity, brown, moist with some organic materials.
- NATURAL, Shaley Clay, low plasticity, dark brown/grey, weathered.

Groundwater seepage was not encountered at a depth of approximately 0.5m in borehole/s (A1) during the drilling process, with the maximum depth of drilling at one borehole location being 2.0m.

No unusual colouring or shells were detected in the soil suggesting the presence of pyrite (iron sulphide) or Jarosite was unlikely.

7.2 Field pH results

The results of field pH tests are presented in Table 1 below.

Table 1: Summary of field analysis results

Sample	Depth (m)	pH -F	pH-FOX	Reaction Strength	Change in pH (pH_f – pH_{fox})
A1	0.5	5.2	3.7	Low	**1.5**
A1	1.5	5.0	4.3	Low	0.7
A2	0.6	5.1	3.7	Low	**1.4**
A2	1.8	5.1	4.2	Low	**0.9**
A3	1.0	5.2	3.5	Medium	**1.7**
A4	0.9	5.4	3.7	Medium	**1.7**
A5	1.3	5.1	3.9	Low	**1.2**
A6	1.2	5.1	3.5	Medium	**1.6**

Notes:

- pH_f refers to pH field (soil and distilled H_2O).
- pH_{fox} refers to pH field oxidised (soil and peroxide).
- Change in pH refers to pH field minus pH field oxidised.
- - refers to a more acidic change in pH
- + refers to a more alkali change in pH
- **Bold** refers to detection.

To investigate the pH of the soils (pH_{fox}) water was added to the soil samples and it was found that the pH_f of the investigated samples was well above 4. This indicates the soils from which the samples were collected did not contain actual ASS.

To investigate the presence of PASS, 30% peroxide (H_2O_2) was added to soil samples and the resulting pH of the mixture was measured (as per field test protocols that are presented – ASSMAC (1998) Field pH and peroxide test protocol). The pH of the soil peroxide solution (pH_{fox}) did not decrease below 3 at varying intervals, however there was a significant change in some of the pH values that decreased more than 1 pH unit and the strength of the reaction was medium within some samples. All remaining samples had a no other indicators of acid sulphate soils indicating the lack of unoxidised sulphates.

Based on this result it can be seen that the soils may contain ***potential acid sulphate*** soils between depths of 0.5m - 2.0m. Based on the results of the field testing it was recommended that further analysis for SPOCAS be undertaken.

7.3 SPOCAS Testing (Suspended Peroxide Oxidation Combined Acidity and Sulphate)

The soils were assessed against the guidelines set out in Acid Sulphate Soils Management Advisory Committee (ASSMAC) (1998) *Acid Sulphate Soils Assessment Guidelines*. The action criteria selected was based on if there will be between 1 to 1,000 tonnes of soils disturbed within the site. The results are assessed against two available criteria, those being:

- Sulphur Trail (S_{pos}) = 0.03% - Course Texture
  = 0.06% - Medium Texture
  = 0.1% - Fine Texture

- Acid Trail (TPA) = 18 mol H^+/tonne - Course Texture
  = 36 mol H^+/tonne - Medium Texture
  = 62 mol H^+/tonne - Fine Texture

The laboratory analysis results are presented in the following Table 2.

Table 2: Laboratory SPOCAS Test Results

Sample	Depth (m)	S-POS (%) (sulphur trail)	TAA (mol H^+/ tonne)	TPA (mol H^+/ tonne) (acid trail)	TSA (mol H^+/tonne) (acid trail)
A1	0.5	<0.02	140	**150**	14
A3	1.0	<0.02	150	**170**	20
A4	0.9	<0.02	130	**150**	20
A5	1.3	<0.02	150	**250**	**100**
ASSMAC Guidelines		**0.1**	**-**	**62**	**62**

Notes for Table 1:

- Guidelines follow the ASSMAC "Acid Sulphate Soils Assessment Guidelines 1998".
- Criteria based upon clay content of >40%
- Criteria based upon more than 1000 tonnes disturbed
- Bold values exceed ASSMAC guidelines

The results shown above suggest that based on the soils described above it is considered that they most closely resemble the *"Fine Texture Medium to Heavy clays and silty clays"* described in Table 4.4, Assessment Guidelines of the NSW Acid Sulphate Soil Management Advisory Committee (ASSMAC) *"Acid Sulphate Soil Manual"* (August 1998).

When comparing the results summarised above in Table 2 to Table 4.4 (ASSMAC) for Fine Texture soils it can be determined that the percentage of oxidisable Sulphur (SPOS) was below the relevant action criteria. However, the acid trail (TPA/TSA) was noted to exceed the relevant action criteria in all the samples tested. Based on the TPA/TSA results it is indicated that the soil material has already generated some acid potential within the soil matrix.

Based on the results of the SPOCAS testing it was recommended that further analysis for Chromium Reducible Sulphur be undertaken

7.4 Chromium Reducible Sulphur

Chromium Reducible sulphur method calculates the potential acidity from analysis of sulphide content. This method does not include sulphur from organics and sulphates (e.g. gypsum) and detects as low sulphide content and is therefore suitable to determine potential interferences caused by naturally occurring acidity within the soils.

The laboratory results are presented in the following table:

Table 3: Laboratory Chromium Reducible Sulphur Test Results

Sample	Depth	Chromium Reducible Sulphur (%)
A1	0.5	<0.02
A2	0.9	<0.02
A3	1.3	<0.02

The results indicate that no a lack of oxidisable sulphur compounds were detected within the soil on site.

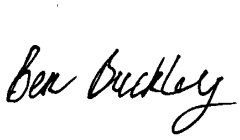
8.0 DISCUSSION AND CONCLUSIONS

The results of the SPOCAS testing indicated that the existing acid trail is greater than the relevant action criteria. However, the observed soil profile, local geology and topography and the results of samples (chromium test suite) indicates the potential for naturally occurring acidity. Therefore based on the above assessment it has been determined that the site is not impacted by acid sulphate soils in samples taken from the maximum depths tested.

We would be pleased to provide further information or discuss any aspect of our report. Please do not hesitate to contact the undersigned should you have any queries.

For and behalf of

Benviron Group



Ben Buckley

Director

Environmental Forensic Scientist

LIMITATIONS

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, although subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

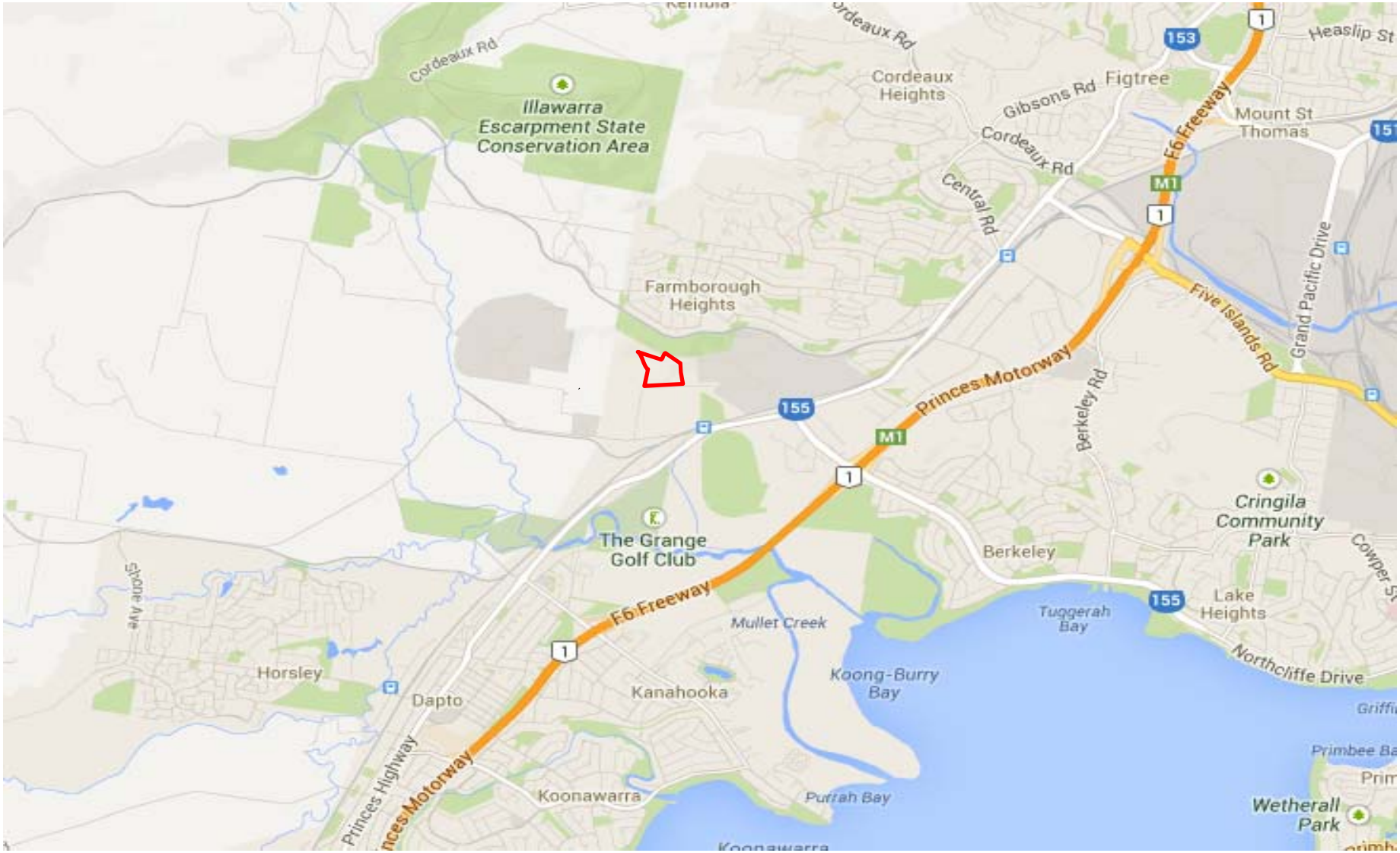
There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions are judgements that are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions.

Although the information provided by an Acid Sulphate Soils Assessment and Management Plan can reduce exposure to risks, no assessment, however diligently carried out, can eliminate them. It must be noted that these findings are professional findings and have limitations. Even a rigorous professional assessment may fail to detect all ASS and/or PASS on a site. Sulphates may be present in areas that were not surveyed or sampled.

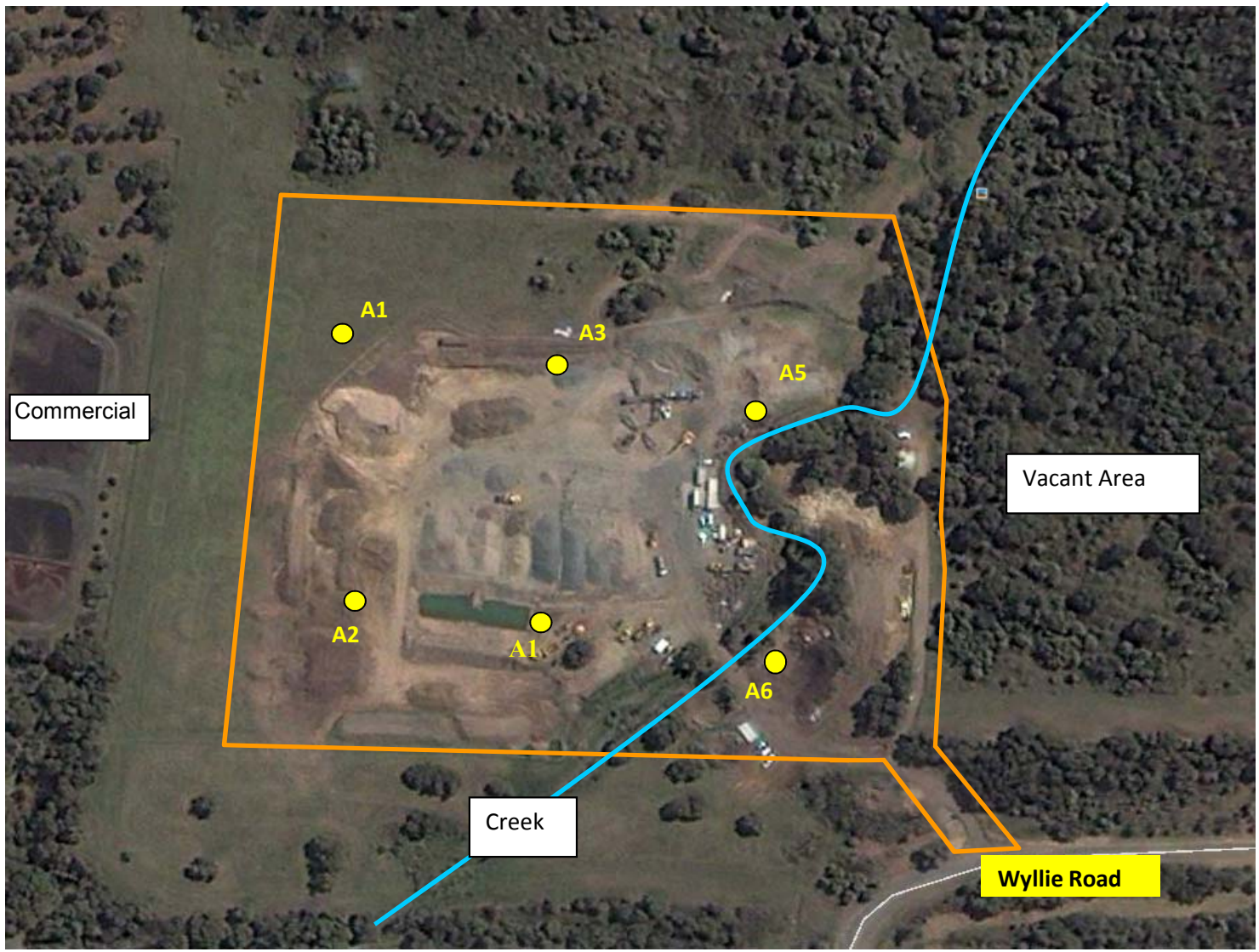
APPENDIX A – SITE PLAN AND SITE LOCATION



Key

Site Location ——

Benviron group simple sustainable solutions	**DRAWN** BB	SITE LOCATION
	FIGURE 1	Bicorp Pty Ltd
	Job # E49/5	50 Wylie Road, Kembla Grange NSW



Key

Site Boundary

Borehole Location

DRAWN BB	SITE PLAN
FIGURE 2	Bicorp Pty Ltd
Job # E49/5	50 Wylie Road, Kembla Grange NSW

Environ group
simple sustainable solutions

APPENDIX B – BOREHOLE LOGS

BOREHOLE LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**BH1/A1**
PROJECT	Acid Sulphate Soils Assessment	**DATE.**	**30/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/5**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
				F	FILL: Sandy Clay, med plasticity, brown with traces of grave and some inert materials	
0.5				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials	
1						
1.5				SiC	NATURAL, Shaley CLAY, low plasticity, dark brown/grey weathered	
2					End of Borehole @ 2.0m BGL in natural clay	
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

Standing groundwater level in borehole

Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth

S - Surface water sample

GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers

M Moist - Does not run freely but no free water visible on soil surface

W Wet - Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**BH2/A2**
PROJECT	Acid Sulphate Soils Assessment	**DATE.**	**30/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/5**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
				F	FILL: Sandy Clay, med plasticity, brown with traces of grave and some inert materials	
0.5				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials	
1						
1.5				SiC	NATURAL, Shaley CLAY, low plasticity, dark brown/grey weathered	
2					End of Borehole @ 2.0m BGL in natural clay	
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

Standing groundwater level in borehole

Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth

S - Surface water sample

GW/W - Groundwater sample/water sample

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M Moist - Does not run freely but no free water visible on soil surface

W Wet - Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS	Very Soft	- Unconfined compressive strength less than 25kPa
S	Soft	- Unconfined compressive strength 25-50kPa
F	Firm	- Unconfined compressive strength 50-100kPa
St	Stiff	- Unconfined compressive strength 100-200kPa
VSt	Very Stiff	- Unconfined compressive strength 200-400kPa
H	Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**BH3/A3**
PROJECT	Acid Sulphate Soils Assessment	**DATE.**	**30/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/5**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
				F	FILL: Sandy Clay, med plasticity, brown with traces of grave and some inert materials	
0.5				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials	
1						
1.5				SiC	NATURAL, Shaley CLAY, low plasticity, dark brown/grey weathered	
2						
2.5					End of Borehole @ 2.0m BGL in natural clay	
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

Standing groundwater level in borehole

Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth

S - Surface water sample

GW/W - Groundwater sample/water sample

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M Moist - Does not run freely but no free water visible on soil surface

W Wet - Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**BH4/A4**
PROJECT	Acid Sulphate Soils Assessment	**DATE.**	**30/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/5**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
				F	FILL: Sandy Clay, med plasticity, brown with traces of grave and some inert materials	
0.5				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials	
1						
1.5						
2				SiC	NATURAL, Shaley CLAY, low plasticity, dark brown/grey weathered	
2.5					End of Borehole @ 2.0m BGL in natural clay	
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3.5						
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4.5						
5						
5.5						
6						

Log Symbols

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Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**BH5/A5**
PROJECT	Acid Sulphate Soils Assessment	**DATE.**	**30/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/5**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
				F	FILL: Sandy Clay, med plasticity, brown with traces of grave and some inert materials	
0.5				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials	
1						
1.5				SiC	NATURAL, Shaley CLAY, low plasticity, dark brown/grey weathered	
2					End of Borehole @ 2.0m BGL in natural clay	
2.5						
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

Standing groundwater level in borehole

Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth

S - Surface water sample

GW/W - Groundwater sample/water sample

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M Moist - Does not run freely but no free water visible on soil surface

W Wet - Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS Very Soft	- Unconfined compressive strength less than 25kPa
S Soft	- Unconfined compressive strength 25-50kPa
F Firm	- Unconfined compressive strength 50-100kPa
St Stiff	- Unconfined compressive strength 100-200kPa
VSt Very Stiff	- Unconfined compressive strength 200-400kPa
H Hard	- Unconfined compressive strength greater than 400kPa

BOREHOLE LOG

CLIENT	Bicorp Pty Ltd	**BOREHOLE NO.**	**BH6/A6**
PROJECT	Acid Sulphate Soils Assessment	**DATE.**	**30/07/2013**
LOCATION	50 Wyllie Road, Kembla Grange NSW	**JOB NO.**	**E49/5**
METHOD	Drill Rig	**SURFACE ELEV.**	**N/A**
LOGGED BY	BB	**CHECKED BY**	**BB**

Depth (m)	Sample	Graphic Symbol	Ground Water	Classification Symbol	Soil Description (Colour, particle characteristics, strength, placticity, moisture, etc)	Observations
				F	FILL: Sandy Clay, med plasticity, brown with traces of grave and some inert materials	
0.5				SiC	NATURAL, Silty Sandy CLAY, high plasticity, brown and moist with some organic materials	
1						
1.5						
2				SiC	NATURAL, Shaley CLAY, low plasticity, dark brown/grey weathered	
2.5					End of Borehole @ 2.0m BGL in natural clay	
3						
3.5						
4						
4.5						
5						
5.5						
6						

Log Symbols

Standing groundwater level in borehole

Water seepage in borehole (wet)

Samples

BH1.0.5 - Soil sample taken at indicated depth

S - Surface water sample

GW/W - Groundwater sample/water sample

Moisture Condition

D Dry - Runs freely through fingers

M Moist - Does not run freely but no free water visible on soil surface

W Wet - Free water visible on soil surface

Soil Classification

Clay	- Particle size less than 0.002mm
Silt	- Particle size between 0.002 and 0.06mm
Sand	- Particle size between 0.06 and 2.0mm
Gravel	- Particle size between 2.0 and 60mm

Strength

VS	Very Soft	- Unconfined compressive strength less than 25kPa
S	Soft	- Unconfined compressive strength 25-50kPa
F	Firm	- Unconfined compressive strength 50-100kPa
St	Stiff	- Unconfined compressive strength 100-200kPa
VSt	Very Stiff	- Unconfined compressive strength 200-400kPa
H	Hard	- Unconfined compressive strength greater than 400kPa

APPENDIX C - LABORATORY RESULTS

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Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Benviron Group
64 Glenrock Parade
Koolewong
NSW 2256

Attention: **Ben Buckley**

Report **385645-S**
Client Reference ACID SULPHATE SOILS KEMBLA GRANGE E49/5
Received Date Jul 11, 2013

Client Sample ID			**A1 0.5**	**A1 1.5**	**A2 0.6**	**A2 1.8**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Jl08398**	**S13-Jl08399**	**S13-Jl08400**	**S13-Jl08401**
Date Sampled			**Jul 10, 2013**	**Jul 10, 2013**	**Jul 10, 2013**	**Jul 10, 2013**
Test/Reference	LOR	Unit				
Acid Sulphate Soils Field pH Test						
pH-F (Field pH test)	0.1	units	5.2	5.0	5.1	5.1
pH-FOX (Field pH Peroxide test)	0.1	units	3.7	4.3	3.7	4.2
Reaction Ratings		comment	Low	Low	Low	Low

Client Sample ID			**A3 1.0**	**A4 0.9**	**A6 1.2**	**A5 1.3**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Jl08402**	**S13-Jl08403**	**S13-Jl08404**	**S13-Jl08414**
Date Sampled			**Jul 10, 2013**	**Jul 10, 2013**	**Jul 10, 2013**	**Jul 10, 2013**
Test/Reference	LOR	Unit				
Acid Sulphate Soils Field pH Test						
pH-F (Field pH test)	0.1	units	5.2	5.4	5.1	5.1
pH-FOX (Field pH Peroxide test)	0.1	units	3.5	3.7	3.9	3.5
Reaction Ratings		comment	Medium	Medium	Low	Medium

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 (regarding both quality and NATA accreditation).

Description	Testing Site	Extracted	Holding Time
Acid Sulphate Soils Field pH Test	Sydney	Jul 11, 2013	7 Day
- Method: Acid Sulphate Soils Guideline Series			

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Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F6, 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

Company Name: Benviron Group
Address: 64 Glenrock Parade
Koolewong
NSW 2256

Client Job No.: ACID SULPHATE SOILS KEMBLA GRANGE E49/5

Order No.:
Report #: 385645
Phone:
Fax:

Received: Jul 11, 2013 1:20 PM
Due: Jul 12, 2013
Priority: 1 Day
Contact Name: Ben Buckley

Eurofins | mgt Client Manager: Jean Heng

Sample Detail					Acid Sulphate Soils Field pH Test
Laboratory where analysis is conducted					
Melbourne Laboratory - NATA Site # 1254 & 14271					
Sydney Laboratory - NATA Site # 18217					X
Brisbane Laboratory - NATA Site # 20794					
External Laboratory					
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
A1 0.5	Jul 10, 2013		Soil	S13-Jl08398	X
A1 1.5	Jul 10, 2013		Soil	S13-Jl08399	X
A2 0.6	Jul 10, 2013		Soil	S13-Jl08400	X
A2 1.8	Jul 10, 2013		Soil	S13-Jl08401	X
A3 1.0	Jul 10, 2013		Soil	S13-Jl08402	X
A4 0.9	Jul 10, 2013		Soil	S13-Jl08403	X
A6 1.2	Jul 10, 2013		Soil	S13-Jl08404	X
A5 1.3	Jul 10, 2013		Soil	S13-Jl08414	X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. 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 Sample Receipt Acknowledgment.

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.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Units

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. 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.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	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

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 50-150% - Phenols 20-130%.

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, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene 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 Arochlor 1260 in Matrix Spikes and LCS's.
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 RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Jean Heng Client Services

Dr. Bob Symons
Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Uncertainty data is available on request

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Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Benviron Group
64 Glenrock Parade
Koolewong
NSW 2256

Attention: **Ben Buckley**

Report **390082-S**
Client Reference KEMBLA GRANGE ACID SULPHATE SOILS E49/5
Received Date Aug 21, 2013

Client Sample ID			**A1 0.5**	**A2 0.9**	**A3 1.3**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Au16490**	**S13-Au16491**	**S13-Au16492**
Date Sampled			**Aug 21, 2013**	**Aug 21, 2013**	**Aug 21, 2013**
Test/Reference	LOR	Unit			
Acid Base Accounting (Chromium Reducible Sulfur)					
ANC Fineness Factor	0.5	units	1.5	1.5	1.5
Liming rate - CRS[T01]	1	kg CaCO3/t	6.0	7.4	17
Net Acidity (acidity units) - CRS	10	mol H+/t	80	98	220
Net Acidity (sulfur units) - CRS	0.02	% S	0.13	0.16	0.35
Chromium Suite					
Acid trail - Titratable Actual Acidity	2	mol H+/t	80	98	220
Chromium Reducible Sulfur	0.02	% S	< 0.02	< 0.02	< 0.02
pH-KCL	0.1	units	4.5	4.4	4.2
sulfidic - Titratable Actual Acidity	0.02	% pyrite S	0.13	0.16	0.35
% Moisture	0.1	%	27	28	27

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 (regarding both quality and NATA accreditation).

Description	Testing Site	Extracted	Holding Time
Acid Base Accounting (Chromium Reducible Sulfur)	Melbourne	Aug 26, 2013	
Chromium Suite	Melbourne	Aug 26, 2013	6 Weeks
- Method: Acid Sulphate Soils Laboratory Methods Guidelines, Version 2.1			
% Moisture	Melbourne	Aug 23, 2013	14 Day
- Method: Method 102 - ANZECC - % Moisture			

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Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F6, 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

Company Name: Benviron Group
Address: 64 Glenrock Parade
Koolewong
NSW 2256

Client Job No.: KEMBLA GRANGE ACID SULPHATE SOILS E49/5

Order No.:
Report #: 390082
Phone:
Fax:

Received: Aug 21, 2013 3:30 PM
Due: Aug 28, 2013
Priority: 5 Day
Contact Name: Ben Buckley

Eurofins | mgt Client Manager: Jean Heng

Sample Detail					% Moisture	Chromium Suite
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
A1 0.5	Aug 21, 2013		Soil	S13-Au16490	X	X
A2 0.9	Aug 21, 2013		Soil	S13-Au16491	X	X
A3 1.3	Aug 21, 2013		Soil	S13-Au16492	X	X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

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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.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Units

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.
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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. In the case of water samples these are performed on de-ionised water.
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Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
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Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
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Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

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.
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3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene 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 Arochlor 1260 in Matrix Spikes and LCS's.
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 RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
T01	Includes 1.5 Safety Factor

Authorised By

Jean Heng	Client Services
Glenn Jackson	Senior Analyst-SPOCAS (VIC)

Dr. Bob Symons
Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Uncertainty data is available on request

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Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Benviron Group
64 Glenrock Parade
Koolewong
NSW 2256

Attention: **Ben Buckley**

Report **385853-S**
Client Reference ADDITIONAL: ACID SULPHATE SOILS KEMBLA GRANGE E59/5
Received Date Jul 12, 2013

Client Sample ID			**A1 0.5**	**A3 1.0**	**A4 0.9**	**A5 1.3**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**S13-Jl09744**	**S13-Jl09745**	**S13-Jl09746**	**S13-Jl09747**
Date Sampled			**Jul 10, 2013**	**Jul 10, 2013**	**Jul 10, 2013**	**Jul 10, 2013**
Test/Reference	LOR	Unit				
Acidity Trail						
Acid trail - Titratable Actual Acidity	2	mol H+/t	140	150	130	150
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	150	170	150	250
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	14	20	20	100
sulfidic - Titratable Actual Acidity	0.02	% pyrite S	0.22	0.24	0.21	0.24
sulfidic - Titratable Peroxide Acidity	0.02	% pyrite S	0.24	0.28	0.24	0.4
sulfidic - Titratable Sulfidic Acidity	0.02	% pyrite S	0.02	0.03	0.03	0.16
Sulfur Trail						
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	< 10	< 10	< 10	< 10
Sulfur - KCl Extractable	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Sulfur - Peroxide	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
pH Measurements						
pH-KCL	0.1	units	4.5	4.6	4.5	4.4
pH-OX	0.1	units	4.2	4.1	3.9	3.9
Calcium Values						
Acid Reacted Calcium	0.02	% Ca	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Calcium	10	mol H+/t	< 10	< 10	< 10	< 10
Calcium - KCl Extractable	0.02	% Ca	0.07	0.04	0.04	0.05
Calcium - Peroxide	0.02	% Ca	0.07	0.04	0.04	0.06
sulfidic - Acid Reacted Calcium	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Magnesium Values						
Acid Reacted Magnesium	0.02	% Mg	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Magnesium	10	mol H+/t	< 10	< 10	< 10	< 10
Magnesium - KCl Extractable	0.02	% Mg	0.08	0.07	0.06	0.07
Magnesium - Peroxide	0.02	% Mg	0.07	0.07	0.07	0.07
sulfidic - Acid Reacted Magnesium	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Acid Base Accounting (SPOCAS)						
ANC Fineness Factor	0.5	units	1.5	1.5	1.5	1.5
Liming rate - SPOCAS	1	kg CaCO3/t	10	11	9.7	11
Net Acidity (acidity units) - SPOCAS	10	mol H+/t	140	150	130	150
Net Acidity (sulfur units) - SPOCAS	0.02	% S	0.22	0.2	0.2	0.2
% Moisture	0.1	%	29	27	27	28

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 (regarding both quality and NATA accreditation).

Description	Testing Site	Extracted	Holding Time
SPOCAS (Acid Sulphate Soils)			
Acidity Trail	Melbourne	Jul 18, 2013	0 Day
- Method: Acid Sulphate Soils Laboratory Methods Guidelines Version 2.1 - June 2004			
Sulfur Trail	Melbourne	Jul 18, 2013	
pH Measurements	Melbourne	Jul 18, 2013	
Calcium Values	Melbourne	Jul 18, 2013	
Magnesium Values	Melbourne	Jul 18, 2013	
- Method: Acid Sulphate Soils Laboratory Methods Guidelines Version 2.1 - June 2004			
Acid Base Accounting (SPOCAS)	Melbourne	Jul 18, 2013	
- Method: Acid Sulphate Soils Laboratory Methods Guidelines Version 2.1 - June 2004			
% Moisture	Melbourne	Jul 16, 2013	14 Day
- Method: Method 102 - ANZECC - % Moisture			

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ABN – 50 005 085 521 e.mail : enviro@mgtlabmark.com.au web : www.mgtlabmark.com.au

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NATA # 1261
Site # 1254 & 14271

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Unit F6, Building F
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Order No.:
Report #: 385853
Phone:
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Received: Jul 12, 2013 1:45 PM
Due: Jul 19, 2013
Priority: 5 Day
Contact Name: Ben Buckley

Client Job No.: ADDITIONAL: ACID SULPHATE SOILS KEMBLA GRANGE E59/5

Eurofins | mgt Client Manager: Jean Heng

Sample Detail					% Moisture	SPOCAS (Acid Sulphate Soils)
Laboratory where analysis is conducted						
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X
Sydney Laboratory - NATA Site # 18217						
Brisbane Laboratory - NATA Site # 20794						
External Laboratory						
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
A1 0.5	Jul 10, 2013		Soil	S13-Jl09744	X	X
A3 1.0	Jul 10, 2013		Soil	S13-Jl09745	X	X
A4 0.9	Jul 10, 2013		Soil	S13-Jl09746	X	X
A5 1.3	Jul 10, 2013		Soil	S13-Jl09747	X	X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. 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 Sample Receipt Acknowledgment.

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.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Units

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. 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.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	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

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 50-150% - Phenols 20-130%.

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, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene 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 Arochlor 1260 in Matrix Spikes and LCS's.
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 RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Acidity Trail Acid Sulphate Soils Laboratory Methods Guidelines Version 2.1 - June 2004							
Acid trail - Titratable Actual Acidity	mol H+/t	< 2			2	Pass	
Acid trail - Titratable Peroxide Acidity	mol H+/t	< 2			2	Pass	
Acid trail - Titratable Sulfidic Acidity	mol H+/t	< 2			2	Pass	
sulfidic - Titratable Actual Acidity	% pyrite S	< 0.02			0.02	Pass	
sulfidic - Titratable Peroxide Acidity	% pyrite S	< 0.02			0.02	Pass	
sulfidic - Titratable Sulfidic Acidity	% pyrite S	< 0.02			0.02	Pass	
Method Blank							
Sulfur Trail Sulfur Trail							
acidity - Peroxide Oxidisable Sulfur	mol H+/t	< 10			10	Pass	
Sulfur - KCl Extractable	% S	< 0.02			0.02	Pass	
Sulfur - Peroxide	% S	< 0.02			0.02	Pass	
Sulfur - Peroxide Oxidisable Sulfur	% S	< 0.02			0.02	Pass	
Method Blank							
Calcium Values Calcium Values							
Acid Reacted Calcium	% Ca	< 0.02			0.02	Pass	
acidity - Acid Reacted Calcium	mol H+/t	< 10			10	Pass	
Calcium - KCl Extractable	% Ca	< 0.02			0.02	Pass	
Calcium - Peroxide	% Ca	< 0.02			0.02	Pass	
sulfidic - Acid Reacted Calcium	% S	< 0.02			0.02	Pass	
Method Blank							
Magnesium Values Acid Sulphate Soils Laboratory Methods Guidelines Version 2.1 - June 2004							
Acid Reacted Magnesium	% Mg	< 0.02			0.02	Pass	
acidity - Acid Reacted Magnesium	mol H+/t	< 10			10	Pass	
Magnesium - KCl Extractable	% Mg	< 0.02			0.02	Pass	
Magnesium - Peroxide	% Mg	< 0.02			0.02	Pass	
sulfidic - Acid Reacted Magnesium	% S	< 0.02			0.02	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Acidity Trail				Result 1	Result 2	RPD			
Acid trail - Titratable Actual Acidity	S13-Jl09744	CP	mol H+/t	140	140	5.0	30%	Pass	
Acid trail - Titratable Peroxide Acidity	S13-Jl09744	CP	mol H+/t	150	150	<1	30%	Pass	
Acid trail - Titratable Sulfidic Acidity	S13-Jl09744	CP	mol H+/t	14	7.7	< 1	30%	Pass	
sulfidic - Titratable Actual Acidity	S13-Jl09744	CP	% pyrite S	0.22	0.23	5.0	30%	Pass	
sulfidic - Titratable Peroxide Acidity	S13-Jl09744	CP	% pyrite S	0.24	0.24	<1	30%	Pass	
sulfidic - Titratable Sulfidic Acidity	S13-Jl09744	CP	% pyrite S	0.02	< 0.02	< 1	30%	Pass	
Duplicate									
Sulfur Trail				Result 1	Result 2	RPD			
acidity - Peroxide Oxidisable Sulfur	S13-Jl09744	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
Sulfur - KCl Extractable	S13-Jl09744	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - Peroxide	S13-Jl09744	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - Peroxide Oxidisable Sulfur	S13-Jl09744	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
Calcium Values				Result 1	Result 2	RPD			
Acid Reacted Calcium	S13-Jl09744	CP	% Ca	< 0.02	< 0.02	<1	30%	Pass	
acidity - Acid Reacted Calcium	S13-Jl09744	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
Calcium - KCl Extractable	S13-Jl09744	CP	% Ca	0.07	0.07	<1	30%	Pass	
Calcium - Peroxide	S13-Jl09744	CP	% Ca	0.07	0.07	<1	30%	Pass	
sulfidic - Acid Reacted Calcium	S13-Jl09744	CP	% S	< 0.02	< 0.02	<1	30%	Pass	

Duplicate									
Magnesium Values				Result 1	Result 2	RPD			
Acid Reacted Magnesium	S13-Jl09744	CP	% Mg	< 0.02	< 0.02	<1	30%	Pass	
acidity - Acid Reacted Magnesium	S13-Jl09744	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
Magnesium - KCl Extractable	S13-Jl09744	CP	% Mg	0.08	0.08	<1	30%	Pass	
Magnesium - Peroxide	S13-Jl09744	CP	% Mg	0.07	0.08	4.0	30%	Pass	
sulfidic - Acid Reacted Magnesium	S13-Jl09744	CP	% S	< 0.02	< 0.02	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	No
Some samples have been subcontracted	No

Authorised By

Jean Heng	Client Services
Glenn Jackson	Senior Analyst-SPOCAS (VIC)

Dr. Bob Symons
Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Uncertainty data is available on request