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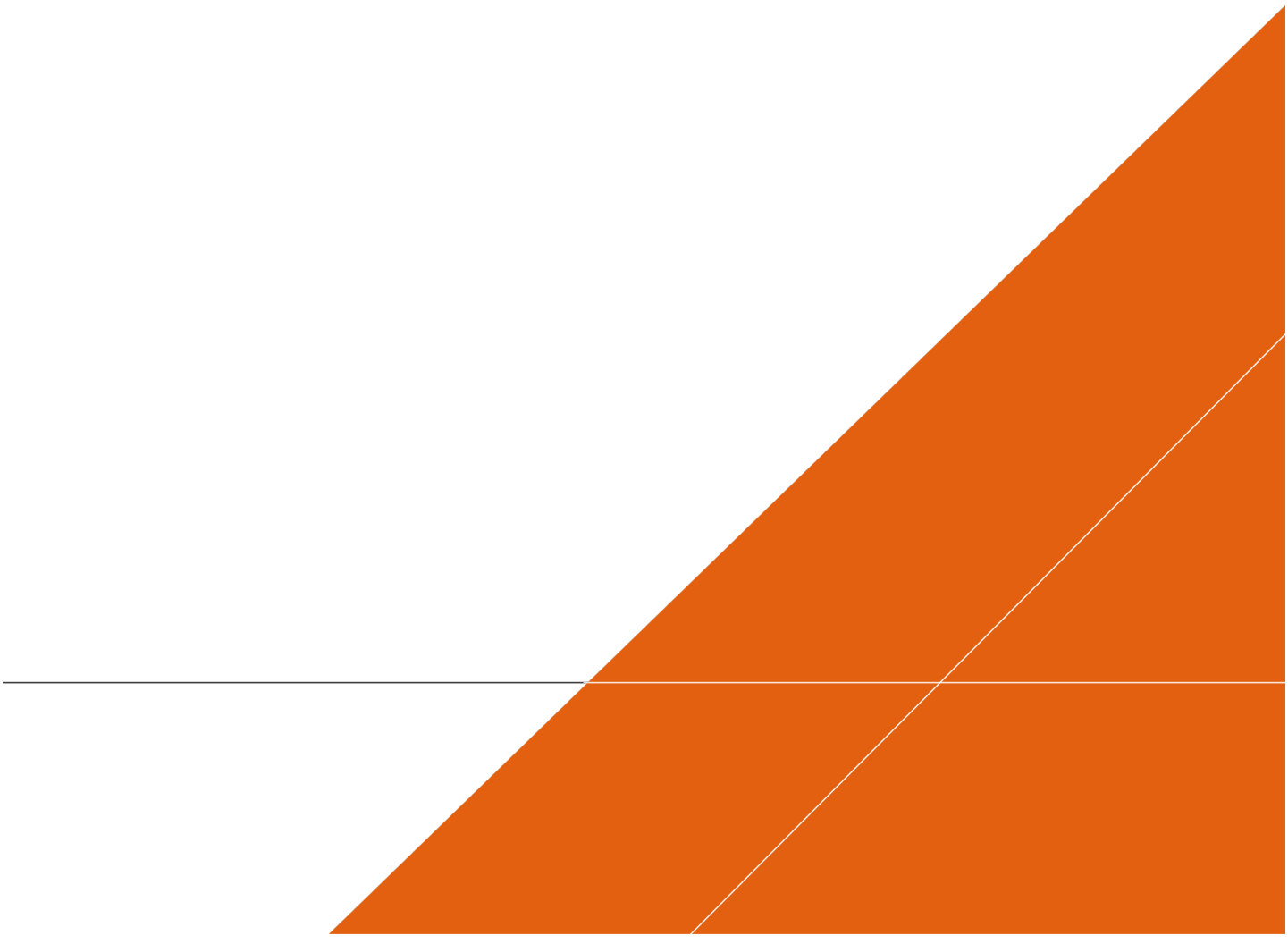
ACID SULFATE SOIL MANAGEMENT PLAN

Qantas Flight Training Centre and Carpark

297 King St, Mascot, NSW 2020

12 APRIL 2019



CONTACT

GREG BARTLETT
Senior Environmental Scientist

T (02) 8907 3929
M 0435 965 974
E Greg.Bartlett@arcadis.com

Arcadis
Level 16, 580 George Street,
Sydney NSW 2000

ACID SULFATE SOIL MANAGEMENT PLAN
QANTAS FLIGHT TRAINING CENTRE AND CARPARK

297 King Street, Mascot NSW

Qantas Airways Limited

Author	Doug Craven	
Checker	Greg Bartlett	
Approver	Greg Bartlett	

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INTRODUCTION

Arcadis Australia Pacific Pty Ltd (Arcadis), was commissioned by Qantas Airways Limited (Qantas) to prepare an Acid Sulfate Soils Management Plan (ASSMP) for the Qantas Flight Training Centre and Carpark at 297 King Street in Mascot, NSW (the Site).

In January 2019, Arcadis prepared an ESA for a footprint of the site (approximately 2.5 hectares) proposed to be developed as a wash-down bay and storage shed. The ESA identified the Site to be located within an area mapped as Class 2 acid sulfate soil (ASS) under the *Botany Bay Local Environmental Plan 2013* Environmental Planning Instrument (EPI). Acid sulphate soils in a Class 2 area are described as 'works below natural ground surface present an environmental risk works by which the water table is likely to be lowered present an environmental risk'.

A review of the Atlas of Australian Acid Sulfate Soils (ASS) map shows the site is situated in a Class B category with a low probability of occurrence (6 70% chance of occurrence) with occurrence across the site.

The proposed works includes excavation to around 1 metre in depth that has the potential to encounter potential acid sulfate soil (PASS) (from around 0.6 metres below grade) and ASS (from around 1 metre below grade). Under Section 6.1 of the BBLEP 2013 an acid sulfate soil management plan (ASSMP) is required for these works.

STANDARD TERMS

- Sydney Central Business District (CBD) not City, Sydney City etc.
- Sydney Kingsford Smith Airport (the Airport).
- Mascot Campus refers to all of Qantas' Mascot land.
- The Site – when referring directly to the site as per attached images.
- The Project – when referring to the proposal in its entirety.
- Sydney Gateway Project (Gateway).
- Bayside Council Local Government Area (LGA).
- Botany Bay Local Environmental Plan 2013 (BBLEP 2013).
- Botany Bay Development Control Plan 2013 (BBDCP 2013).

GLOSSARY

Term	Definition
Acid Sulfate Soils	Acid sulfate soils (ASS) is the common name given to naturally occurring soil and sediment containing iron sulfides. When these natural occurring sulfides are disturbed and exposed to air, oxidation occurs, and sulfuric acid is ultimately produced. ASS are generally acidic (< 4.5 pH) in an undisturbed natural state.
Accreditation	The formal recognition of a laboratory's competence to carry out specific tests. It covers a lab's quality system and its technical quality.
Analyte	The specific component or element measured in chemical analysis.
Anthropogenic	Coming from or having been caused by man.
Aquatic	Growing, living in or frequenting water, occurring or situated in or on water.
Aquifer	Stratum or zone below the surface of the earth capable of producing water as from a well.
Aromatic Compounds	Contain ring structure formed from closed loops of carbon chains (most often containing C-atoms) where carbons in the ring have resonant double bonds. Aromatic compounds include compounds such as benzene, toluene, ethylbenzene and xylene (BTEX), as well as polyaromatic compounds such as naphthalene. Because of the double bonding between carbon atoms, the molecules are not saturated with hydrogen atoms (as with un-saturated hydrocarbons).
Background	An area not influenced by chemicals released from the site under evaluation or other impacts created by the activity on the site under evaluation.
Bentonite	A type of mineral deposit consisting principally of montmorillonite clay. (A major constituent of drilling muds.)
Calibration	Comparison of a measurement standard or instrument with another standard or instrument in order to report or eliminate by adjustment any variation (deviation) in the accuracy of the item being compared.
Casing	The lining put into a well. It extends the total length of the wellbore to ensure safe control of production, prevent water from entering the wellbore and keep rock formations from slumping into the well bore.
Contaminant	A general term referring to any chemical compound added to a receiving environment in excess of natural conditions. The term includes chemicals or effects not generally regarded as "toxic", such as nutrients, salts and colour.
Contamination	The condition or state of soil, water or air caused by a substance release or escape which results in an impairment of, or damage to, the environment, human health, safety, or property.
Environmental Health	The study of the protection of human populations from biological, chemical and physical hazards in their environment.
Exposure Assessment	The process of estimating the amount (concentration or dose) of a chemical that is taken up by a receptor from the environment.
Exposure Pathway	The route by which an organism comes into contact with a contaminant.

Term	Definition
Fill	Depth of which material is to be placed (filled) to bring the surface to a predetermined grade. Also, the material itself.
Guideline	A basis for determining a course of action. An environmental guidelines can be either procedural (directing a course of action) or numerical (providing a numerical value that is generally recommended to support and maintain a specified use.
Jetbase	Qantas leased land within the boundaries of Sydney Kingsford Smith Airport.
Light Non-Aqueous Phase Liquid (LNAPL)	Compounds that are soluble in hydrocarbons but less dense than water, thus these compounds will float on water.
Neutralisation	The Process of Appling Lime of calcium carbonate to neutralise the acidic effects of the soil effectively producing an inert soil pH ranging from 6-8
Mascot Campus	Over 19ha of Qantas Airways Limited controlled land in Mascot to the north of Sydney Kingsford Smith Airport consisting of freehold and leased land. The following lots are owned by Qantas: Lot 133 DP 659434; Lots 4 & 5 DP 38594 Lot 23 DP 883548; Lots 1 & 2 DP 738342; Lot 3 DP 230355; Lot 4 DP 537339; Lots 2 & 4 DP 234489; Lot 4 234489; Lot 1 DP 81210; Lot 1 DP 202093; Lot 1 DP 721562; Lot 2 DP 510447; Lot 1 DP 445957; Lot B DP 164829 and Lot 1 DP 202747 and equates to 16.5ha of land. The following lots are leased by Qantas: Lot 14 DP 1199594 and Lot 2 DP 792885 and equates to 2.7ha of land.
Mottling	Formation or presence of soil mottles (spots of blotches of different colour or shades of colour found in imperfectly drained soils).
Peat	Material constituting peatlands, exclusive of the live plant cover, consisting of largely organic residues accumulated as a result of incomplete decomposition of dead plant constituents under conditions of excessive moisture (submergence in water and/or waterlogging).
Petroleum	A naturally occurring mixture of hydrocarbons in gaseous, liquid or solid form.
Pit	An excavation in the surface made for the purposes of removing, opening up, or proving sand, gravel, clay or any other substances and includes any associated infrastructure, but does not include a mine, quarry or borrow excavation.
Potential Acid Sulfate Soil	Soils that can potently produce acidic conditions if disturbed and exposed to atmospheric oxygen. PASS is generally non-acidic in its natural undisturbed state (>4.5pH) but has the potential to become acidic if disturbed.
The Project	The construction of a new Flight Training Centre and ancillary uses to replace the existing facility on the Qantas Jetbase that will be impacted by RMS' Sydney Gateway Project.
Receptor	The person or organism subjected to exposure to chemicals or physical agents.
Remediation	The removal, reduction or neutralisation of substances, wastes or hazardous material from a site so as to prevent or minimise any adverse effects on the environment now or in the future.

Term	Definition
Sediment	Soil material, both mineral or organic, that is in suspension, is being transported, or has been moved from its surface of origin by air, water, gravity or ice and has come to rest on the earth's surface either above or below sea level.
Sydney Gateway Project	A RMS Project including a road and rail component that is intended to increase capacity and improve connections to the ports to assist with growth in passenger, freight and commuter movements across the region, by expanding and improving the existing road and freight rail networks.
The Site	Qantas Airways Limited owned land in Mascot to the north of Sydney Kingsford Smith Airport consisting of Lots 2-5 DP 234489, Lot 1 DP 202747, Lot B DP 164829 and Lot 133 DP 659434. Current site improvements include including at-grade car parking for Qantas staff, an industrial shed to store spare aviation parts, a substation, a disused gatehouse, a Sydney Water Asset with two driveways over it, the Qantas catering facility and Qantas tri-generation plant.

ABBREVIATIONS

Acronym	Definition
AF/FA	Asbestos fines / fibrous asbestos
AHD	Australian Height Datum
ANZECC & ARMCANZ	Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulfate Soils
ASSMAC	Acid Sulfate Soil Management Advisory Committee
ASSMP	Acid Sulfate Soil Management Plan
B(a)P	Benzo(a)pyrene
BBLEP	*Botany Bay Local Environmental Plan 2013*
BH	*Borehole*
BTEXN	*Benzene, toluene, ethylbenzene, xylene and naphthalene*
CLM Act	*Contaminated Land Management Act (1997)*
CoPCs	*Contaminants of potential concern*
COC	*Chain of Custody*
DSI	Detailed site investigation
EMP	Environmental Management Plan)
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
ESA	Environmental Site Assessment
LEP	Local Environmental Plan
LGA	Local Government Area
MW	Monitoring Well
mBGS	Meters below ground surface
NATA	National Association of Testing Authorities
NEPM/NEPC	National Environment Protection Measure (2013) / National Environment Protection Council
NEMP	National Environmental Plan
NSW	New South Wales
NSW EPA	New South Wales Environment Protection Authority
OCP & OPP	Organochlorine & organophosphorus pesticides
OEH	Office of Environment and Heritage
PAH	Polycyclic aromatic hydrocarbon
PASS	Potential Acid Sulfate Soils

Acronym	Definition
PFAS	Per- and poly- fluorinated alkyl substances
pH^F	pH field
pH^{FOX}	pH Field (oxidising agent)
POEO Act	Protection of the Environment (Operations) Act 1997
PSI	Preliminary Site Investigation
Qantas	Qantas Airways Limited
QA/QC	Quality Assurance/ Quality Control
RAP	Remedial action plan
RPD	Relative Percentage Difference
SEARs	Secretary's Environmental Assessment Requirements
SEPP	*State Environmental Planning Policy*
SPOCAS	*Suspension peroxide oxidation combined acidity and sulfur analysis*
SSD	State Significant Development
SWMs	Safe Work Method Statement
SWL	Standing Water Level
TAA	Total Actual Acidity
TPA	Total Potential Acidity
TSA	Total Sulfate Acidity
The Airport	Sydney Kingsford Smith Airport
TPH/TRH	Total petroleum hydrocarbons / total recoverable hydrocarbons
UPSS	Underground Petroleum Storage Systems
USCS	Unified Soil Classification System
UST	Underground Service Tank
VOCs/SVOCs	Volatile organic compounds / semi-volatile organic compounds

1 OBJECTIVES AND SCOPE OF WORK

1.1 Objective

The objective of the ASSMP is to provide Qantas with guidance on the management and monitoring of works related to the disturbance of PASS/ASS at the Site.

1.2 Scope of Work

To meet the objectives, the following scope of work was completed:

- Review of the site setting in terms of local hydrology, topography, geology and hydrogeology.
- Review of acid sulfate soil maps for the Site and surrounding area.
- Review to the ASS Investigation report (February 2019) and recommendations within.
- Development of ASS management protocols including soil handling and treatment/storage, water management, monitoring requirements and contingency plans.

1.3 Guidance

According to “Acid Sulphate Soil Manual”, prepared by NSW Acid Sulphate Soil Management Advisory Committee (ASSMAC) (August 1998), acid sulphate soils (ASS) is the common name given to naturally occurring soil and sediment containing iron sulphides. When these naturally occurring sulphides are disturbed and exposed to air, oxidation occurs and sulphuric acid is ultimately produced. It is this sulphuric acid that can cause significant socio-economic and environmental impacts if not managed appropriately during the construction and redevelopment process.

This ASSMP has been prepared in general accordance with the requirements of the following industry best-practice guidance documents:

- Acid Sulfate Soil Assessment Guidelines (NSW Acid Sulfate Soils Management Advisory Committee, 1998).
- Treatment and management of soil and water in acid sulfate soil landscapes (Western Australian Department of Environment Regulation, June 2015).

1.4 Regulatory Requirements

The proposed works will be carried out in accordance with the following Commonwealth, State and Local legislative and regulatory requirements:

- Environmental Planning and Assessment Act 1979
- Environmental Planning and Assessment Regulation 2000
- State Environmental Planning Policy (Infrastructure) 2007
- Botany Bay Local Environmental Plan 2013 (BBLEP 2013)
- Botany Bay Development Control Plan 2013 (BBDCP 2013)
- Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- Protection of the Environment Operations Act 1997 (PoEO Act)
- Contaminated Land Management Act 1997 (CLM Act)
- State Environmental Planning Policy (Rural Lands) 2008 (SEPP Rural Lands)

- State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)

2 LIMITATIONS

The findings of this report are based on the scope of work outlined in Section 1.2 as agreed by Qantas. Arcadis performed its services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties, expressed or implied are made.

Subject to the scope of work, Arcadis' assessment was limited strictly to identifying the environmental conditions associated with the subject property and does not include evaluation of any other issues. The absence of any identified hazardous or toxic materials should not be interpreted as a guarantee that such materials do not exist on the subject property.

Additionally, unless otherwise stated Arcadis did not conduct soil, air, wastewater or other matrix analyses including asbestos or perform contaminated sampling of any kind. Nor did Arcadis investigate any waste material from the property that may have been disposed of at the site or undertake an assessment or review of related site waste management practices.

The results of this assessment are based upon (if undertaken as part of the scope work) a site inspection conducted by Arcadis personnel and/or information from interviews with people who have knowledge of site conditions and/or information provided by regulatory agencies. All conclusions and recommendations regarding the property are the professional opinions of the Arcadis personnel involved with the project, subject to the qualifications made above.

All conclusions and recommendations regarding the property are the professional opinions of the Arcadis personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Arcadis assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements or sources outside of Arcadis, or developments resulting from situations outside the scope of this project.

Arcadis is not engaged in environmental assessment and reporting for the purpose of advertising sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. The client acknowledges that this report is for the exclusive use of the client.

3 SITE DESCRIPTION

The site is located at 297 King Street, Mascot and comprises land known as Lots 2-5 DP 234489, Lot 1 DP 202747, Lot B DP 164829 and Lot 133 DP 659434. Physical attributes of the site include three sections of carpark and two buildings in an industrial/commercial area. The Site location is shown on Figure 1 and Figure 2, Appendix A. A further description of the Site is provided below, and additional description of the site with respect to the onsite contamination risk is provided in the ESA (Arcadis 2019), which should be read in conjunction with this ASSMP.

3.1 Key features of the site are as follows:

- The site is approximately 5.417ha and is an irregular shape. It is approximately 240m in length and maintains a variable width of between approximately 321m in the northern portion of the site and approximately 93m along the King Street frontage, refer to Appendix A.
- The site possesses a relatively level slope across the site. An open Sydney Water drainage channel bisects the northern portion of the site in an east-west direction. There are some isolated changes in level immediately adjacent to this channel. A Site Survey Plan accompanies the application which details the topographic characteristics of the site.
- Multiple mature Plane Trees are scattered throughout the site. A variety of native and exotic tress and vegetation also exist around the perimeter of the site which help screen the site from surrounding uses.
- Site improvements include at-grade car parking for Qantas staff, an industrial shed to store spare aviation parts, a substation, a disused gatehouse, a Sydney Water Asset with two driveways over it, the Qantas catering facility and Qantas tri-generation plant.
- The site forms part of a larger land holding under the ownership of Qantas that generally extends between Qantas Drive to the west, Ewan Street to the south, Coward Street to the north, with the Qantas “Corporate Campus” fronting Bourke Road.
- Vehicular access to the site from the local road network is available from King Street. The site has intra-campus connections along the northern boundary in the form of two connecting driveways in the north-eastern and north-western corner of the site along the northern boundary which link it to the broader Mascot Campus.
- The site is located within the Bayside LGA.

3.2 Key features of the locality are:

- North: The site is bounded to the north low scale industrial development, beyond which is Coward Street. Further north of the site is the Mascot Town Centre which is characterised by transport-oriented development including high density mixed-use development focussed around the Mascot Train Station.
- East: The site is bordered to the east by commercial development including a newly completed Travelodge hotel which includes a commercial car park. Additional commercial development to the east includes the Ibis Hotel and Pullman Sydney Airport fronting O’Riordan Street.
- South: The site is bounded to the south by King Street, beyond which is Qantas owned at-grade car parking and other industrial uses. Further south is the Botany Freight Rail Line and Qantas Drive beyond which is the Domestic Terminal at Sydney Airport.

- West: The site is bordered to the west by the Botany Freight Rail Line and Qantas Drive, beyond which lies Sydney Kingsford Smith Airport and the Qantas Jetbase (location of the current Flight Training Centre).

3.3 Local Sensitive Environments

Local sensitive environments as identified in the ESA (Arcadis 2019) include:

- The nearest residential area is located approximately 200 m southeast of the site and contains a series of medium to high density residential dwellings;
- Alexandra Canal located approximately 700 m northwest of the site, which drains into Botany Bay; and
- Botany Bay located approximately 2.50 km south of the site.

3.4 Topography

The topography of the site is largely a result of cutting and filling. The site elevation peaks in the centre of the site and along the eastern border, and slopes very slightly to the northwest. The site has an approximate elevation of 6 m Australian Height Datum (AHD).

4 GEOLOGICAL DESCRIPTION

4.1.1 Geology and Soil Type

The Sydney 1:100,000 Geological Map indicates that the site is underlain by the following geological units and structures;

- Quaternary medium to fine-grained marine sand; and
- Quaternary peat, sandy peat and mud.

The Sydney 1:100,000 Soil Landscapes map indicates that the soil landscape of the site comprises Tuggerah aeolian and disturbed terrain soils.

Further discussion of soil type is discussed in the ESA (Arcadis, 2019) and soil observations recorded during ASS investigation works are detailed in Appendix B.

4.1.2 Acid Sulphate Soils

The online acid sulfate soil risk mapping provided by environment.nsw.gov.au/eSpade shows the site to be located in an area of “X4: Disturbed Terrain.

A site-specific ASS investigation was conducted at the site and Potential Acid Sulfate soils (PASS) were identified at the site primarily within the natural soil horizon.

The ASS investigation is presented in Appendix B and further summarised with in section 7.

4.2 Hydrological Description

A review of NSW Department of Primary Industries Office of Water records for groundwater bores within a 2km radius of the site indicated the presence of 276 water bores. The majority of existing boreholes are used as monitoring bores, but are also used for industrial, testing, domestic, irrigation and recreational purposes. Recorded standing water levels (SWL) of the bores ranged from 0.90 m to 14.90 m below ground Surface (BGS).

During the ESA (Arcadis, 2019) groundwater was encountered between 0.975m and 3.553m below ground level and between 1.307m and 3.182m when corrected to AHD. Based on groundwater contours determined during the ESA, groundwater flow direction was determined to flow towards the west.

4.3 Hydrology Description

The nearest surface water deposit is Alexandra Canal, which is located approximately 700 m west of the site. The Alexandra Canal drains into Botany Bay, located approximately 2.50 km south of the site.

5 PROJECT DESCRIPTION

Safety is Qantas' first priority. The flight training centre is a key pillar of this value. The facility enables pilots and flight crews to undertake periodic testing to meet regulatory requirements by simulating both aircraft and emergency procedural environments. The Project seeks consent for the construction and operation of a new flight training centre, and associated ancillary uses including a multi-deck car park. The Project is comprised of the following uses:

5.1 Flight Training Centre

The proposed flight training centre will occupy the southern portion of the site. It is a building that comprises 4 core elements as follows:

- An emergency procedures hall that contains;
  - cabin evacuation emergency trainers,
  - an evacuation training pool,
  - door trainers,
  - fire trainers,
  - slide descent towers,
  - security room,
  - aviation medicine training and equipment rooms.
- A flight training centre that contains:
  - a flight training hall with 14 bays that will house aircraft simulators,
  - integrated procedures training rooms, computer rooms, a maintenance workshop, storerooms, multiple de-briefing and briefing rooms, pilot's lounge and a shared lounge.
- Teaching Space that contains
  - training rooms,
  - classrooms and two computer-based exam rooms.
- Office Space
  - Office space for staff and associated shared amenities including multiple small, medium and large meeting rooms, think tank rooms, informal meeting spaces, a video room and lunch/tea room.
- Ancillary spaces including the reception area at the ground floor, toilets, roof plant and vertical circulation. The external ground floor layout will include a loading dock, at-grade car parking for approximately 39 spaces and a bus drop-off zone at the northern site boundary.

5.2 Car Park

The proposed multi-deck car park will be located to the north-east of the flight training centre and adjacent the existing Qantas catering facility and tri-generation plant. The car park is 13 levels and will provide 2059 spaces for Qantas staff. Vehicle access to the car park will be provided via King Street, Kent Road and from Qantas Drive via the existing catering bridge.

6 PROPOSED WORKS

No proposed plans of excavations of sub surface disturbance works were provided for the construction of the planned development summarised in Section 5, however sub surface excavations are expected as part of the proposed development.

Arcadis has assumed that excavations of PASS material are highly probable and tailored this ASSMP accordingly.

During the ASS investigation SWL was observed between 1.75m and 3.20 mBGS, During the ESA groundwater was encountered form at 0.975 mBGS. This indicates that groundwater depths fluctuate across the site. Depending on where excavations are located, interception of groundwater is a high probability on the site.

Excavations below the standing water level will require dewatering thought a dewatering management plan, in addition any saturated soils removed that have been dewatered greatly increase the oxidisation rate of the soils if PASS material is present at the excavated depths.

7 ACID SUFATE SOIL INVESTIGATION SUMMARY

The Acid Sulphate Soil Investigation Report is provided as Appendix B and contains all laboratory reports, bore logs and figures relevant to the investigation. Review of this report was performed to determine the ASSMP recommendations

The ASS investigation was conducted on 31st January 2019 at the site comprising of eight locations samples at 1 metre intervals to 6 mBGS

The geological profiles of the site indicated that both reworked sands and fill overlaying natural sands were encountered.

The Field pH (pH^F) screening results ranged from 4.8 - 8.5 indicating that ASS is not present in the soil profile in its natural state, However the low range of the pH^F is marginally above 4.5 indicating that the soil is partially acidic in its natural state.

The field pH after oxidisation (pH^{FOX}) results ranged from 2.0 to 8.0 which indicated that PASS is present at the site, further SPOCAS analysis identified a wide range of results indicating that specific layers within the tested locations contain PASS.

Of the 48 analysed samples, 37 were identified to contain PASS material though SPOCAS analysis with PASS identified at a wide range of depths both within the fill and natural material on the site. This indicates that that the PASS is either in lenses with in the subsurface matrix or the underlying soil has been reworked.

A summary of the SPOCAS identified locations and depths is presented in Table 7-1

Table 7-1 PASS identified Location and Depths summary

Location	Reported PASS Depth (m)	Fill Depth Range (m)	Pass Reported in Fill
BH01	1-3 and 5-6	0.0-0.5	No
BH03	1-3 and 5-6	0.0-0.8	No
BH05	1-6	0.0-0.5	No
BH15	3-6	0.0-2.3	No
BH18	3 and 5-6	0.0-3.2	Yes
BH26	4-6	0.0-0.4	No
BH28	2 and 4-6	0.0-1.6	No
MW06	1-2 and 4-6	0.0-1.7	Yes

An assessment of the bore logs provided with in Appendix B shows that varying thicknesses of fill is overlying naturals sandy soils at each location.

Locations where PASS was identified in the fill layers (BH18 and MW06) were generally near the fill/natural horizon indicating that reworking of the soils during the filling process could have occurred. In addition, locations where, thicker fill layers were encountered (BH15 and BH18) pass was not identified in the upper portion of the fill indicating that the majority of the PASS identified at the site resides with in the natural layers of undisturbed soils.

8 RISK ASSESSMENT

Based on the above information regarding the site location, site setting, and proposed works the following risk assessment is made.

Excavations works present a significant risk of exposing PASS/ASS soils during redevelopment of the site. Exposure of PASS/ASS to oxygen will generate acid runoff if the material is stockpiled onsite without appropriate treatment by neutralising with a liming agent or off-site disposal to a licenced facility.

The risk of harm due to the release of acid water is moderate to high given the location of the area being:

- Shallow groundwater ranging between 0.975 and 3.2mBGS.
- PASS being identified at the site primarily within the natural sands
- Site location is within 700m of surface water bodies.
- The amount of material to be excavated is undetermined at the time of this report.

However, the risked posed to sensitive ecological receptors from the works will be negligible if the management procedures described in Section 9 are followed.

9 ACID SULFATE SOIL MANAGEMENT PLAN

The ASSMP requirements for the project are provided in Table 9-1.

Table 9-1 Acid Sulfate Soil Management Plan

Item	Description
Soil Characterisation	Soil samples were collected across the development footprint (8 locations to 6mbgl) to assess for AASS/PASS at the site. From this treatment/management of soil has been more accurately designed. PASS has been identified at the site primarily with in the natural sands underlying the fill at each location.
Earthworks Program	Excavation activities should occur in a staged process to allow efficient assessment and management of the excavated materials. Excavated materials should be placed on an impermeable surface such as a PVC liner or compacted clay with a 300mm layer of crushed limestone. The stockpiled materials should be either treated/neutralised with lime at a rate designed from insitu sampling data (if available) or the stockpiles should be assessed for ASS/PASS and neutralised accordingly. Excavations into ASS/PASS material should be filled as soon as practicable to minimise the amount of time ASS/PASS are exposed to the atmosphere.
Stockpile Management	Where treatment/neutralisation of the stockpiled materials is required, the stockpiles should be managed as follows: • Excavated PASS/ASS should be laid down in layers up to 300mm thick with lime applied as the require rate between layers. • The ASS/PASS and lime should be mixed with an excavator taking care not to damage the impervious layer at the base. • The stockpiles should be covered and bunded to prevent rain fall and stormwater ingress and prevent runoff from the stockpile entering the receiving environment. • The stockpiles should have a runoff capture drain to allow any runoff to be managed. • Runoff should be sampled and managed accordingly before release to the environment/stormwater. • The stockpiled material should be sampled and analysed for SPOCAS to validate the effectiveness of the treatment/neutralisation.
Validation Program	Following successful neutralisation of the stockpiled material, the treatment area should be decommissioned, and validation samples of the footprint collected to show that the natural ground surface has not been adversely impacted.
Contingency Plan	ASS/ PASS is expected to be encountered and due to the shallow fill layers on the site the ASS/PASS primarily residing with in the natural sands above and below the water table. The following contingencies are provided: • If sampling of the stockpile following treatment/neutralisation shows the suitability criteria to not be met, then additional treatment/neutralisation is required.

Item	Description
	• If site conditions do not allow for onsite treatment/neutralisation, then off-site disposal to a licenced facility is required. • If excavations are required below the water table and dewatering is required, a dewatering management plan may be required. • If stockpile runoff is shown to be unsuitable for release to the environment or the local stormwater network, a water treatment plan for disposal may be required. • If stockpile runoff breaches the bund, excavation of the impacted area and treatment/neutralisation will be required.
Offsite waste management	ASS/PASS soils cannot be classified as VENM or ENM due to the sulfidic ores that reside within. Assessment of the soils in regard to Contaminants of Potential Concern (PCoC) at the site need to be considered and waste classification based on contamination concentrations accordingly. Assessment of the NSW EPA Waste Classification Guidelines for offsite disposal options. Review of the ESA (Arcadis 2019) is required to help determine PCoC at the specific locations of excavation. A suitable waste handling facility will need to be found ie Holts Kurnell that will accept the waste based on both the ASS/PASS classification and the waste classification provided by a suitably qualified contaminated land consultant.
Onsite reuse of excavated soils	Onsite reuse of neutralised classified ASS/PASS soils is permissible assuming that neutralisation and validation of the materials has occurred and that the soils are in line with the NEPM for the designated land use.
Site Management Plan	It is understood that the works will operated under a Construction Environment Management Plan (CEMP). The CEMP should be read in conjunction with this ASSMP and the ESA.
Assessment Criteria	For treated/neutralised stockpiled material to be considered suitable for reuse/off-site disposal from as ASS/PASS perspective, the following criteria should be met: • the neutralising capacity of the treated soil must exceed the existing plus potential acidity of the soil, (e.g. pH_{fox} must be >5.0 or shown to ne not containing ASS or PASS material though laboratory analysis); • the neutralising material has been thoroughly mixed with the soil; • soil pH must be in the range 6.0 to 8.5; and • excess neutralising agent must remain within the soil until all acid generation reactions are complete and the soil has no further capacity to generate acidity • Assessment of the NSW EPA Waste Classification Guidelines for offsite disposal options.
Closure Reporting	Following completion of the works a closure report detailing the ASS/PASS management measures and validation procedures should be prepared by a suitable qualified contaminated land consultant.

10 NETURALISTION RATES OF ONSITE RUEUSE OF PASS

Laboratory analysis performed within the ASS investigation (Appendix B) reported the required liming rates for each sample were PASS was identified. A conservative approach has been used to determine the liming rate required for neutralisation at each location.

Table 10-1 Laboratory indicated liming rates for each location

Location	Reported PASS Depth (m)	Minimum volume of lime (KG $CaCO_3$/Ton)
BH01	1-3 and 5-6	7
BH03	1-3 and 5-6	7
BH05	1-6	7
BH15	3-6	4
BH18	3 and 5-6	5
BH26	4-6	10
BH28	2 and 4-6	15
MW06	1-2 and 4-6	11

APPENDIX A **FIGURES**

10026439 - King Street North

Legend

- Motorway
- Major roads
- Local road
- Railway
- Site Boundary

1:5,000 at A3

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ARCADIS AUSTRALIA PACIFIC PTY LTD
ABN 76 104 485 289
Level 16, 580 George St | Sydney NSW 2000
P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001

Coordinate System: GDA 1994 MGA Zone 56
Date issued: January 24, 2019

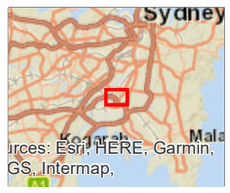

Figure 1 - Site Locations

0 50 100 200 300 400
m

Date: 24/01/2019 Path: C:\Arc Templates\Temporary Projects\10026439 - King Street North\10026439 - Figure 1 - Site Location.mxd
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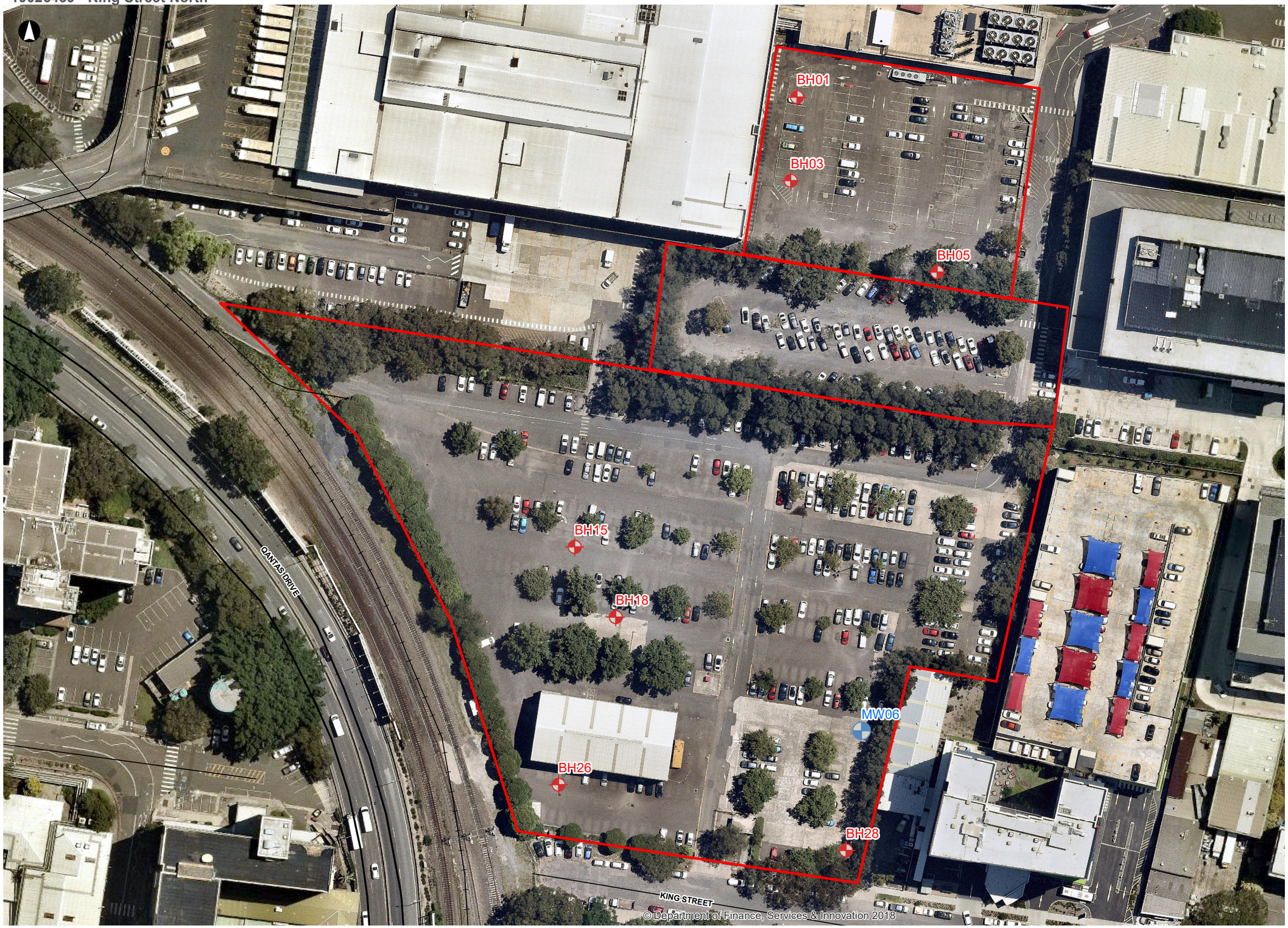
10026439 - King Street North



Legend

Sampling Locations

Descriptio, ASS

- MW, Yes
- SB, Yes
- Motorway
- Major roads
- Local road
- Railway
- Site Boundary

1:1,018 at A3

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ARCADIS AUSTRALIA PACIFIC PTY LTD
ABN 76 104 485 289
Level 16, 580 George St | Sydney NSW 2000
P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001

Coordinate System: GDA 1994 MGA Zone 56
Date issued: February 1, 2019

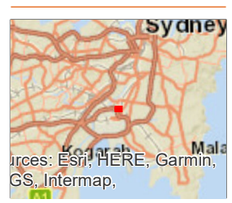

Figure 2 - Sampling Locations (ASS)

0 10 20 40 60 80
m

Date: 1/02/2019 Path: C:\Arc Templates\Temporary Projects\10026439 - King Street North\10026439 - Figure 2 - Sampling Locations ASS.mxd
Created by : Environmental Restoration
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APPENDIX B ACID SULFATE SOIL INVESTGATION REPORT

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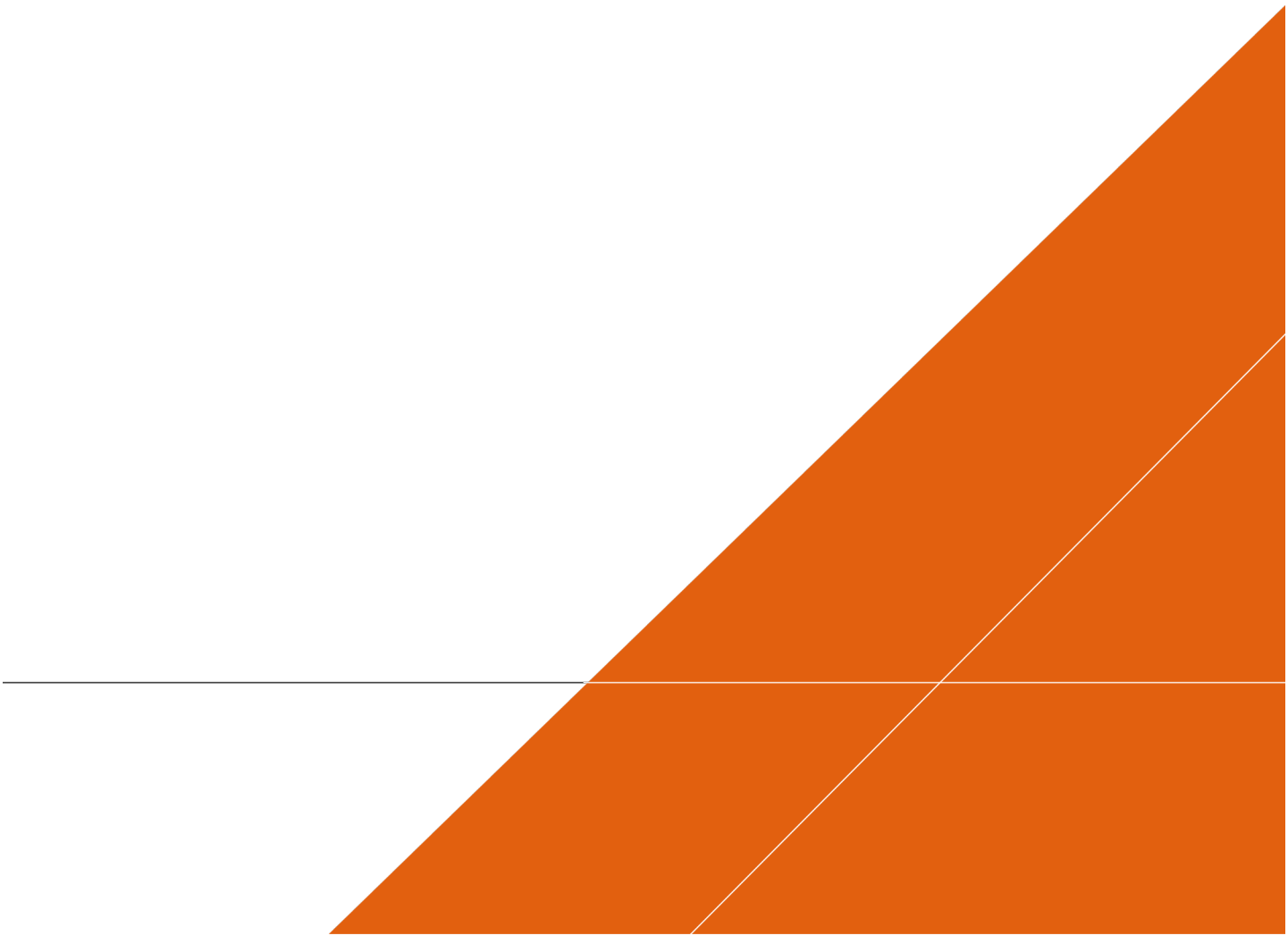
ACID SULFATE SOIL INVESTIGATION REPORT

Qantas Flight Training Centre and Carpark

297 King St, Mascot, NSW 2020

12 APRIL 2019



CONTACT

GREG BARTLETT
Senior Environmental Scientist

T (02) 8907 3929
M 0435 965 974
E Greg.Bartlett@arcadis.com

Arcadis
Level 16, 580 George Street,
Sydney NSW 2000

ACID SULFATE SOIL INVESTIGATION REPORT

297 King Street, Mascot NSW

Qantas Airways Limited

Author	Tom Keatley	
Author	Doug Craven	
Approver	Greg Bartlett	

Report No	10026439RP02 – ASS Investigation
Date	12/04/2019
Revision Text	01

REVISIONS

Revision	Date	Description	Prepared by	Approved by
0	15/02/2019	First Draft	DC	GB
01	12/04/2019	Addressing client comments	CR	GB

CONTENTS

APPENDICES

INTRODUCTION

Arcadis Australia Pacific Pty Ltd (Arcadis), was commissioned by Qantas Airways Limited (Qantas) to prepare an Acid Sulfate Soils Investigation for or the Qantas Flight Training Centre and Carpark at 297 King Street in Mascot, NSW (the Site).

In January 2019, Arcadis prepared an ESA for a footprint of the site (approximately 2.5 hectares) proposed to be developed as a wash-down bay and storage shed. The ESA identified the Site to be located within an area mapped as Class 2 acid sulfate soil (ASS) under the Botany Bay Local Environmental Plan 2013 Environmental Planning Instrument (EPI). Acid Sulfate soils in a Class 2 area are described as 'works below natural ground surface present an environmental risk works by which the water table is likely to be lowered present an environmental risk'.

A review of the Atlas of Australian Acid Sulfate Soils (ASS) map shows the site is situated in a Class B category with a low probability of occurrence (60- 70% chance of occurrence) with occurrence across the site.

The proposed works includes excavation to approximately 1 metre in depth that has the potential to encounter potential acid sulfate soil (PASS) (from around 0.6 metres below grade) and ASS (from around 1 metre below grade). Under Section 6.10 of the SLEP 2013, an acid sulfate soil management plan (ASSMP) is required for these works.

STANDARD TERMS

Please be aware that these are the standard terms to be used across all reports. They should be spelt out fully in the first instance and then contracted. All reports to refer to:

- Sydney Central Business District (CBD) not City, Sydney City etc.
- Sydney Kingsford Smith Airport (the Airport).
- Mascot Campus refers to all of Qantas' Mascot land.
- The Site – when referring directly to the site as per attached images.
- The Project – when referring to the proposal in its entirety.
- Sydney Gateway Project (Gateway).
- Bayside Council Local Government Area (LGA).
- Botany Bay Local Environmental Plan 2013 (BBLEP 2013).
- Botany Bay Development Control Plan 2013 (BBDCP 2013).

GLOSSARY

Term	Definition
Acid Sulfate Soils	Acid sulfate soils is the common name given to naturally occurring soil and sediment containing iron sulfides. When these natural occurring sulfides are disturbed and exposed to air, oxidation occurs, and sulfuric acid is ultimately produced. ASS are generally acidic (<4.5pH) in an undisturbed natural state.
Accreditation	The formal recognition of a laboratory's competence to carry out specific tests. It covers a lab's quality system and its technical quality.
Analyte	The specific component or element measured in chemical analysis.
Anthropogenic	Coming from or having been caused by man.
Aquatic	Growing, living in or frequenting water, occurring or situated in or on water.
Aquifer	Stratum or zone below the surface of the earth capable of producing water as from a well.
Aromatic Compounds	Contain ring structure formed from closed loops of carbon chains (most often containing C-atoms) where carbons in the ring have resonant double bonds. Aromatic compounds include compounds such as benzene, toluene, ethylbenzene and xylene (BTEX), as well as polyaromatic compounds such as naphthalene. Because of the double bonding between carbon atoms, the molecules are not saturated with hydrogen atoms (as with un-saturated hydrocarbons).
Background	An area not influenced by chemicals released from the site under evaluation or other impacts created by the activity on the site under evaluation.
Bentonite	A type of mineral deposit consisting principally of montmorillonite clay. (A major constituent of drilling muds.)
Calibration	Comparison of a measurement standard or instrument with another standard or instrument in order to report or eliminate by adjustment any variation (deviation) in the accuracy of the item being compared.
Casing	The lining put into a well. It extends the total length of the wellbore to ensure safe control of production, prevent water from entering the wellbore and keep rock formations from slumping into the well bore.
Contaminant	A general term referring to any chemical compound added to a receiving environment in excess of natural conditions. The term includes chemicals or effects not generally regarded as "toxic", such as nutrients, salts and colour.
Contamination	The condition or state of soil, water or air caused by a substance release or escape which results in an impairment of, or damage to, the environment, human health, safety, or property.
Environmental Health	The study of the protection of human populations from biological, chemical and physical hazards in their environment.
Exposure Assessment	The process of estimating the amount (concentration or dose) of a chemical that is taken up by a receptor from the environment.
Exposure Pathway	The route by which an organism comes into contact with a contaminant.

Term	Definition
Fill	Depth of which material is to be placed (filled) to bring the surface to a predetermined grade. Also, the material itself.
Guideline	A basis for determining a course of action. An environmental guidelines can be either procedural (directing a course of action) or numerical (providing a numerical value that is generally recommended to support and maintain a specified use.
Jetbase	Qantas leased land within the boundaries of Sydney Kingsford Smith Airport.
Light Non-Aqueous Phase Liquid (LNAPL)	Compounds that are soluble in hydrocarbons but less dense than water, thus these compounds will float on water.
Neutralisation	The Process of Appling Lime of calcium carbonate to neutralise the acidic effects of the soil effectively producing an inert soil pH ranging from 6-8
Mascot Campus	Over 19ha of Qantas Airways Limited controlled land in Mascot to the north of Sydney Kingsford Smith Airport consisting of freehold and leased land. The following lots are owned by Qantas: Lot 133 DP 659434; Lots 4 & 5 DP 38594 Lot 23 DP 883548; Lots 1 & 2 DP 738342; Lot 3 DP 230355; Lot 4 DP 537339; Lots 2 & 4 DP 234489; Lot 4 234489; Lot 1 DP 81210; Lot 1 DP 202093; Lot 1 DP 721562; Lot 2 DP 510447; Lot 1 DP 445957; Lot B DP 164829 and Lot 1 DP 202747 and equates to 16.5ha of land. The following lots are leased by Qantas: Lot 14 DP 1199594 and Lot 2 DP 792885 and equates to 2.7ha of land.
Mottling	Formation or presence of soil mottles (spots of blotches of different colour or shades of colour found in imperfectly drained soils).
Peat	Material constituting peatlands, exclusive of the live plant cover, consisting of largely organic residues accumulated as a result of incomplete decomposition of dead plant constituents under conditions of excessive moisture (submergence in water and/or waterlogging).
Petroleum	A naturally occurring mixture of hydrocarbons in gaseous, liquid or solid form.
Pit	An excavation in the surface made for the purposes of removing, opening up, or proving sand, gravel, clay or any other substances and includes any associated infrastructure, but does not include a mine, quarry or borrow excavation.
Potential Acid Sulfate Soil	Soils that can potently produce acidic conditions if disturbed and exposed to atmospheric oxygen. PASS is generally non-acidic in its natural undisturbed state (>4.5pH) but has the potential to become acidic if disturbed.
The Project	The construction of a new Flight Training Centre and ancillary uses to replace the existing facility on the Qantas Jetbase that will be impacted by RMS' Sydney Gateway Project.
Receptor	The person or organism subjected to exposure to chemicals or physical agents.
Remediation	The removal, reduction or neutralisation of substances, wastes or hazardous material from a site so as to prevent or minimise any adverse effects on the environment now or in the future.

Term	Definition
Sediment	Soil material, both mineral or organic, that is in suspension, is being transported, or has been moved from its surface of origin by air, water, gravity or ice and has come to rest on the earth's surface either above or below sea level.
Sydney Gateway Project	A RMS Project including a road and rail component that is intended to increase capacity and improve connections to the ports to assist with growth in passenger, freight and commuter movements across the region, by expanding and improving the existing road and freight rail networks.
The Site	Qantas Airways Limited owned land in Mascot to the north of Sydney Kingsford Smith Airport consisting of Lots 2-5 DP 234489, Lot 1 DP 202747, Lot B DP 164829 and Lot 133 DP 659434. Current site improvements include including at-grade car parking for Qantas staff, an industrial shed to store spare aviation parts, a substation, a disused gatehouse, a Sydney Water Asset with two driveways over it, the Qantas catering facility and Qantas tri-generation plant.

1 OBJECTIVES AND SCOPE OF WORK

1.1 Objective

The objective of the investigation is to provide Qantas with the presence and or extent of the PASS or ASS at the site to help facilitate informed decision making related to the ASSMP.

1.2 Scope of Work

- Formation of eight (8) soil bores using a track mounted Geoprobe® drill rig, to a depth of 6m from surface;
- Six (6) soil samples per borehole (one every metre) will be submitted to a NATA accredited laboratory for analysis of:
  - pH – pH_f and pH_{fox}
  - SPOCAS; and
- Results will be compared against the Acid Sulfate Soil Manual (1998); and
- Preparation of a report discussing the results.

1.3 Guidance

According to “Acid Sulfate Soil Manual”, prepared by NSW Acid Sulfate Soil Management Advisory Committee (ASSMAC) (August 1998), acid Sulfate soils (ASS) is the common name given to naturally occurring soil and sediment containing iron sulphides. When these naturally occurring, sulphides are disturbed and exposed to air, oxidation occurs, and sulphuric acid is ultimately produced. It is this sulphuric acid that can cause significant socio-economic and environmental impacts if not managed appropriately during the construction and redevelopment process.

This investigation has been prepared in general accordance with the requirements of the following industry best-practice guidance documents:

- Acid Sulfate Soil Assessment Guidelines (NSW Acid Sulfate Soils Management Advisory Committee, 1998).

2 LIMITATIONS

The findings of this report are based on the scope of work outlined in Section 1.2 as agreed by Qantas Airways Limited. Arcadis performed its services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties, expressed or implied are made.

Subject to the scope of work, Arcadis' assessment was limited strictly to identifying the environmental conditions associated with the subject property and does not include evaluation of any other issues. The absence of any identified hazardous or toxic materials should not be interpreted as a guarantee that such materials do not exist on the subject property.

Additionally, unless otherwise stated Arcadis did not conduct soil, air, wastewater or other matrix analyses including asbestos or perform contaminated sampling of any kind. Nor did Arcadis investigate any waste material from the property that may have been disposed of at the site or undertake an assessment or review of related site waste management practices.

The results of this assessment are based upon (if undertaken as part of the scope work) a site inspection conducted by Arcadis personnel and/or information from interviews with people who have knowledge of site conditions and/or information provided by regulatory agencies. All conclusions and recommendations regarding the property are the professional opinions of the Arcadis personnel involved with the project, subject to the qualifications made above.

All conclusions and recommendations regarding the property are the professional opinions of the Arcadis personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Arcadis assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements or sources outside of Arcadis, or developments resulting from situations outside the scope of this project.

Arcadis is not engaged in environmental assessment and reporting for the purpose of advertising sales promoting, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. The client acknowledges that this report is for the exclusive use of the client.

3 SITE DESCRIPTION

The site is located at 297 King Street, Mascot and comprises land known as Lots 2-5 DP 234489, Lot 1 DP 202747, Lot B DP 164829 and Lot 133 DP 659434. The site is identified below in Figure 1.

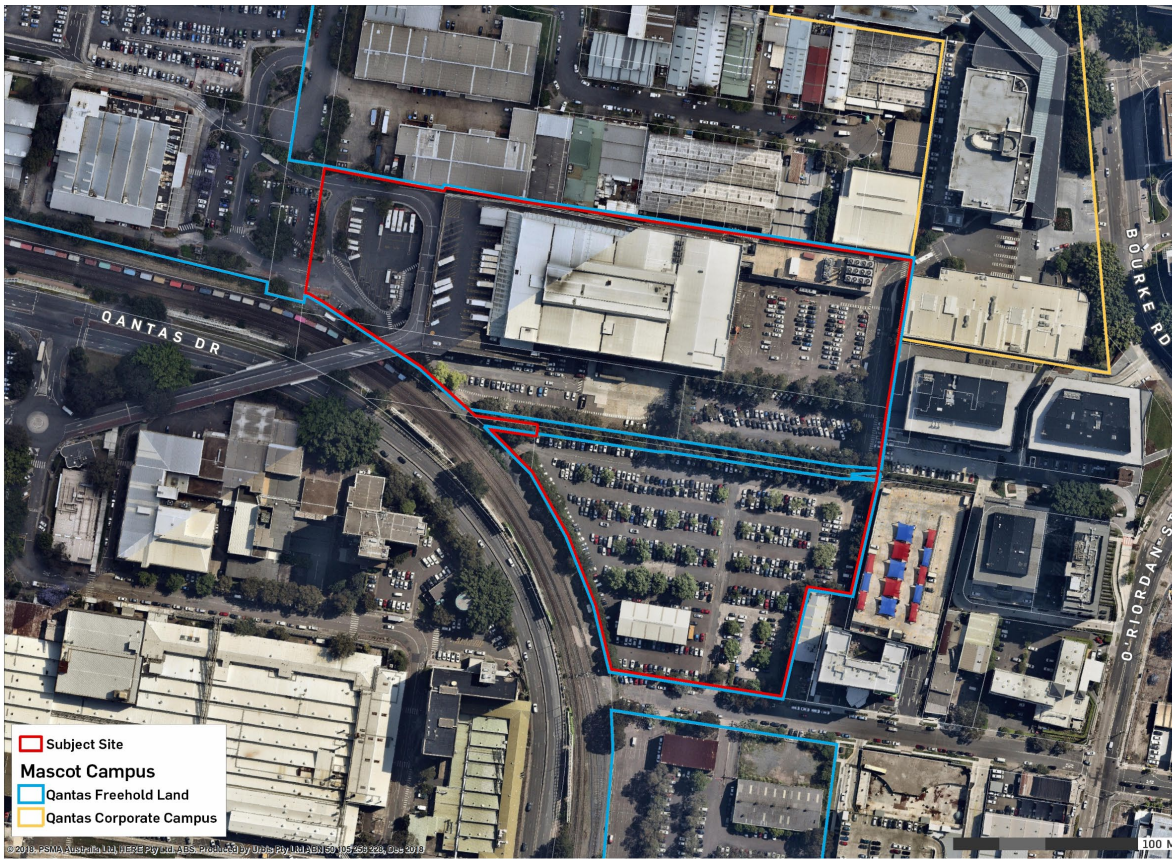


Figure 1 - The Site

Physical attributes of the site include three sections of carpark and two buildings in an industrial/commercial area. The Site location is shown on Figure 1 and Figure 2, Appendix A. A further description of the Site is provided below, and additional description of the site with respect to the onsite contamination risk is provided in the ESA (Arcadis 2019), which should be read in conjunction with this ASSMP.

3.1 Key Features of the Site

- The site is approximately 5.417ha and is an irregular shape. It is approximately 240m in length and maintains a variable width of between approximately 321m in the northern portion of the site and approximately 93m along the King Street frontage, refer to Appendix A.
- The site possesses a relatively level slope across the site. An open Sydney Water drainage channel bisects the northern portion of the site in an east-west direction. There are some isolated changes in level immediately adjacent to this channel. A Site Survey Plan accompanies the application which details the topographic characteristics of the site.
- Multiple mature Plane Trees are scattered throughout the site. A variety of native and exotic tress and vegetation also exist around the perimeter of the site which help screen the site from surrounding uses.
- Site improvements include at-grade car parking for Qantas staff, an industrial shed to store spare aviation parts, a substation, a disused gatehouse, a Sydney Water

Asset with two driveways over it, the Qantas catering facility and Qantas tri-generation plant.

- The site forms part of a larger land holding under the ownership of Qantas that generally extends between Qantas Drive to the west, Ewan Street to the south, Coward Street to the north, with the Qantas “Corporate Campus” fronting Bourke Road.
- Vehicular access to the site from the local road network is available from King Street. The site has intra-campus connections along the northern boundary in the form of two connecting driveways in the north-eastern and north-western corner of the site along the northern boundary which link it to the broader Mascot Campus.
- The site is located within the Bayside LGA.

3.2 Key Features of the Locality

- North: The site is bounded to the north low scale industrial development, beyond which is Coward Street. Further north of the site is the Mascot Town Centre which is characterised by transport-oriented development including high density mixed-use development focussed around the Mascot Train Station.
- East: The site is bordered to the east by commercial development including a newly completed Travelodge hotel which includes a commercial car park. Additional commercial development to the east includes the Ibis Hotel and Pullman Sydney Airport fronting O’Riordan Street.
- South: The site is bounded to the south by King Street, beyond which is Qantas owned at-grade car parking and other industrial uses. Further south is the Botany Freight Rail Line and Qantas Drive beyond which is the Domestic Terminal at Sydney Airport.
- West: The site is bordered to the west by the Botany Freight Rail Line and Qantas Drive, beyond which lies Sydney Kingsford Smith Airport and the Qantas Jetbase (location of the current Flight Training Centre).

3.3 Local Sensitive Environments

Local sensitive environments as identified in the ESA (Arcadis 2019) include:

- The nearest residential area is located approximately 200 m southeast of the site and contains a series of medium to high density residential dwellings;
- Alexandra Canal located approximately 700 m northwest of the site, which drains into Botany Bay; and
- Botany Bay located approximately 2.50 km south of the site.

3.4 Topography

The topography of the site is largely a result of cutting and filling. The site elevation peaks in the centre of the site and along the eastern border, and slopes very slightly to the northwest. The site has an approximate elevation of 6 m Australian Height Datum (AHD).

4 GEOLOGICAL DESCRIPTION

4.1.1 Geology and Soil Type

The Sydney 1:100,000 Geological Map indicates that the site is underlain by the following geological units and structures;

- Quaternary medium to fine-grained marine sand; and
- Quaternary peat, sandy peat and mud.

The Sydney 1:100,000 Soil Landscapes map indicates that the soil landscape of the site comprises Tuggerah aeolian and disturbed terrain soils.

Further discussion of soil type is discussed in the ESA (Arcadis, 2019) and soil observations recorded during ASS investigation works are detailed in Appendix B.

4.1.2 Acid Sulphate Soils

The online acid sulfate soil risk mapping provided by environment.nsw.gov.au/eSpade shows the site to be located in an area of “X4: Disturbed Terrain.

4.2 Hydrological Description

A review of NSW Department of Primary Industries Office of Water records for groundwater bores within a 2km radius of the site indicated the presence of 276 water bores. The majority of existing boreholes are used as monitoring bores, but are also used for industrial, testing, domestic, irrigation and recreational purposes. Recorded standing water levels (SWL) of the bores ranged from 0.90 m to 14.90 m below ground Surface (BGS).

During the ESA (Arcadis, 2019) groundwater was encountered between 0.975m and 3.553m below ground level and between 1.307m and 3.182m when corrected to AHD. Based on groundwater contours determined during the ESA, groundwater flow direction was determined to flow towards the west.

4.3 Hydrology Description

The nearest surface water deposit is Alexandra Canal, which is located approximately 700 m west of the site. The Alexandra Canal drains into Botany Bay, located approximately 2.50 km south of the site.

5 PROJECT DESCRIPTION

Safety is Qantas' first priority. The flight training centre is a key pillar of this value. The facility enables pilots and flight crews to undertake periodic testing to meet regulatory requirements by simulating both aircraft and emergency procedural environments. The Project seeks consent for the construction and operation of a new flight training centre, and associated ancillary uses including a multi-deck car park. The Project is comprised of the following uses:

5.1 Flight Training Centre

The proposed flight training centre will occupy the southern portion of the site. It is a building that comprises 4 core elements as follows:

- An emergency procedures hall that contains;
  - cabin evacuation emergency trainers,
  - an evacuation training pool,
  - door trainers,
  - fire trainers,
  - slide descent towers,
  - security room,
  - aviation medicine training and equipment rooms.
- A flight training centre that contains:
  - a flight training hall with 14 bays that will house aircraft simulators,
  - integrated procedures training rooms, computer rooms, a maintenance workshop, storerooms, multiple de-briefing and briefing rooms, pilot's lounge and a shared lounge.
- Teaching Space that contains
  - training rooms,
  - classrooms and two computer-based exam rooms.
- Office Space
  - Office space for staff and associated shared amenities including multiple small, medium and large meeting rooms, think tank rooms, informal meeting spaces, a video room and lunch/tea room.
- Ancillary spaces including the reception area at the ground floor, toilets, roof plant and vertical circulation. The external ground floor layout will include a loading dock, at-grade car parking for approximately 39 spaces and a bus drop-off zone at the northern site boundary.

5.2 Car Park

The proposed multi-deck car park will be located to the north-east of the flight training centre and adjacent the existing Qantas catering facility and tri-generation plant. The car park is 13 levels and will provide 2059 spaces for Qantas staff. Vehicle access to the car park will be provided via King Street, Kent Road and from Qantas Drive via the existing catering bridge.

6 PROPOSED WORKS

No proposed plans of excavations of sub surface disturbance works were provided for the construction of the planned development summarised in Section 5, however sub surface excavations are expected as part of the proposed development.

Arcadis has assumed that excavations are highly probable during the proposed works.

Excavations below the standing water level will require dewatering thought a dewatering management plan, in addition any saturated soils removed that have been dewatered greatly increase the oxidisation rate of the soils if PASS material is present at the excavated depths.

7 SAMPLING AND ANALYSIS PLAN AND INVESTIGATION METHODOLOGY

This section provides details on sampling and analysis, including the rationale for sampling locations, description of field equipment used, decontamination procedures, field and laboratory quality assurance and control, laboratory analytical methods and sample preservation.

All field work and sampling was carried out by an experienced environmental scientist.

7.1 Schedule of Work

The schedule of work conducted by Arcadis is outlined in Table 5-1

Table 5-1 - Schedule of Work

Date	Description of Work
31 January 2019	Drilling of BH01, BH03, BH05, BH15, BH18, BH26, BH28 and MW06

7.2 Sampling and Analysis Plan

Soil sampling locations were assigned locations based on and accessibility (active carpark). Soil bores, were installed to optimise site coverage. Refer to **Figure 2**, **Appendix A**, for sample locations.

Soil samples for Acid Sulfate soils were collected at 1m intervals to 6m (total of six samples collected per borehole).

7.2.1 Sampling Methodologies

7.2.1.1 Completion of Soil Bores

Soil sampling was conducted during the drilling works.

Soil bores were advanced using a tracked Geoprobe®. The drill rig employed push tube drilling until required depth.

The soil bores were extended to a maximum depth of 6m below surface level.

Fill and natural soil samples from bore holes were collected directly from the push tube using disposable nitrile gloves, which were changed between each sampling event.

The soil samples were collected in a zip lock plastic bag with (~250ml), including the sample name, the job number, the date of sample and the sample depth.

Sample preservation was undertaken in accordance with the requirements of the NEPM (2013). Samples were immediately bagged any excess air removed from bag before sealing and transferred to an ice cooled Esky to chill them below 4°C. all samples were delivered to the laboratory (same day). A signed chain of custody form was completed with the required analysis.

Soil bore, locations are provided on **Figure 2, Appendix A,** laboratory COC's are provided in **Appendix C** and bore logs are provided in **Appendix D.**

7.2.1.2 Nomenclature for Sample Identification

Soil sample identification was as follows:

- BH – Bore Hole Locations
- MW- Monitoring Well Location

8 SOIL LOGGING AND SAMPLING

Soil sampling was conducted in general accordance with *Australian Standard 4482.1-2005 Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil – Part 1: Non-Volatile and Semi-Volatile Compounds* and Arcadis 'Standard Operating Procedures' for soil sampling.

Soil sampling was conducted during bore advancement with the soil type/s described in general accordance with the Unified Soil Classification System (USCS). A detailed log was completed at each location. Bore logs can be found in **Appendix D**. The following details were recorded during drilling:

- Fill thickness and materials, including the presence or absence of indicators of contamination, such as presence of chemical (Hydrogen Sulphide and Hydrocarbon) odours, unusual staining, anthropogenic materials, including asbestos-containing materials
- Natural soils according to the USCS classification
- Presence or absence of moisture
- Staining
- Anthropogenic materials

Field pH and the Peroxide test were not undertaken in the field, however the test was performed by the laboratory on all samples.

8.1 Analytical Suite

A total of 48 samples were submitted for analysis. All samples were analysed for the following:

- pH – pH^F and pH^{FOX} (Nata Accredited)
- SPOCAS

Samples were submitted to a NATA accredited laboratory Envirolab Services (Envirolab) – NATA Accreditation number 2901.Envirolab is accredited by NATA to ISO 17025.

8.2 ASS Assessment Criteria

Samples collected from the soil profile were screened to assess the presence of actual acid Sulfate soil (ASS) and potential acid Sulfate soil (PASS). ASS is described as soil that is producing acid in its natural state. PASS is described as soil that is not currently producing acid but will do if exposed to oxygen as a result of excavation from below the groundwater table or lowering of the groundwater table.

pH Screening involved laboratory testing the pH of soil with distilled water (pH^F) and a with an oxidising agent, hydrogen peroxide (pH^{FOX}), this process is usually performed in the field as screening tool to determine further analysis of SPOCAS testing. For this assessment pH field testing was performed in the lab in conjunction with SPOCAS analysis. Low values of pH^F and pH^{FOX} generally below 4.5 provide an indication of ASS and PASS respectively.

SPOCAS testing of the samples were assessed against ASSMAC guidelines presented in Table 6-1 below.

Table 6-1 - Schedule of Work SPOCAS Analysis action criteria to determine the presence of ASS / PASS

Type of Material		***Action Criteria 1-1000 tonnes disturbed***		***Action Criteria if more than 1000 tonnes disturbed***	
Texture range.McDonald et al. (1990)	***Approx. clay content (%<0.002 mm)***	***Sulfur trail*** *% S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}*	***Acid trail*** *mol H^+/ tonne (oven-dry basis) eg, TPA or TSA*	***Sulfur trail*** *% S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}*	***Acid trail*** *mol H^+/ tonne (oven-dry basis) eg, TPA or TSA*
Coarse Texture Sands to loamy sands	≤5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5 - 40	0.06	36	0.03	18
Fine Texture Medium to heavy clays and silty clays	≥40	0.1	62	0.03	18

For the proposed of this investigation based on the bore logs and the undefined volume of material potentially excavated or exposed to atmosphere the **course texture** criteria will be applied to determine the presence of ASS/ PASS on the site.

9 RESULTS

9.1 Field Observations

Soil sampling was undertaken by Arcadis Environmental Scientist Tom Keatley during drilling works on the 31st January 2019.

Fill material across the site varied in thickness. The depth of fill across the site ranged from 1.20 m to 3.50m and generally consisted of the following layers:

- Asphalt or concrete hardstands surface;
- Road base consisting of sandy gravels, high compaction, poorly sorted, dry;
- Reworked, silty sand, light brown to grey, coarse grained, poorly sorted, some angular gravels. Foreign inclusions including glass fragments, scrap metal, brick fragments, terracotta fragments, woodchips, were evident at some locations; and

The natural material consisted of silty sand, silty clay, clayey sand, sandy silt and peat and was generally described as light grey to brown.

Groundwater was encountered in six of the eight bores ranging from 1.0 – 3.0mBGL.

9.2 Analytical Results

9.2.1 pH Screening

The results of the screening programme are provided in **Appendix B** and summarise in Table 7-1 below.

The pH^F results ranged from 4.8-8.5 which indicate that ASS is not present in the soil profile, However the low range of the pH^F is marginally above 4.5 indicating that the soil is partially acidic in its natural state.

The pH^{FOX} results ranged from 2.0 to 8.0 which indicate that PASS is present. All soil samples were sent for quantitative SPOCAS analysis to confirm the presence of PASS in the soil profile.

Table 7-1- Field screening of soil pH

Parameter	Range of Results (pH units)
pH^F	4.8 - 8.5
pH^{fox}	2 - 8

9.2.2 SPOCAS

A summary of SPOCAS analytes depths ranges is provide in Table 7.2 and Table 7-3 SPOCAS summary tables and laboratory reports are provided in **Appendix B** and **Appendix** C respectively.

Table 7-2 SPOCAS analysis summary

Analyte	Unit	Range of Results
Total Actual Acidity (TAA)	mol H+ / tonne	<2 – 70
Total Potential Acidity (TPA)	mol H+ / tonne	<2 - 465
Total Sulfate Acidity (TSA)	mol H+ / tonne	<2 - 399
S – KCl	%S	<0.02 – 0.07
S – P	%S	<0.02 – 0.163
S – POS	%S	<0.02 – 0.16

Exceedance of the course texture criteria for either TPA, TSA or Spos determines the presence of PASS using SPOCAS analysis. A summary of the locations that exceeded the ASS action guidelines is provided in Table 7.3 below.

Table 7-3 Locations identified to contain PASS

Location	Depth (m)	TPA Concentration (mole H+ / t)
BH01	1	40
BH01	2	72
BH01	3	114
BH01	5	41
BH01	6	24
BH03	1	133
BH03	2	194
BH03	3	50
BH03	5	88
BH03	6	23
BH05	1	24
BH05	2	267
BH05	3	132

Location	Depth (m)	TPA Concentration (mole H+ / t)
BH05	4	65
BH05	5	243
BH05	6	86
BH15	3	152
BH15	4	101
BH15	5	55
BH15	6	54
BH18	3	192
BH18	5	21
BH18	6	30
BH26	4	456
BH26	5	225
BH26	6	159
BH28	2	362
BH28	4	28
BH28	5	291
BH28	6	69
MW06	1	81
MW06	2	184
MW06	4	54
MW06	5	189
MW06	6	243

SPOCAS analysis identified a wide range of results indicating that specific layers with in the tested locations were either absent of or contain PASS. Reported analytical results show 37 of the 48 analysed samples were identified to contain PASS material identified at a wide range of depths both within the fill and natural layers. This indicates that that the PASS is either in lenses with in the subsurface matrix or the underlying soil has been reworked.

Table 7-4 PASS Presence Depth summary

Location	Depth (m)	Fill Depth Range (m)	Pass Reported in Fill
BH01	1-3 and 5-6	0.0-0.5	No
BH03	1-3 and 5-6	0.0-0.8	No
BH05	1-6	0.0-0.5	No
BH15	3-6	0.0-2.3	No
BH18	3 and 5-6	0.0-3.2	Yes
BH26	4-6	0.0-0.4	No
BH28	2 and 4-6	0.0-1.6	No
MW06	1-2 and 4-6	0.0-1.7	Yes

Locations where PASS was identified in the fill layers (BH18 and MW06) were generally near the fill/natural horizon indicating that reworking of the soils during the filling process could have occurred. In addition, locations where, thicker fill layers were encountered (BH15 and BH18) pass was not identified in the upper portion of the fill indicating that the majority of the PASS identified at the site resides with in the natural layers of undisturbed soils.

10 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

10.1 Field QA/QA

10.1.1 Decontamination

New nitrile gloves were used between each sample location. Soil samples were collected by hand directly from the push tube sleeve at each location.

10.1.2 Chain of Custody Details

Samples were transferred to the laboratory under chain-of-custody (CoC) procedures. The details included on the chain-of-custody forms included the following:

- Job name and number;
- List of samples;
- Analysis required;
- Date sampled; and
- Date results are required;
- Preservation method;
- Release signature and date;
- Acceptance signature and date

CoCs are provided in Appendix C along with the laboratory reports.

10.1.3 Sampling Splitting Techniques

Soil duplicates were collected by the laboratory by splitting the primary sample.

10.1.4 Statement of Replicate Frequency

Laboratory split duplicates for intra-laboratory QA/QC were sampled at a rate of at least 1:20 samples. For this project, the following QA/QC samples were collected:

- DUP1 was the soil intra-laboratory duplicate for BH01@3.0;
- DUP2 was the soil intra-laboratory duplicate for BH03@4.0; and
- DUP3 was the soil intra-laboratory duplicate for BH15@4.0.

Based on the above, collected replicates were at a rate of approximately 1:16 meeting the adopted replicate frequency criteria.

Inter-laboratory duplicates were not collected due to the limited amount of sample within a push tube.

10.1.5 Rinsate Sample Results

Rinsate samples were not collected for the current sampling event.

10.1.6 Trip Blank

Trip Blank samples were not collected for the current sampling event.

10.1.7 Trip Spike Results

Trip Spike samples were not collected for the current sampling event.

10.2 Laboratory QA/QC

10.2.1 Holding Times

Holding times were reported as being outside the specified ranges for the following analytes and samples:

- All samples were submitted by Arcadis to the laboratory within the required holding time.

10.2.2 Laboratory Accreditation for Analytical Methods Used

The primary laboratory used was Australian Laboratory Services (ALS) Brisbane is accredited by NATA to ISO/IEC 17025, accreditation number 825.

10.2.3 Relative Percentage Differences

Laboratory split samples were used to duplicate analyse and assess the RPD of the internal analytic method the following samples were spilt and sampled:

- BH01-3 and Dup 1
- BH03-4 and Dup 2
- BH15-4 and Dup 3

The following soil RPD analytes were outside of acceptable range:

- Soil RPD exceedances for SPOCAS were report as
  - PH^{OX}- 34% between BH03-3 (3.7) and Dup01(5.2)
  - TAA (mole H+/t) – 100% between BH03-3 (6) and Dup01(<2) and 86% between BH03-4 (<2) and Dup 2 (5)
  - Net Acidity (mole H+/t) – 102% between BH03-3 (31) and Dup01(<10), 129% between BH03-4 (<10) and Dup 2 (46) and 89% Between BH15-4(26) and Dup3 (<10)
  - Spos (mole H+/t) – 86% between BH03-3 (25) and Dup01(<10) and 122% between BH03-4 (<10) and Dup 2 (41)

The exceedances of RPD within soil is most likely due to the heterogenous nature of sampled material, the low detection concentrations variance and the highly reactive nature of the analytes to atmospheric oxygen. Arcadis is confident that the exceeding RPDs for soil do not affect the integrity of the analytical data.

The detailed RPD table is provided in **Appendix B**

10.2.4 Percent Recoveries of Matrix Spikes and Surrogates

Laboratory QA/QC is provided in the laboratory reports in **Appendix C.**

Due to the type of analysis no matrix spike or matrix spike duplicates are required to be reported

10.2.5 Laboratory Duplicate Results

No Laboratory duplicate results were reported.

10.2.6 Quality Control Sample Frequency

No quality control sample frequency outliers were reported:

10.3 QA/QC Data Evaluation

10.3.1 Evaluation of the QA/QC Information Compared to the DQOs

- Documentation completeness:
  - Soil logs and chain-of-custody forms were completed and appropriate.
- Data completeness:
  - All samples were received by the laboratory and analytical results reported including laboratory QA/QC.
- Data comparability:
  - Arcadis standard operating procedures, Australian Standards and industry practice were followed during sampling;
  - Consistent field conditions and similarly trained staff were used during sampling;
  - Standard analytical methods were used by the laboratories for all analyses; and
  - The limits of reporting are appropriate and generally consistent from each laboratory.
- Data representativeness:
  - After review Arcadis considers the analytical data shows that suitable decontamination methods were used during the field works; and
  - The frequency of laboratory blanks, spikes and standard solutions were acceptable, and the results/frequencies were within specified ranges.
- Precision:
  - Intra-laboratory samples for soil were collected at a rate of 1:16, which is within guidance provided in AS4482.1-2005. Note: Inter-laboratory samples were not collected
  - Laboratory duplicates were generally collected at acceptable frequencies. The intra-laboratory and inter-laboratory duplicates RPDs were generally reported within acceptable ranges.

In conclusion, Arcadis considers the data quality suitable for use in this assessment.

11 CONCLUSION AND RECOMENDATIONS

The pH^F screening results ranged from 4.8 - 8.5 indicating that ASS is not present in the soil profile in its natural state, However the low range of the pH^F is marginally above 4.5 indicating that the soil is partially acidic in its natural state.

The pH^{FOX} results ranged from 2.0 to 8.0 which indicated that PASS is present at the site, further SPOCAS analysis identified a wide range of results indicating that specific layers with in the tested locations were either absent of or contain PASS.

Of the 48 analysed samples, 37 were identified to contain PASS material identified at a wide range of depths both within the fill and natural material on the site. This indicates that that the PASS is either in lenses with in the subsurface matrix or the underlying soil has been reworked.

Locations where PASS was identified in the fill layers (BH18 and MW06) were generally near the fill/natural horizon indicating that reworking of the soils during the filling process could have occurred. In addition, locations where, thicker fill layers were encountered (BH15 and BH18) pass was not identified in the upper portion of the fill indicating that the majority of the PASS identified at the site resides with in the natural layers of undisturbed soils.

In the natural current state, ASS has not been identified in this investigation, however should excavation or disturbance of the soils at the identified locations occur Potential Acid Sulfate soils (PASS) most likely will be encountered, Arcadis recommend that an Acid Sulfate management plan be produced for the site.

APPENDIX A **FIGURES**

10026439 - King Street North

Legend

- Motorway
- Major roads
- Local road
- Railway
- Site Boundary

1:5,000 at A3

ARCADIS Design & Consultancy for natural and built assets

ARCADIS AUSTRALIA PACIFIC PTY LTD
ABN 76 104 485 289
Level 16, 580 George St | Sydney NSW 2000
P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001

Coordinate System: GDA 1994 MGA Zone 56
Date issued: January 24, 2019

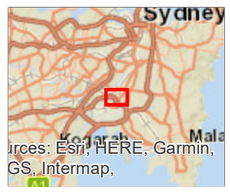
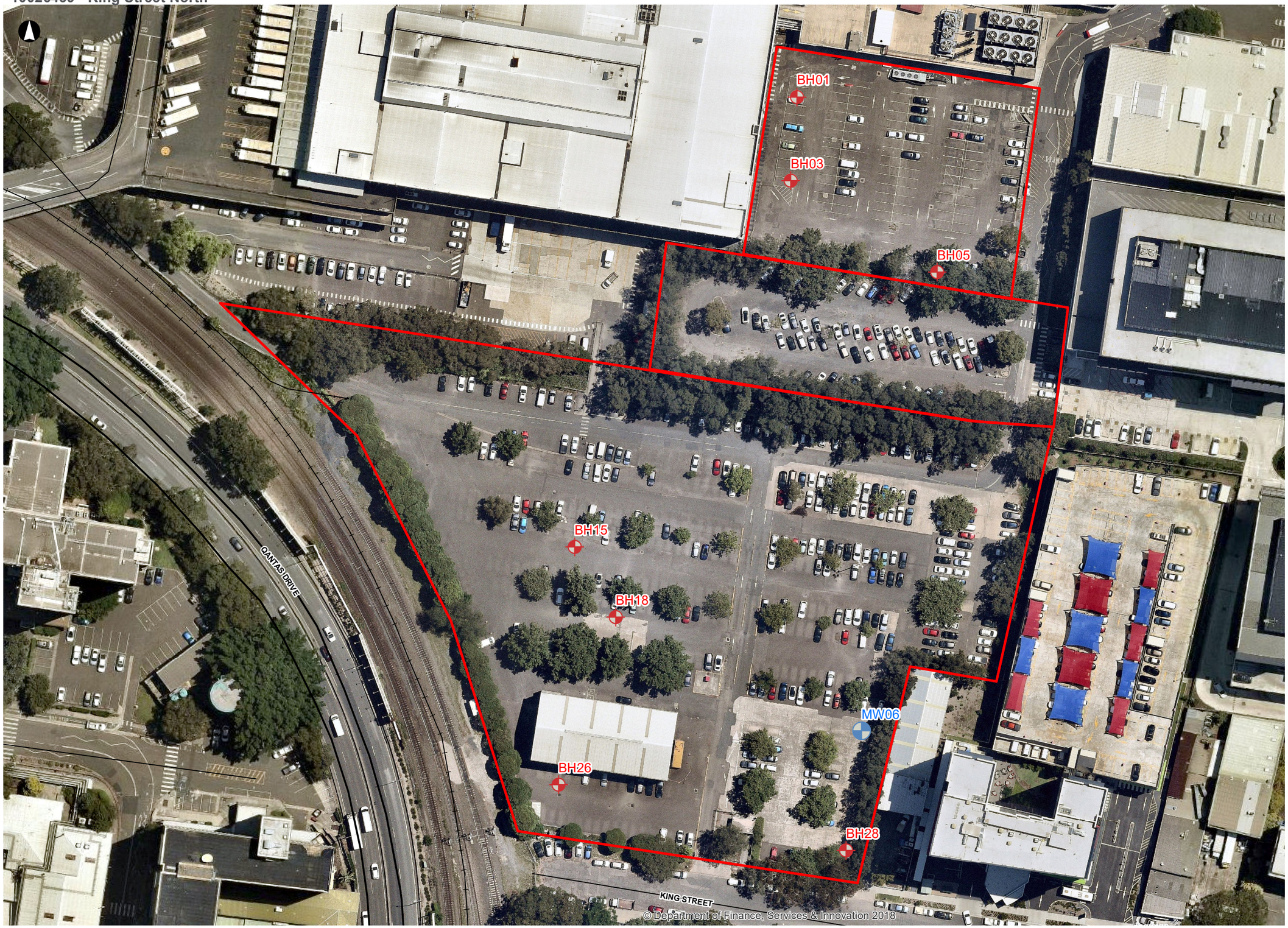


Figure 1 - Site Locations

0 50 100 200 300 400
m

Date: 24/01/2019 Path: C:\Arc Templates\Temporary Projects\10026439 - King Street North\10026439 - Figure 1 - Site Location.mxd
Created by : Environmental Restoration
QA by : Environmental Restoration

10026439 - King Street North



Legend

Sampling Locations

Descriptio, ASS

- MW, Yes
- SB, Yes
- Motorway
- Major roads
- Local road
- Railway
- Site Boundary

1:1,018 at A3

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ARCADIS AUSTRALIA PACIFIC PTY LTD
ABN 76 104 485 289
Level 16, 580 George St | Sydney NSW 2000
P: +61 (0) 2 8907 9000 | F: +61 (0) 2 8907 9001

Coordinate System: GDA 1994 MGA Zone 56
Date issued: February 1, 2019

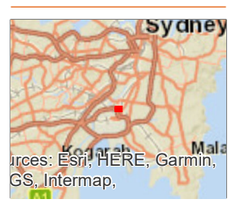

Figure 2 - Sampling Locations (ASS)

0 10 20 40 60 80
m

Date: 1/02/2019 Path: C:\Arc Templates\Temporary Projects\10026439 - King Street North\10026439 - Figure 2 - Sampling Locations ASS.mxd
Created by : Environmental Restoration
QA by : Environmental Restoration

APPENDIX B **DATA TABLES**

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			pH			Acidity Trail							Sulfur Trail				Acid Base Accounting				SPOCAS			
			pH (F)	pH (Fox)	pH (Ox)	pH (KCl)	Titratable Actual Acidity (TAA)	Titratable Peroxide Acidity (TPA)	Titratable Sulfidic Acidity (TSA)	Sulfidic - Titratable Actual Acidity (s-23F)	Sulfidic - Titratable Peroxide Acidity (s-23G)	Sulfidic - Titratable Sulfidic Acidity (s-23H)	KCl Extractable Sulfur (2.23Ce)	Peroxide Sulfur (2.30e)	Peroxide Oxidisable Sulfur (Spos)	acidity - Peroxide Oxidisable Sulfur (a-23E)	ANC Fineness Factor	Liming Rate	Liming rate without ANCE	Net Acidity (acidity units)	acidity - Acid Reacted Calcium	acidity - Acid Reacted Magnesium	acidity - Excess Acid Neutralising Capacity	acidity - Peroxide Oxidisable Sulfur
			pH Unit	pH Unit	pH Unit	pH Unit	mole H+/t	mole H+ / t	mole H+ / t	% pyrite S	% pyrite S	% pyrite S	% S	% S	% S	mole H+ / t	-	kg CaCO3/t	kg CaCO3/t	mole H+/t	mole H+/t	mole H+/t	mole H+/t	mole H+/t
EQL			0.1	0.1	0.1	0.1	2	2	2	2	0.02	0.02	0.02	0.02	0.02	10	0.5	1	1	10	10	10	10	10
Action Criteria	Course Texture / or greater than 1000 tones removed	Sands to sandy loams						18	18						0.03									
	Medium Texture	Sandly loams to light clays						36	36						0.06									
	Fine Texture	Medium to Heavey Clays						62	62						0.1									

Location_Code	Sampled_Date_Time	Sample_Depth_Range																							
6	31-Jan-19	1	7.4	2.5	3.3	6	12	40	29	<0.020	0.065	0.046	<0.020	0.118	0.118	74	1.5	6	6	86	30	<10	-	74
bh01 - 2	31-Jan-19	2	7.1	4.4	4	5.9	4	72	68	<0.020	0.115	0.108	<0.020	0.029	0.029	18	1.5	2	2	22	<10	<10	-	18
bh01 - 3	31-Jan-19	3	7	4.3	3.7	6.1	6	114	108	<0.020	0.183	0.174	<0.020	0.04	0.04	25	1.5	2	2	31	<10	<10	-	25
bh01 - 4	31-Jan-19	4	6.7	3.9	3.8	5.7	3	14	10	<0.020	0.022	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
bh01 - 5	31-Jan-19	5	6	3.6	3.5	5.2	12	41	29	<0.020	0.066	0.047	<0.020	<0.020	<0.020	<10	1.5	<1	<1	12	<10	<10	-	<10
bh01 - 6	31-Jan-19	6	6.4	3.6	3.7	5.5	6	24	18	<0.020	0.039	0.029	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
bh03 - 1	31-Jan-19	1	7.1	2	2.9	5	16	133	118	0.025	0.214	0.189	<0.020	0.095	0.095	59	1.5	6	6	75	<10	<10	-	59
bh03 - 2	31-Jan-19	2	6.9	4.2	3.8	4.9	29	194	165	0.047	0.312	0.264	<0.020	0.073	0.073	45	1.5	6	6	75	<10	<10	-	45
bh03 - 3	31-Jan-19	3	7.1	4.8	4	6.1	3	50	47	<0.020	0.08	0.075	<0.020	0.025	0.025	15	1.5	1	1	19	<10	<10	-	15
bh03 - 4	31-Jan-19	4	7	4.3	3.7	6.3	<2	16	16	<0.020	0.025	0.025	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
bh03 - 5	31-Jan-19	5	5.8	3.2	3.1	4.8	21	88	67	0.034	0.141	0.107	<0.020	0.021	0.021	13	1.5	2	2	34	<10	<10	-	13
bh03 - 6	31-Jan-19	6	5.8	2	3.6	5.3	9	23	14	<0.020	0.037	0.023	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
bh05 - 1	31-Jan-19	1	7.1	3.2	3.9	6.3	<2	24	24	<0.020	0.038	0.038	<0.020	0.043	0.043	27	1.5	2	2	27	<10	<10	-	27
bh05 - 2	31-Jan-19	2	6.8	4.3	3.6	5.5	16	267	250	0.026	0.428	0.401	<0.020	0.085	0.085	53	1.5	5	5	69	<10	<10	-	53
bh05 - 3	31-Jan-19	3	7	2.5	3.1	6.1	7	132	125	<0.020	0.211	0.2	<0.020	0.094	0.094	59	1.5	5	5	66	20	<10	-	59
bh05 - 4	31-Jan-19	4	6.8	4.6	4	5.7	6	65	59	<0.020	0.105	0.094	<0.020	0.027	0.027	17	1.5	2	2	24	<10	<10	-	17
bh05 - 5	31-Jan-19	5	5.2	3.3	3.4	4.7	39	243	204	0.062	0.389	0.327	<0.020	0.063	0.063	39	1.5	6	6	78	11	<10	-	39
bh05 - 6	31-Jan-19	6	5.1	2.3	2.9	5	15	86	72	0.024	0.138	0.115	<0.020	0.098	0.098	61	1.5	6	6	76	<10	<10	-	61
BH15 - 1	31-Jan-19	1	7	4.5	6.8	6.4	<2	<2	<2	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	11	<10	437	<10
BH15 - 2	31-Jan-19	2	7	4	7.6	6.5	<2	<2	<2	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	12	<10	438	<10
BH15 - 3	31-Jan-19	3	6.6	4.4	4	5.9	6	152	146	<0.020	0.244	0.235	<0.020	0.056	0.056	35	1.5	3	3	40	<10	<10	-	35
BH15 - 4	31-Jan-19	4	5.8	3.9	3.7	5.4	9	101	92	<0.020	0.161	0.147	<0.020	0.028	0.028	17	1.5	2	2	26	10	<10	-	17
BH15 - 5	31-Jan-19	5	5.4	3	3.6	5.4	6	55	49	<0.020	0.088	0.079	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
BH15 - 6	31-Jan-19	6	5.6	2.6	3.4	5.2	9	54	45	<0.020	0.086	0.072	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
BH18 - 1	31-Jan-19	1	8.5	7.9	7.8	9	<2	<2	<2	<0.020	<0.020	<0.020	<0.020	0.094	0.094	59	1.5	<1	4	<10	3120	475	3180	59
BH18 - 2	31-Jan-19	2	7.8	8	8.4	8.6	<2	<2	<2	<0.020	<0.020	<0.020	0.07	0.163	0.093	58	1.5	<1	4	<10	4140	377	2740	58
BH18 - 3	31-Jan-19	3	6.7	4	3.9	6.1	7	192	185	<0.020	0.308	0.296	<0.020	0.08	0.08	50	1.5	4	4	57	26	<10	-	50
BH18 - 4	31-Jan-19	4	6.6	4.2	5.1	7.2	<2	<2	<2	<0.020	<0.020	<0.020	<0.020	0.026	0.026	16	1.5	<1	<1	<10	<10	<10	-	16
BH18 - 5	31-Jan-19	5	6.1	3.3	3.8	5.4	7	21	14	<0.020	0.033	0.022	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
BH18 - 6	31-Jan-19	6	5.4	2.8	3.2	5.2	9	30	21	<0.020	0.048	0.033	<0.020	0.026	0.026	16	1.5	2	2	26	<10	<10	-	16
BH26 -1	31-Jan-19	1	7.5	4.7	6.1	6.7	<2	<2	<2	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
BH26 -2	31-Jan-19	2	7.1	5.2	5.1	6.3	<2	<2	<2	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
BH26 -3	31-Jan-19	3	7	5	5.4	6.1	<2	3	3	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
BH26 -4	31-Jan-19	4	5.8	3.7	3.7	5	57	456	399	0.091	0.73	0.639	<0.020	0.106	0.106	66	1.5	9	9	123	<10	<10	-	66
BH26 -5	31-Jan-19	5	5.9	3.7	3.3	5	30	225	195	0.048	0.36	0.313	<0.020	0.069	0.069	43	1.5	5	5	73	<10	<10	-	43
BH26 -6	31-Jan-19	6	5.4	2.6	3	4.8	30	159	129	0.049	0.255	0.206	<0.020	0.044	0.044	28	1.5	4	4	58	<10	<10	-	28
bh28 - 1	31-Jan-19	1	5.9	3.2	4.2	5.7	4	4	<2	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
bh28 - 2	31-Jan-19	2	4.8	3.2	3.2	4.3	70	362	291	0.113	0.58	0.467	<0.020	0.049	0.049	30	1.5	8	8	101	<10	<10	-	30
bh28 - 3	31-Jan-19	3	6.3	3.4	4	5.6	6	8	<2	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
bh28 - 4	31-Jan-19	4	6.3	4.1	4	5.6	6	28	21	<0.020	0.044	0.034	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
bh28 - 5	31-Jan-19	5	4.9	2.3	2.2	4.5	69	291	222	0.111	0.467	0.356	<0.020	0.16	0.16	100	1.5	13	13	169	<10	<10	-	100
bh28 - 6	31-Jan-19	6	5	2.8	3.2	5	16	69	52	0.026	0.11	0.084	<0.020	0.029	0.029	18	1.5	2	2	34	<10	<10	-	18
mw06 - 1	31-Jan-19	1	5.2	3.4	3.8	4.7	40	81	40	0.065	0.129	0.064	<0.020	<0.020	<0.020	<10	1.5	3	3	40	<10	<10	-	<10
mw06 - 2	31-Jan-19	2	5	3.4	3.3	4.7	33	184	152	0.053	0.296	0.243	<0.020	0.031	0.031	19	1.5	4	4	52	<10	<10	-	19
mw06 - 3	31-Jan-19	3	5.7	4	4.6	5.7	2	5	3	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<10	1.5	<1	<1	<10	<10	<10	-	<10
mw06 - 4	31-Jan-19	4	5.6	3.5	3.8	5.2	14	54	40	0.022	0.086	0.064	<0.020	<0.020	<0.020	<10	1.5	1	1	14	<10	<10	-	<10
mw06 - 5	31-Jan-19	5	5.6	2.3	2.7	5.1	23	189	166	0.037	0.303	0.266	<0.020	0.086	0.086	54	1.5	6	6	77	<10	<10	-	54
mw06 - 6	31-Jan-19	6	5.3	2.1	2.4	4.6	42	243	201	0.067	0.389	0.322	<0.020	0.159	0.159	99	1.5	10	10	141	<10	<10	-	99

Statistical Summary

Number of Results	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	4	48
Number of Detects	48	48	48	48	38	41	39	17	37	36	1	29	29	29	48	28	30	29	9	2	4	29	
Minimum Concentration	4.8	2	2.2	4.3	<2	<2	<2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<10	1.5	<1	<1	<10	<10	<10	437	<10	
Minimum Detect	4.8	2	2.2	4.3	2	3	3	0.022	0.022	0.022	0.07	0.021	0.021	13	1.5	1	1	12	10	377	437	13	
Maximum Concentration	8.5	8	8.4	9	70	456	399	0.113	0.73	0.639	0.07	0.163	0.16	100	1.5	13	13	169	4140	475	3180	100	
Maximum Detect	8.5	8	8.4	9	70	456	399	0.113	0.73	0.639	0.07	0.163	0.16	100	1.5	13	13	169	4140	475	3180	100	
Average Concentration	6.3	3.7	4	5.6	15	96	81	0.025	0.15	0.13	0.011	0.046	0.045	27	1.5	2.9	3	38	158	23	1699	27	
Median Concentration	6.3	3.6	3.7	5.5	7	54.5	46	0.01	0.087	0.0735	0.01	0.0275	0.0275	17	1.5	2	2	25	5	5	1589	17	
Standard Deviation	0.87	1.2	1.3	0.92	17	106	91	0.027	0.17	0.15	0.0087	0.044	0.041	26	0	3	3	40	739	86	1467	26	
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Field Duplicates (soil)
Filter: SDG in('ALSE-B

		SDG	ALSE-Brisbane 05-Feb-19	ALSE-Brisbane 05-Feb-19		ALSE-Brisbane 05-Feb-19	ALSE-Brisbane 05-Feb-19		ALSE-Brisbane 05-Feb-19	ALSE-Brisbane 05-Feb-19	
		Field ID	bh01 - 3	DUP01	**RPD**	bh03 - 4	DUP02	**RPD**	BH15 - 4	DUP03	**RPD**
		Sampled Date/Time	31-01-19 10:54	31-01-19 10:54		31-01-19 10:54	31-01-19 10:54		31-01-19 10:54	31-01-19 10:54	
Method_T	**ChemNam**	**Units**	**EQL**								
pH field/fox	pH (F)	pH Unit	0.1	7	7	0	7	7	0	5.8	6	3
Suspensio	pH (Ox)	pH Unit	0.1	**3.7**	**5.2**	**34**	3.7	3.7	0	3.7	4.3	15
	pH (KCl)	pH Unit	0.1	6.1	6	2	6.3	6	5	5.4	5.7	5
	Titratable A	mole H+/t	2	**6**	**<2**	**100**	**<2**	**5**	**86**	9	4	77
	ANC Finer	-	0.5	1.5	1.5	0	1.5	1.5	0	1.5	1.5	0
	Liming Rat	kg CaCO3/	1	2	<1	67	**<1**	**3**	**100**	2	<1	67
	Liming rate	kg CaCO3/	1	2	<1	67	**<1**	**3**	**100**	2	<1	67
	Net Acidity	mole H+/t	10	**31**	**<10**	**102**	**<10**	**46**	**129**	**26**	**<10**	**89**
	acidity - Ac	mole H+/t	10	<10	<10	0	<10	<10	0	10	<10	0
	acidity - Ac	mole H+/t	10	<10	<10	0	<10	<10	0	<10	<10	0
	acidity - Pe	mole H+/t	10	**25**	**<10**	**86**	**<10**	**41**	**122**	17	<10	52

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

APPENDIX C **LABRATORY REPORTS**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1902737**	Page	: 1 of 24
Client	: **ARCADIS AUSTRALIA PACIFIC PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CAITLAIN REGENA	Contact	: Customer Services EB
Address	: L16, 480 GEORGE STREET SYDNEY NSW 2000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 02 8907 9000	Telephone	: +61-7-3243 7222
Project	: 10026439 - task 2	Date Samples Received	: 05-Feb-2019 09:30
Order number	: ----	Date Analysis Commenced	: 07-Feb-2019
C-O-C number	: ----	Issue Date	: 11-Feb-2019 15:39
Sampler	: TOM KEATLEY		
Site	: ----		
Quote number	: EN/091/17 (Primary Work only)		
No. of samples received	: 51		
No. of samples analysed	: 51		

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*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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.

- ASS: EA029 (SPOCAS): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ($CaCO_3$) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from kg/t dry weight to kg/m3 in-situ soil, multiply reported results x wet bulk density of soil in t/m3.
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH26 -1	BH26 -2	BH26 -3	BH26 -4	BH26 -5
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-001	EB1902737-002	EB1902737-003	EB1902737-004	EB1902737-005
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	7.5	7.1	7.0	5.8	5.9
pH (Fox)	----	0.1	pH Unit	4.7	5.2	5.0	3.7	3.7
Reaction Rate	----	1	Reaction Unit	1	1	1	2	2
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	6.7	6.3	6.1	5.0	5.0
pH OX (23B)	----	0.1	pH Unit	6.1	5.1	5.4	3.7	3.3
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	57	30
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	3	456	225
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	3	399	195
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	0.091	0.048
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	0.730	0.360
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	0.639	0.313
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	<0.020	<0.020	0.106	0.069
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	<0.020	<0.020	0.106	0.069
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	<10	66	43
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	<0.020	0.091	<0.020	0.088	0.024
Peroxide Calcium (23Wh)	----	0.020	% Ca	<0.020	0.099	<0.020	0.088	0.024
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	<0.020	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH26 -1	BH26 -2	BH26 -3	BH26 -4	BH26 -5
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-001	EB1902737-002	EB1902737-003	EB1902737-004	EB1902737-005
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	**0.20**	**0.12**
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	**123**	**73**
Liming Rate	----	1	kg CaCO3/t		<1	<1	<1	**9**	**5**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	**0.20**	**0.12**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	<10	**123**	**73**
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	<1	**9**	**5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH26 -6	BH18 - 1	BH18 - 2	BH18 - 3	BH18 - 4
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-006	EB1902737-007	EB1902737-008	EB1902737-009	EB1902737-010
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	5.4	8.5	7.8	6.7	6.6
pH (Fox)	----	0.1	pH Unit	2.6	7.9	8.0	4.0	4.2
Reaction Rate	----	1	Reaction Unit	2	4	4	2	2
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	4.8	9.0	8.6	6.1	7.2
pH OX (23B)	----	0.1	pH Unit	3.0	7.8	8.4	3.9	5.1
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	30	<2	<2	7	<2
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	159	<2	<2	192	<2
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	129	<2	<2	185	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	0.049	<0.020	<0.020	<0.020	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	0.255	<0.020	<0.020	0.308	<0.020
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	0.206	<0.020	<0.020	0.296	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	0.070	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	0.044	0.094	0.163	0.080	0.026
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.044	0.094	0.093	0.080	0.026
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	28	59	58	50	16
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	<0.020	0.374	0.393	0.130	0.080
Peroxide Calcium (23Wh)	----	0.020	% Ca	<0.020	6.62	8.70	0.184	0.090
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	6.24	8.31	0.053	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	3120	4140	26	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	4.99	6.64	0.042	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	0.040	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	0.618	0.458	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	0.578	0.458	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	475	377	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	0.762	0.604	<0.020	<0.020
EA029-F: Excess Acid Neutralising Capacity								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH26 -6	BH18 - 1	BH18 - 2	BH18 - 3	BH18 - 4
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-006	EB1902737-007	EB1902737-008	EB1902737-009	EB1902737-010
					Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity - Continued									
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO3		**----**	**15.9**	**13.7**	**----**	**----**
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t		**----**	**3180**	**2740**	**----**	**----**
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S		**----**	**5.09**	**4.38**	**----**	**----**
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		**0.09**	<0.02	<0.02	**0.09**	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		**58**	<10	<10	**57**	<10
Liming Rate	----	1	kg CaCO3/t		**4**	<1	<1	**4**	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		**0.09**	**0.09**	**0.09**	**0.09**	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**58**	**59**	**58**	**57**	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		**4**	**4**	**4**	**4**	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH18 - 5	BH18 - 6	mw06 - 1	mw06 - 2	mw06 - 3
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-011	EB1902737-012	EB1902737-013	EB1902737-014	EB1902737-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.1**	**5.4**	**5.2**	**5.0**	**5.7**
pH (Fox)	----	0.1	pH Unit	**3.3**	**2.8**	**3.4**	**3.4**	**4.0**
Reaction Rate	----	1	Reaction Unit	**2**	**3**	**2**	**2**	**1**
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	**5.4**	**5.2**	**4.7**	**4.7**	**5.7**
pH OX (23B)	----	0.1	pH Unit	**3.8**	**3.2**	**3.8**	**3.3**	**4.6**
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**7**	**9**	**40**	**33**	**2**
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	**21**	**30**	**81**	**184**	**5**
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	**14**	**21**	**40**	**152**	**3**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	**0.065**	**0.053**	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	**0.033**	**0.048**	**0.129**	**0.296**	<0.020
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	**0.022**	**0.033**	**0.064**	**0.243**	<0.020
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	**0.026**	<0.020	**0.031**	<0.020
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	**0.026**	<0.020	**0.031**	<0.020
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	**16**	<10	**19**	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	<0.020	<0.020	**0.026**	**0.065**	<0.020
Peroxide Calcium (23Wh)	----	0.020	% Ca	<0.020	<0.020	**0.030**	**0.066**	<0.020
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	<0.020	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH18 - 5	BH18 - 6	mw06 - 1	mw06 - 2	mw06 - 3
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-011	EB1902737-012	EB1902737-013	EB1902737-014	EB1902737-015
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	**0.04**	**0.06**	**0.08**	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	**26**	**40**	**52**	<10
Liming Rate	----	1	kg CaCO3/t		<1	**2**	**3**	**4**	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	**0.04**	**0.06**	**0.08**	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	**26**	**40**	**52**	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	**2**	**3**	**4**	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	mw06 - 4	mw06 - 5	mw06 - 6	bh28 - 1	bh28 - 2
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-016	EB1902737-017	EB1902737-018	EB1902737-019	EB1902737-020
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	5.6	5.6	5.3	5.9	4.8
pH (Fox)	----	0.1	pH Unit	3.5	2.3	2.1	3.2	3.2
Reaction Rate	----	1	Reaction Unit	1	2	2	3	2
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.2	5.1	4.6	5.7	4.3
pH OX (23B)	----	0.1	pH Unit	3.8	2.7	2.4	4.2	3.2
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	14	23	42	4	70
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	54	189	243	4	362
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	40	166	201	<2	291
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	0.022	0.037	0.067	<0.020	0.113
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	0.086	0.303	0.389	<0.020	0.580
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	0.064	0.266	0.322	<0.020	0.467
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	0.086	0.159	<0.020	0.049
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	0.086	0.159	<0.020	0.049
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	54	99	<10	30
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	<0.020	0.034	0.022	0.026	0.051
Peroxide Calcium (23Wh)	----	0.020	% Ca	<0.020	0.034	0.023	0.026	0.051
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	<0.020	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-G: Retained Acidity								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	mw06 - 4	mw06 - 5	mw06 - 6	bh28 - 1	bh28 - 2
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-016	EB1902737-017	EB1902737-018	EB1902737-019	EB1902737-020
					Result	Result	Result	Result	Result
EA029-G: Retained Acidity - Continued									
HCl Extractable Sulfur (20Be)	----	0.020	% S		----	----	----	----	<0.020
Net Acid Soluble Sulfur (20Je)	----	0.020	% S		----	----	----	----	<0.020
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t		----	----	----	----	<10
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.020	% pyrite S		----	----	----	----	<0.020
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		**0.02**	**0.12**	**0.23**	<0.02	**0.16**
Net Acidity (acidity units)	----	10	mole H+ / t		**14**	**77**	**141**	<10	**101**
Liming Rate	----	1	kg CaCO3/t		**1**	**6**	**10**	<1	**8**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		**0.02**	**0.12**	**0.23**	<0.02	**0.16**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**14**	**77**	**141**	<10	**101**
Liming Rate excluding ANC	----	1	kg CaCO3/t		**1**	**6**	**10**	<1	**8**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	bh28 - 3	bh28 - 4	bh28 - 5	bh28 - 6	bh01 - 1
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-021	EB1902737-022	EB1902737-023	EB1902737-024	EB1902737-025
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	6.3	6.3	4.9	5.0	7.4
pH (Fox)	----	0.1	pH Unit	3.4	4.1	2.3	2.8	2.5
Reaction Rate	----	1	Reaction Unit	2	2	2	2	3
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.6	5.6	4.5	5.0	6.0
pH OX (23B)	----	0.1	pH Unit	4.0	4.0	2.2	3.2	3.3
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	6	6	69	16	12
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	8	28	291	69	40
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	21	222	52	29
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	0.111	0.026	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	0.044	0.467	0.110	0.065
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	0.034	0.356	0.084	0.046
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	<0.020	0.160	0.029	0.118
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	<0.020	0.160	0.029	0.118
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	100	18	74
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.028	<0.020	<0.020	<0.020	0.236
Peroxide Calcium (23Wh)	----	0.020	% Ca	0.031	<0.020	<0.020	<0.020	0.297
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	<0.020	0.061
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	30
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	0.048
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	0.037
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	0.037
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	bh28 - 3	bh28 - 4	bh28 - 5	bh28 - 6	bh01 - 1
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-021	EB1902737-022	EB1902737-023	EB1902737-024	EB1902737-025
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	**0.27**	**0.06**	**0.14**
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	**169**	**34**	**86**
Liming Rate	----	1	kg CaCO3/t		<1	<1	**13**	**2**	**6**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	**0.27**	**0.06**	**0.14**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	**169**	**34**	**86**
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	**13**	**2**	**6**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	bh01 - 2	bh01 - 3	bh01 - 4	bh01 - 5	bh01 - 6
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-026	EB1902737-027	EB1902737-028	EB1902737-029	EB1902737-030
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	7.1	7.0	6.7	6.0	6.4
pH (Fox)	----	0.1	pH Unit	4.4	4.3	3.9	3.6	3.6
Reaction Rate	----	1	Reaction Unit	2	2	2	2	2
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.9	6.1	5.7	5.2	5.5
pH OX (23B)	----	0.1	pH Unit	4.0	3.7	3.8	3.5	3.7
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	4	6	3	12	6
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	72	114	14	41	24
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	68	108	10	29	18
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	0.115	0.183	0.022	0.066	0.039
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	0.108	0.174	<0.020	0.047	0.029
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	0.029	0.040	<0.020	<0.020	<0.020
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.029	0.040	<0.020	<0.020	<0.020
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	18	25	<10	<10	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.023	0.100	<0.020	<0.020	<0.020
Peroxide Calcium (23Wh)	----	0.020	% Ca	0.024	0.105	<0.020	<0.020	<0.020
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	<0.020	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	bh01 - 2	bh01 - 3	bh01 - 4	bh01 - 5	bh01 - 6
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-026	EB1902737-027	EB1902737-028	EB1902737-029	EB1902737-030
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		**0.04**	**0.05**	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		**22**	**31**	<10	**12**	<10
Liming Rate	----	1	kg CaCO3/t		**2**	**2**	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		**0.04**	**0.05**	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**22**	**31**	<10	**12**	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		**2**	**2**	<1	<1	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	bh03 - 1	bh03 - 2	bh03 - 3	bh03 - 4	bh03 - 5
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-031	EB1902737-032	EB1902737-033	EB1902737-034	EB1902737-035
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	7.1	6.9	7.1	7.0	5.8
pH (Fox)	----	0.1	pH Unit	2.0	4.2	4.8	4.3	3.2
Reaction Rate	----	1	Reaction Unit	3	2	2	2	2
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.0	4.9	6.1	6.3	4.8
pH OX (23B)	----	0.1	pH Unit	2.9	3.8	4.0	3.7	3.1
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	16	29	3	<2	21
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	133	194	50	16	88
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	118	165	47	16	67
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	0.025	0.047	<0.020	<0.020	0.034
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	0.214	0.312	0.080	0.025	0.141
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	0.189	0.264	0.075	0.025	0.107
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	0.095	0.073	0.025	<0.020	0.021
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	0.095	0.073	0.025	<0.020	0.021
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	59	45	15	<10	13
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.029	<0.020	0.043	<0.020	<0.020
Peroxide Calcium (23Wh)	----	0.020	% Ca	0.029	<0.020	0.045	<0.020	<0.020
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	<0.020	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	bh03 - 1	bh03 - 2	bh03 - 3	bh03 - 4	bh03 - 5
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-031	EB1902737-032	EB1902737-033	EB1902737-034	EB1902737-035
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		**0.12**	**0.12**	**0.03**	<0.02	**0.06**
Net Acidity (acidity units)	----	10	mole H+ / t		**75**	**75**	**19**	<10	**34**
Liming Rate	----	1	kg CaCO3/t		**6**	**6**	**1**	<1	**2**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		**0.12**	**0.12**	**0.03**	<0.02	**0.06**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**75**	**75**	**19**	<10	**34**
Liming Rate excluding ANC	----	1	kg CaCO3/t		**6**	**6**	**1**	<1	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	bh03 - 6	bh05 - 1	bh05 - 2	bh05 - 3	bh05 - 4
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-036	EB1902737-037	EB1902737-038	EB1902737-039	EB1902737-040
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	5.8	7.1	6.8	7.0	6.8
pH (Fox)	----	0.1	pH Unit	2.0	3.2	4.3	2.5	4.6
Reaction Rate	----	1	Reaction Unit	4	3	1	3	1
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.3	6.3	5.5	6.1	5.7
pH OX (23B)	----	0.1	pH Unit	3.6	3.9	3.6	3.1	4.0
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	9	<2	16	7	6
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	23	24	267	132	65
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	14	24	250	125	59
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	0.026	<0.020	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	0.037	0.038	0.428	0.211	0.105
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	0.023	0.038	0.401	0.200	0.094
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	0.043	0.085	0.094	0.027
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	0.043	0.085	0.094	0.027
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	27	53	59	17
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	<0.020	0.036	0.069	0.152	0.028
Peroxide Calcium (23Wh)	----	0.020	% Ca	<0.020	0.038	0.069	0.191	0.029
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	<0.020	<0.020	0.039	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	20	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	0.031	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	bh03 - 6	bh05 - 1	bh05 - 2	bh05 - 3	bh05 - 4
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-036	EB1902737-037	EB1902737-038	EB1902737-039	EB1902737-040
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	**0.04**	**0.11**	**0.10**	**0.04**
Net Acidity (acidity units)	----	10	mole H+ / t		<10	**27**	**69**	**66**	**24**
Liming Rate	----	1	kg CaCO3/t		<1	**2**	**5**	**5**	**2**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	**0.04**	**0.11**	**0.10**	**0.04**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	**27**	**69**	**66**	**24**
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	**2**	**5**	**5**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	bh05 - 5	bh05 - 6	DUP01	DUP02	DUP03
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-041	EB1902737-042	EB1902737-043	EB1902737-044	EB1902737-045
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.2**	**5.1**	**7.0**	**7.0**	**6.0**
pH (Fox)	----	0.1	pH Unit	**3.3**	**2.3**	**5.0**	**4.4**	**4.3**
Reaction Rate	----	1	Reaction Unit	**1**	**4**	**1**	**4**	**1**
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	**4.7**	**5.0**	**6.0**	**6.0**	**5.7**
pH OX (23B)	----	0.1	pH Unit	**3.4**	**2.9**	**5.2**	**3.7**	**4.3**
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**39**	**15**	<2	**5**	**4**
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	**243**	**86**	**15**	**225**	**31**
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	**204**	**72**	**15**	**220**	**27**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	**0.062**	**0.024**	<0.020	<0.020	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	**0.389**	**0.138**	**0.024**	**0.361**	**0.049**
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	**0.327**	**0.115**	**0.024**	**0.353**	**0.043**
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	**0.063**	**0.098**	<0.020	**0.066**	<0.020
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	**0.063**	**0.098**	<0.020	**0.066**	<0.020
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	**39**	**61**	<10	**41**	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	<0.020	<0.020	<0.020	**0.087**	<0.020
Peroxide Calcium (23Wh)	----	0.020	% Ca	**0.023**	<0.020	<0.020	**0.088**	<0.020
Acid Reacted Calcium (23X)	----	0.020	% Ca	**0.023**	<0.020	<0.020	<0.020	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	**11**	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	bh05 - 5	bh05 - 6	DUP01	DUP02	DUP03
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-041	EB1902737-042	EB1902737-043	EB1902737-044	EB1902737-045
					Result	Result	Result	Result	Result
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		**0.12**	**0.12**	<0.02	**0.07**	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		**78**	**76**	<10	**46**	<10
Liming Rate	----	1	kg CaCO3/t		**6**	**6**	<1	**3**	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		**0.12**	**0.12**	<0.02	**0.07**	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**78**	**76**	<10	**46**	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		**6**	**6**	<1	**3**	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH15 - 1	BH15 - 2	BH15 - 3	BH15 - 4	BH15 - 5
			Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit	EB1902737-046	EB1902737-047	EB1902737-048	EB1902737-049	EB1902737-050
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	7.0	7.0	6.6	5.8	5.4
pH (Fox)	----	0.1	pH Unit	4.5	4.0	4.4	3.9	3.0
Reaction Rate	----	1	Reaction Unit	3	3	2	2	2
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	6.4	6.5	5.9	5.4	5.4
pH OX (23B)	----	0.1	pH Unit	6.8	7.6	4.0	3.7	3.6
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	6	9	6
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	152	101	55
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	146	92	49
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	<0.020	<0.020	<0.020	<0.020
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	<0.020	<0.020	0.244	0.161	0.088
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	<0.020	<0.020	0.235	0.147	0.079
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	<0.020	0.056	0.028	<0.020
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	<0.020	0.056	0.028	<0.020
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	35	17	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	0.035	0.041	0.120	<0.020	<0.020
Peroxide Calcium (23Wh)	----	0.020	% Ca	0.058	0.066	0.128	0.021	<0.020
Acid Reacted Calcium (23X)	----	0.020	% Ca	0.023	0.025	<0.020	0.021	<0.020
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	11	12	<10	10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	<0.020	<0.020	<0.020	<0.020
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	<0.020	<0.020	<0.020	<0.020
EA029-F: Excess Acid Neutralising Capacity								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH15 - 1	BH15 - 2	BH15 - 3	BH15 - 4	BH15 - 5
				Client sampling date / time	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00	31-Jan-2019 00:00
Compound	CAS Number	LOR	Unit		EB1902737-046	EB1902737-047	EB1902737-048	EB1902737-049	EB1902737-050
					Result	Result	Result	Result	Result
EA029-F: Excess Acid Neutralising Capacity - Continued									
Excess Acid Neutralising Capacity (23Q)	----	0.020	% CaCO3		**2.19**	**2.19**	**----**	**----**	**----**
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t		**437**	**438**	**----**	**----**	**----**
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.020	% S		**0.700**	**0.701**	**----**	**----**	**----**
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	**0.06**	**0.04**	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	**40**	**26**	<10
Liming Rate	----	1	kg CaCO3/t		<1	<1	**3**	**2**	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	<0.02	**0.06**	**0.04**	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	<10	**40**	**26**	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	<1	**3**	**2**	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH15 - 6	----	----	----	----
			Client sampling date / time	31-Jan-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1902737-051	--------	--------	--------	--------
				Result	----	----	----	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.6**	----	----	----	----
pH (Fox)	----	0.1	pH Unit	**2.6**	----	----	----	----
Reaction Rate	----	1	Reaction Unit	**2**	----	----	----	----
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	**5.2**	----	----	----	----
pH OX (23B)	----	0.1	pH Unit	**3.4**	----	----	----	----
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**9**	----	----	----	----
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	**54**	----	----	----	----
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	**45**	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.020	% pyrite S	<0.020	----	----	----	----
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.020	% pyrite S	**0.086**	----	----	----	----
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.020	% pyrite S	**0.072**	----	----	----	----
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.020	% S	<0.020	----	----	----	----
Peroxide Sulfur (23De)	----	0.020	% S	<0.020	----	----	----	----
Peroxide Oxidisable Sulfur (23E)	----	0.020	% S	<0.020	----	----	----	----
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	----	----	----	----
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.020	% Ca	<0.020	----	----	----	----
Peroxide Calcium (23Wh)	----	0.020	% Ca	<0.020	----	----	----	----
Acid Reacted Calcium (23X)	----	0.020	% Ca	<0.020	----	----	----	----
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	----	----	----	----
sulfidic - Acid Reacted Calcium (s-23X)	----	0.020	% S	<0.020	----	----	----	----
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.020	% Mg	<0.020	----	----	----	----
Peroxide Magnesium (23Tm)	----	0.020	% Mg	<0.020	----	----	----	----
Acid Reacted Magnesium (23U)	----	0.020	% Mg	<0.020	----	----	----	----
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	----	----	----	----
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.020	% S	<0.020	----	----	----	----
EA029-H: Acid Base Accounting								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH15 - 6	----	----	----	----
				Client sampling date / time	31-Jan-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1902737-051	--------	--------	--------	--------
					Result	----	----	----	----
EA029-H: Acid Base Accounting - Continued									
ANC Fineness Factor	----	0.5	-		**1.5**	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S		<0.02	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t		<10	----	----	----	----
Liming Rate	----	1	kg CaCO3/t		<1	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		<0.02	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		<10	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t		<1	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB1902737**	Page	: 1 of 12
Client	: **ARCADIS AUSTRALIA PACIFIC PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CAITLAIN REGENA	Contact	: Customer Services EB
Address	: L16, 480 GEORGE STREET SYDNEY NSW 2000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 02 8907 9000	Telephone	: +61-7-3243 7222
Project	: 10026439 - task 2	Date Samples Received	: 05-Feb-2019
Order number	: ----	Date Analysis Commenced	: 07-Feb-2019
C-O-C number	: ----	Issue Date	: 11-Feb-2019
Sampler	: TOM KEATLEY		
Site	: ----		
Quote number	: EN/091/17 (Primary Work only)		
No. of samples received	: 51		
No. of samples analysed	: 51		

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*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA003 :pH (field/fox) (QC Lot: 2176067)									
EB1902737-001	BH26 -1	EA003: pH (F)	----	0.1	pH Unit	7.5	7.3	2.03	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	4.7	4.5	3.89	0% - 20%
EB1902737-010	BH18 - 4	EA003: pH (F)	----	0.1	pH Unit	6.6	6.6	0.00	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	4.2	4.3	3.31	0% - 20%
EA003 :pH (field/fox) (QC Lot: 2176068)									
EB1902737-021	bh28 - 3	EA003: pH (F)	----	0.1	pH Unit	6.3	6.4	0.00	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.4	3.4	0.00	0% - 20%
EB1902737-030	bh01 - 6	EA003: pH (F)	----	0.1	pH Unit	6.4	6.4	0.00	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.6	3.4	5.65	0% - 20%
EA003 :pH (field/fox) (QC Lot: 2176069)									
EB1902737-041	bh05 - 5	EA003: pH (F)	----	0.1	pH Unit	5.2	5.3	0.00	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.3	3.2	3.35	0% - 20%
EB1902737-050	BH15 - 5	EA003: pH (F)	----	0.1	pH Unit	5.4	5.4	0.00	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.0	3.0	0.00	0% - 20%
EA029-A: pH Measurements (QC Lot: 2171655)									
EB1902737-001	BH26 -1	EA029: pH KCl (23A)	----	0.1	pH Unit	6.7	6.7	0.00	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	6.1	6.0	1.65	0% - 20%
EB1902737-011	BH18 - 5	EA029: pH KCl (23A)	----	0.1	pH Unit	5.4	5.6	3.64	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	3.8	3.8	0.00	0% - 20%
EA029-A: pH Measurements (QC Lot: 2171656)									
EB1902737-021	bh28 - 3	EA029: pH KCl (23A)	----	0.1	pH Unit	5.6	5.7	1.77	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	4.0	4.0	0.00	0% - 20%
EB1902737-031	bh03 - 1	EA029: pH KCl (23A)	----	0.1	pH Unit	5.0	5.0	0.00	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	2.9	2.9	0.00	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 (%)*
EA029-A: pH Measurements (QC Lot: 2171657)									
EB1902737-041	bh05 - 5	EA029: pH KCl (23A)	----	0.1	pH Unit	4.7	4.7	0.00	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	3.4	3.4	0.00	0% - 20%
EB1902737-051	BH15 - 6	EA029: pH KCl (23A)	----	0.1	pH Unit	5.2	5.2	0.00	0% - 20%
		EA029: pH OX (23B)	----	0.1	pH Unit	3.4	3.4	0.00	0% - 20%
EA029-B: Acidity Trail (QC Lot: 2171655)									
EB1902737-001	BH26 -1	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	2	0.00	No Limit
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	2	0.00	No Limit
EB1902737-011	BH18 - 5	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	0.033	0.036	8.76	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	0.022	0.027	18.8	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	7	6	16.2	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	21	23	8.76	0% - 50%
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	14	17	18.8	No Limit
EA029-B: Acidity Trail (QC Lot: 2171656)									
EB1902737-021	bh28 - 3	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	6	6	0.00	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	8	7	0.00	No Limit
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	0.00	No Limit
EB1902737-031	bh03 - 1	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.025	0.025	0.00	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	0.214	0.188	12.8	0% - 50%
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	0.189	0.163	14.4	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	16	15	0.00	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	133	117	12.8	0% - 20%
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	118	102	14.4	0% - 20%
EA029-B: Acidity Trail (QC Lot: 2171657)									
EB1902737-041	bh05 - 5	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.062	0.059	4.51	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 (%)*
EA029-B: Acidity Trail (QC Lot: 2171657) - continued									
EB1902737-041	bh05 - 5	EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	0.389	0.430	9.89	0% - 20%
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	0.327	0.370	12.4	0% - 50%
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	39	37	4.51	0% - 50%
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	243	268	9.89	0% - 20%
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	204	231	12.4	0% - 20%
EB1902737-051	BH15 - 6	EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	0.086	0.089	2.56	No Limit
		EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	0.072	0.074	2.51	No Limit
		EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	9	9	0.00	No Limit
		EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	54	55	2.56	0% - 20%
		EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	45	46	2.52	0% - 20%
EA029-C: Sulfur Trail (QC Lot: 2171655)									
EB1902737-001	BH26 -1	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-011	BH18 - 5	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-C: Sulfur Trail (QC Lot: 2171656)									
EB1902737-021	bh28 - 3	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-031	bh03 - 1	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	0.095	0.093	2.24	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	0.095	0.093	2.24	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	59	58	2.24	No Limit
EA029-C: Sulfur Trail (QC Lot: 2171657)									
EB1902737-041	bh05 - 5	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	0.063	0.060	5.04	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA029-C: Sulfur Trail (QC Lot: 2171657) - continued									
EB1902737-041	bh05 - 5	EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	0.063	0.060	5.04	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	39	37	5.04	No Limit
EB1902737-051	BH15 - 6	EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-D: Calcium Values (QC Lot: 2171655)									
EB1902737-001	BH26 -1	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-011	BH18 - 5	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-D: Calcium Values (QC Lot: 2171656)									
EB1902737-021	bh28 - 3	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	0.028	0.027	0.00	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	0.031	0.030	4.91	No Limit
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-031	bh03 - 1	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	0.029	0.029	0.00	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	0.029	0.029	0.00	No Limit
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-D: Calcium Values (QC Lot: 2171657)									
EB1902737-041	bh05 - 5	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	0.023	0.025	9.84	No Limit
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	0.023	0.025	9.84	No Limit
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	0.020	0.00	No Limit
		EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	11	13	9.84	No Limit
EB1902737-051	BH15 - 6	EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	<0.020	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 (%)*
EA029-D: Calcium Values (QC Lot: 2171657) - continued									
EB1902737-051	BH15 - 6	EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-E: Magnesium Values (QC Lot: 2171655)									
EB1902737-001	BH26 -1	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-011	BH18 - 5	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-E: Magnesium Values (QC Lot: 2171656)									
EB1902737-021	bh28 - 3	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-031	bh03 - 1	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-E: Magnesium Values (QC Lot: 2171657)									
EB1902737-041	bh05 - 5	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-051	BH15 - 6	EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	<0.020	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 (%)*
EA029-E: Magnesium Values (QC Lot: 2171657) - continued									
EB1902737-051	BH15 - 6	EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	<0.020	0.00	No Limit
		EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	<0.020	0.00	No Limit
		EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-H: Acid Base Accounting (QC Lot: 2171655)									
EB1902737-001	BH26 -1	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.00	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-011	BH18 - 5	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.00	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EA029-H: Acid Base Accounting (QC Lot: 2171656)									
EB1902737-021	bh28 - 3	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.00	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
EB1902737-031	bh03 - 1	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.00	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	0.12	0.12	0.00	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.12	0.12	0.00	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	6	5	0.00	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	6	5	0.00	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	75	73	2.10	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	75	73	2.10	No Limit
EA029-H: Acid Base Accounting (QC Lot: 2171657)									
EB1902737-041	bh05 - 5	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.00	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	0.12	0.12	0.00	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.12	0.12	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 (%)*
EA029-H: Acid Base Accounting (QC Lot: 2171657) - continued									
EB1902737-041	bh05 - 5	EA029: Liming Rate	----	1	kg CaCO3/t	6	6	0.00	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	6	6	0.00	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	78	74	4.78	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	78	74	4.78	No Limit
EB1902737-051	BH15 - 6	EA029: ANC Fineness Factor	----	0.5	-	1.5	1.5	0.00	No Limit
		EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	0.00	No Limit
		EA029: Liming Rate	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	0.00	No Limit
		EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	0.00	No Limit
		EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	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**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA029-A: pH Measurements (QCLot: 2171655)								
EA029: pH KCl (23A)	----	0.1	pH Unit	<0.1	4.5 pH Unit	97.8	70	130
EA029: pH OX (23B)	----	0.1	pH Unit	<0.1	4.5 pH Unit	95.6	70	130
EA029-A: pH Measurements (QCLot: 2171656)								
EA029: pH KCl (23A)	----	0.1	pH Unit	<0.1	4.5 pH Unit	97.8	70	130
EA029: pH OX (23B)	----	0.1	pH Unit	<0.1	4.5 pH Unit	93.3	70	130
EA029-A: pH Measurements (QCLot: 2171657)								
EA029: pH KCl (23A)	----	0.1	pH Unit	<0.1	4.5 pH Unit	97.8	70	130
EA029: pH OX (23B)	----	0.1	pH Unit	<0.1	4.5 pH Unit	95.6	70	130
EA029-B: Acidity Trail (QCLot: 2171655)								
EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	24.6 mole H+ / t	104	70	130
EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	29.1 mole H+ / t	92.6	70	130
EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	----	----	----	----
EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029-B: Acidity Trail (QCLot: 2171656)								
EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	24.6 mole H+ / t	99.6	70	130
EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	29.1 mole H+ / t	94.0	70	130
EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	----	----	----	----
EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029-B: Acidity Trail (QCLot: 2171657)								
EA029: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	24.6 mole H+ / t	96.7	70	130
EA029: Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	29.1 mole H+ / t	99.6	70	130
EA029: Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	----	----	----	----
EA029: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029-C: Sulfur Trail (QCLot: 2171655)								
EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	0.052 % S	87.3	70	130
EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	0.145 % S	99.4	70	130
EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EA029-C: Sulfur Trail (QCLot: 2171655) - continued								
EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	----	----	----	----
EA029-C: Sulfur Trail (QCLot: 2171656)								
EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	0.052 % S	87.7	70	130
EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	0.145 % S	91.2	70	130
EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	----	----	----	----
EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	----	----	----	----
EA029-C: Sulfur Trail (QCLot: 2171657)								
EA029: KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.020	0.052 % S	83.6	70	130
EA029: Peroxide Sulfur (23De)	----	0.02	% S	<0.020	0.145 % S	100	70	130
EA029: Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.020	----	----	----	----
EA029: acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	----	----	----	----
EA029-D: Calcium Values (QCLot: 2171655)								
EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	0.151 % Ca	96.0	70	130
EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	0.296 % Ca	113	70	130
EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	----	----	----	----
EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	----	----	----	----
EA029-D: Calcium Values (QCLot: 2171656)								
EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	0.151 % Ca	91.8	70	130
EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	0.296 % Ca	84.2	70	130
EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	----	----	----	----
EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	----	----	----	----
EA029-D: Calcium Values (QCLot: 2171657)								
EA029: KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.020	0.151 % Ca	91.8	70	130
EA029: Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.020	0.296 % Ca	117	70	130
EA029: Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.020	----	----	----	----
EA029: acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.020	----	----	----	----
EA029-E: Magnesium Values (QCLot: 2171655)								
EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	0.176 % Mg	93.5	70	130
EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	0.175 % Mg	101	70	130
EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	----	----	----	----
EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	----	----	----	----
EA029-E: Magnesium Values (QCLot: 2171656)								
EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	0.176 % Mg	86.6	70	130
EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	0.175 % Mg	92.3	70	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EA029-E: Magnesium Values (QCLot: 2171656) - continued								
EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	----	----	----	----
EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	----	----	----	----
EA029-E: Magnesium Values (QCLot: 2171657)								
EA029: KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.020	0.176 % Mg	83.0	70	130
EA029: Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.020	0.175 % Mg	107	70	130
EA029: Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.020	----	----	----	----
EA029: Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.020	----	----	----	----
EA029-F: Excess Acid Neutralising Capacity (QCLot: 2171655)								
EA029: Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	<0.020	----	----	----	----
EA029: acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	<0.020	----	----	----	----
EA029-F: Excess Acid Neutralising Capacity (QCLot: 2171657)								
EA029: Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	<0.020	----	----	----	----
EA029: acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	<0.020	----	----	----	----
EA029-G: Retained Acidity (QCLot: 2171655)								
EA029: Net Acid Soluble Sulfur (20Je)	----	0.02	% S	<0.020	----	----	----	----
EA029: acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	<10	----	----	----	----
EA029: sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	<0.020	----	----	----	----
EA029: HCl Extractable Sulfur (20Be)	----	0.02	% S	<0.020	0.027 % S	83.4	70	130
EA029-H: Acid Base Accounting (QCLot: 2171655)								
EA029: ANC Fineness Factor	----	0.5	-	<0.5	----	----	----	----
EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	----	----	----
EA029-H: Acid Base Accounting (QCLot: 2171656)								
EA029: ANC Fineness Factor	----	0.5	-	<0.5	----	----	----	----
EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EA029-H: Acid Base Accounting (QCLot: 2171656) - continued								
EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	----	----	----
EA029-H: Acid Base Accounting (QCLot: 2171657)								
EA029: ANC Fineness Factor	----	0.5	-	<0.5	----	----	----	----
EA029: Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
EA029: Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
EA029: Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	----	----	----	----
EA029: Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	----	----	----

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.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1902737**	Page	: 1 of 12
Client	: **ARCADIS AUSTRALIA PACIFIC PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: CAITLAIN REGENA	Telephone	: +61-7-3243 7222
Project	: 10026439 - task 2	Date Samples Received	: 05-Feb-2019
Site	: ----	Issue Date	: 11-Feb-2019
Sampler	: TOM KEATLEY	No. of samples received	: 51
Order number	: ----	No. of samples analysed	: 51

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 / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA003 :pH (field/fox)							
Snap Lock Bag - frozen (EA003)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**11-Feb-2019**	26-Oct-2021	✓	**11-Feb-2019**	12-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-A: pH Measurements							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-B: Acidity Trail							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-C: Sulfur Trail							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-D: Calcium Values							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-E: Magnesium Values							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-F: Excess Acid Neutralising Capacity							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-G: Retained Acidity							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-2019	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA029-H: Acid Base Accounting							
Snap Lock Bag - frozen (EA029)							
BH26 -1, BH26 -2, BH26 -3, BH26 -4, BH26 -5, BH26 -6, BH18 - 1, BH18 - 2, BH18 - 3, BH18 - 4, BH18 - 5, BH18 - 6, mw06 - 1, mw06 - 2, mw06 - 3, mw06 - 4, mw06 - 5, mw06 - 6, bh28 - 1, bh28 - 2, bh28 - 3, bh28 - 4, bh28 - 5, bh28 - 6, bh01 - 1, DUP01, bh01 - 2, bh01 - 3, bh01 - 4, bh01 - 5, bh01 - 6, bh03 - 1, bh03 - 2, bh03 - 3, bh03 - 4, bh03 - 5, bh03 - 6, bh05 - 1, bh05 - 2, bh05 - 3, bh05 - 4, bh05 - 5, bh05 - 6, DUP02, DUP03, BH15 - 1, BH15 - 2, BH15 - 3, BH15 - 4, BH15 - 5, BH15 - 6	**31-Jan-2019**	**07-Feb-2019**	26-Oct-2021	✓	**07-Feb-2019**	08-May-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)							
pH field/fox	EA003	6	51	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	6	51	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	3	51	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	3	51	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH field/fox	EA003	SOIL	In house: Referenced to Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.
Suspension Peroxide Oxidation-Combined Acidity and Sulphate	EA029	SOIL	In house: Referenced to Ahern et al 2004 - a suspension peroxide oxidation method following the 'sulfur trail' by determining the level of 1M KCL extractable sulfur and the sulfur level after oxidation of soil sulphides. The 'acidity trail' is followed by measurement of TAA, TPA and TSA. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

updated COC Ri

CHAIN OF CUSTODY

ALS Environmental Laboratory: please tick →

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

CLIENT: Arcadis Australia Pacific Pty Ltd	TURNAROUND REQUIREMENTS: Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A; Free ice / Frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt: °C
OFFICE:		
10026439 - task 2	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER:		
PROJECT MANAGER: caitlain regena	CONTACT PH:	Other comment:
SAMPLER: Tom Keatley	SAMPLER MOBILE: 0429 948 897	RELINQUISHED BY: Tom Keatley; RECEIVED BY: [illegible]; RELINQUISHED BY: ; RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): ESDAT	DATE/TIME: 31/01/2019 - Drop off pm; DATE/TIME: 5/2/19 9:3>; DATE/TIME: ; DATE/TIME:
Email Reports to: caitlain.regena@arcadis.com; tom.keatley@arcadis.com		
Email Invoice to: Accounts.Payable <AU.Accounts.Payable@arcadis.com>		

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS - MATRIX: SOLID (S) WATER (W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DEPTH	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	pH	SPOCAS								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH26	1	31/01/2019	s	Ziplock	X	X								
2	BH26	2	31/01/2019	s	Ziplock	X	X								
3	BH26	3	31/01/2019	s	Ziplock	X	X								
4	BH26	4	31/01/2019	s	Ziplock	X	X								
5	BH26	5	31/01/2019	s	Ziplock	X	X								
6	BH26	6	31/01/2019	s	Ziplock	X	X								
7	BH18	1	31/01/2019	s	Ziplock	X	X								
8	BH18	2	31/01/2019	s	Ziplock	X	X								
9	BH18	3	31/01/2019	s	Ziplock	X	X								
10	BH18	4	31/01/2019	s	Ziplock	X	X								
11	BH18	5	31/01/2019	s	Ziplock	X	X								
12	BH18	6	31/01/2019	s	Ziplock	X	X								
13	mw06	1	31/01/2019	s	Ziplock	X	X								
14	mw06	2	31/01/2019	s	Ziplock	X	X								
15	mw06	3	31/01/2019	s	Ziplock	X	X								
					TOTAL										

Environmental Division Brisbane
Work Order Reference
EB1902737

Telephone : + 61-7-3243 7222

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

AIN OF STODY

ALS Laboratory: please tick →

SYDNEY: 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

CLIENT: Arcadis Australia Pacific Pty Ltd	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? Yes No N/A
OFFICE:			Free Ice / frozen ice bricks present upon receipt? Yes No N/A
10026439 - task 2	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
ORDER NUMBER:		OF: 1 2 3 4 5 6 7	Other comment:
PROJECT MANAGER: caitlaln.regena	CONTACT PH:		
SAMPLER: Tom Keatley	SAMPLER MOBILE: 0429 948 897	RELINQUISHED BY:	RECEIVED BY: JV, 11/49
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): ESDAT	Tom Keatley pm	RELINQUISHED BY:
Email Reports to : caitlain.regena@arcadis.com; tom.keatley@arcadis.com		DATE/TIME:	DATE/TIME: 9.30 5/2/19
Email Invoice to: Accounts.Payable <AU.Accounts.Payable@arcadis.com>		31/01/2019 - Drop off	RECEIVED BY: DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DEPTH	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	pH	SPOCAS								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
16	mw06	4	31/01/2019	s	Ziplock	X	X								
17	mw06	5	31/01/2019	s	Ziplock	X	X								
18	mw06	6	31/01/2019	s	Ziplock	X	X								
19	bh28	1	31/01/2019	s	Ziplock	X	X								
20	bh28	2	31/01/2019	s	Ziplock	X	X								
21	bh28	3	31/01/2019	s	Ziplock	X	X								
22	bh28	4	31/01/2019	s	Ziplock	X	X								
23	bh28	5	31/01/2019	s	Ziplock	X	X								
24	bh28	6	31/01/2019	s	Ziplock	X	X								
25	bh01	1	31/01/2019	s	Ziplock	X	X								
26	bh01	2	31/01/2019	s	Ziplock	X	X								
27	bh01	3	31/01/2019	s	Ziplock	X	X								
28	bh01	4	31/01/2019	s	Ziplock	X	X								
29	bh01	5	31/01/2019	s	Ziplock	X	X								
30	bh01	6	31/01/2019	s	Ziplock	X	X								
					TOTAL:										

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

AIN OF STODY

Laboratory: please tick →

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

CLIENT: Arcadis Australia Pacific Pty Ltd	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A; Free Ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt: °C; Other comment:
OFFICE:		
10026439 - task 2	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER:		
PROJECT MANAGER: caitlain.regena	CONTACT PH:	
SAMPLER: Tom Keatley	SAMPLER MOBILE: 0429 948 897	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): ESDAT	
Email Reports to : caitlain.regena@arcadis.com; tom.keatley@arcadis.com		
Email Invoice to: Accounts.Payable <AU.Accounts.Payable@arcadis.com>		

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Tom Keatley			
DATE/TIME: 31/01/2019 - Drop off pm	DATE/TIME: 31/1/19 9:35	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DEPTH	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	pH	SPOCAS								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
31	bh03	1	31/01/2019	s	Ziplock	X	X								
32	bh03	2	31/01/2019	s	Ziplock	X	X								
33	bh03	3	31/01/2019	s	Ziplock	X	X								
34	bh03	4	31/01/2019	s	Ziplock	X	X								
35	bh03	5	31/01/2019	s	Ziplock	X	X								
36	bh03	6	31/01/2019	s	Ziplock	X	X								
37	bh05	1	31/01/2019	s	Ziplock	X	X								
38	bh05	2	31/01/2019	s	Ziplock	X	X								
39	bh05	3	31/01/2019	s	Ziplock	X	X								
40	bh05	4	31/01/2019	s	Ziplock	X	X								
41	bh05	5	31/01/2019	s	Ziplock	X	X								
42	bh05	6	31/01/2019	s	Ziplock	X	X								
43	DUP01	3	31/01/2019	s	Ziplock	X	X								Split(Lab) - BH01 @ 3.0
44	DUP02	4	31/01/2019	s	Ziplock	X	X								Split(Lab) - BH03 @ 4.0
45	DUP03	4	31/01/2019	s	Ziplock	X	X								Split(Lab) - BH15 @ 4.0
					TOTAL										

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

AIN OF STODY

ALS Laboratory: please tick →

ADDRESS: 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 | samples.sydney@alsglobal.com

CLIENT: Arcadis Australia Pacific Pty Ltd	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? Yes No N/A
OFFICE:		Free ice / frozen ice bricks present upon receipt? Yes No N/A
10026439 - task 2	ALS QUOTE NO.:	Random Sample Temperature on Receipt: °C
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Other comment:
PROJECT MANAGER: caitlain.regena	CONTACT PH:	
SAMPLER: Tom Keatley	SAMPLER MOBILE: 0429 948 897	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default): ESDAT	
Email Reports to : caitlain.regena@arcadis.com; tom.keatley@arcadis.com		
Email Invoice to: Accounts.Payable <AU.Accounts.Payable@arcadis.com>		

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Tom Keatley	Stelios		
DATE/TIME: 31/01/2019 - Drop off pm	DATE/TIME: 5/2/19 9:30	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DEPTH	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	pH	SPOCAS								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
45	BH15	1	31/01/2019	s	Ziplock	X	X								
51	BH15	2	31/01/2019	s	Ziplock	X	X								
46	BH15	3	31/01/2019	s	Ziplock	X	X								
47	BH15	4	31/01/2019	s	Ziplock	X	X								
50	BH15	5	31/01/2019	s	Ziplock	X	X								
54	BH15	6	31/01/2019	s	Ziplock	X	X								
					TOTAL										

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

APPENDIX D **BORE LOGS**

Borehole Log

ARCADIS Design & Consultancy for natural and built assets

Hole ID.	**BH01**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Depth (mbgl)	USCS Symbol	Material Type	Material Description	Moisture	Observations / Comments
CC	0.040		Fill	**ASPHALT** - black, hard.	slightly moist	No odour. No PACM. Glass, crushed sandstone, charcoal pieces.
	0.500			**FILL** - Gravelly SAND, loose, medium grained, well sorted.		
PT	1.0	SM	Natural	**Silty SAND** - dark brown / black.		Hydrocarbon odour. No PACM.
	1.5					
	2.0					
	2.200					
	2.5	SM		**Silty SAND** - brown.		No odour. No PACM.
	2.700					
	3.0	SM		**Silty SAND** - lighter golden brown.		Sulfur odour. No PACM.
	3.200					
	3.5	SP		**SAND** - dark brown.		Sulfur odour. No PACM.
	3.800					
	4.0	SP		**SAND** - golden brown, with organics.		Sulfur odour. No PACM.
	4.5					
	4.800					
	5.0	SP		**SAND** - dark brown, some clay and organics.		
	5.500					
		SP		**SAND** - brown.		Sulfur odour. No PACM.
				End of Hole at 6.000 m Target depth.		

Additional Comments

Strike Groundwater Level

Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tom Keatley** Date: **31/01/2019**
Checked By: Date:

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Borehole Log

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Hole ID.	**BH03**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Depth (mbgl)	USCS Symbol	Material Type	Material Description	Moisture	Observations / Comments
CC	0.040		Fill	**ASPHALT** - black, hard.		No odour. No PACM.
	0.200			**FILL** - Roadbase. GRAVEL, grey.		No odour. No PACM.
	0.5			**FILL** - SAND, Crushed Sandstone, orange / golden.		
	0.600			**FILL** - Gravelly SAND, golden.		No odour. No PACM.
	0.800					
PT	1.0	OH	Natural	**PEAT, some Sand** - dark brown / black, organic, rootlets.	wet	Sulfur odour. No PACM.
	1.5			Grey 1.6-1.8m.		
	2.0					
	2.300					
	2.500	SP		**SAND** - golden.	sat'd	Sulfur odour. No PACM.
	3.0	SP		**SAND** - dark brown.	sat'd	Sulfur odour. No PACM.
	3.500					
	3.700	SP		**SAND** - golden.	sat'd	Sulfur odour. No PACM.
	4.0	SP		**SAND** - brown.	sat'd	Sulfur odour. No PACM.
	4.5					
	5.0			Black organics at 5m.		
	5.200					
	5.5	SP		**SAND** - golden.	sat'd	Sulfur odour. No PACM.
				End of Hole at 6.000 m Target depth.		

Additional Comments

Strike Groundwater Level

Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tom Keatley** Date: **31/01/2019**
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Borehole Log

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Hole ID.	**BH05**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Water Level	Depth (mbgl)	RL (mAHD)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Sample ID No.	Observations / Comments
CC		0.040				Fill	**ASPHALT** - black, hard.			
		0.500					**FILL** - Roadbase. Sandy GRAVEL, grey, some crushed sandstone pieces.			No odour. No PACM.
		1.0			SM		**Silty SAND** - golden / brown, dense, medium grained.	moist	BH05_1.0	Strong sulfur odour. No PACM.
	▽	1.400								
		1.5			SP		**SAND** - dark brown / black, organics.	sat'd	BH05_2.0	Strong sulfur odour. No PACM.
		2.0								
		2.200								
		2.5			SP		**SAND** - golden, some dark brown.	sat'd		Strong sulfur odour. No PACM.
		2.600								
PT		3.0			SP		**SAND** - dark brown, some peat / clay / organic material.	sat'd	BH05_3.0	Strong sulfur odour. No PACM.
		3.200				Natural				
		3.5			SP		**SAND** - golden, dense, medium grained.	sat'd		Slight sulfur odour. No PACM.
		4.000							BH05_4.0	
		4.5			SP		**SAND** - brown.	sat'd		Slight sulfur odour. No PACM.
		5.0							BH05_5.0	
		5.5								
									BH05_6.0	
							End of Hole at 6.000 m Target depth.			

Additional Comments

▽ Strike Groundwater Level

▼ Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tom Keatley** Date: **31/01/2019**
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Borehole Log

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Hole ID.	**BH15**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Water Level	Depth (mbgl)	RL (mAHD)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Sample ID No.	Observations / Comments
CC		0.040					**ASPHALT** - black, hard.			
PT		1.000				Fill	**FILL** - Silty SAND, dark grey to brown, fine grained, poorly sorted, angular sandstone gravel.	dry		No odour. No PACM. Concrete piece at 0.5m.
PT		2.300				Fill	**FILL** - Silty SAND, light brown, fine grained, well sorted, with few gravels.	moist	SB15_1.0 SB15_2.0	No odour. No PACM.
PT		3.200			SP	Natural	**SAND with Silt, Peat** - black, organics.		SB15_3.0	Strong sulfur odour. No PACM.
PT		4.200			SP	Natural	**SAND** - golden, dense, medium grained, with black lined organics, rootlets at 3.5 & 3.8m.		SB15_4.0	Slight sulfur odour. No PACM.
PT		4.700			SP	Natural	**SAND** - grey, dense, medium grained.			No odour. No PACM.
PT		5.400			SP	Natural	**SAND** - brown / grey. Dark brown from 4.9-5.0m.		SB15_5.0	No odour. No PACM.
PT		6.000			SP	Natural	**SAND** - dark brown.		SB15_6.0	Slight sulfur odour. No PACM.
							End of Hole at 6.000 m Target depth.			

Additional Comments

Strike Groundwater Level

Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tom Keatley** Date: **31/01/2019**
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Borehole Log

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Hole ID.	**BH18**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Water Level	Depth (mbgl)	RL (mAHD)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Sample ID No.	Observations / Comments
CC		0.050				Fill	**ASPHALT** - black, hard.			
PT		0.5					**FILL** - Sandy GRAVEL, dark grey, poorly sorted.			
		0.900					**FILL** - BOULDERS, grey / blue, dense, angular gravels.		SB18_1.0	
		1.200					**FILL** - Sandy GRAVEL, dark grey, poorly sorted.			
		1.500					**FILL** - CLAY, black / brown.			Sulfur odour. No PACM.
		1.700					**FILL** - SAND, red / brown, medium grained, with dead tree root.	dry	SB18_2.0	
		2.200					**FILL** - CLAY, black / brown.	moist	SB18_2.5	Sulfur odour. No PACM.
		2.800					**FILL** - SAND with Gravel, red / brown.	wet		
	▽	3.200			SP	Natural	**SAND** - golden, with black layers. Roots at 3.8m.	sat'd		
		4.000			SP		**SAND** - dark brown.	sat'd	SB18_4.0	Sulfur odour. No PACM.
		4.800			SP		**SAND** - golden.	sat'd	SB18_5.0	Slight sulfur odour. No PACM.
		5.600			SP		**SAND** - dark brown.	sat'd	SB18_6.0	Slight sulfur odour. No PACM.
							End of Hole at 6.000 m Target depth.			

Additional Comments

▽ Strike Groundwater Level

▼ Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

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Hole ID.	**BH26**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Water Level	Depth (mbgl)	RL (mAHD)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Sample ID No.	Observations / Comments
CC		0.050				Fill	**ASPHALT** - black, hard.			No odour. No PACM.
		0.400					**FILL** - Roadbase. Sandy GRAVEL.			
PT	▽	0.5			SM	Natural	**Silty SAND** - light grey to white, loose.	moist	BH26_1.0	No odour. No PACM.
		1.0								
		1.5					Becoming dark brown at 1.5m.		BH26_2.0	
		2.0								
		2.5								
		3.0					Becoming light brown / yellow at 3m.	sat'd	BH26_3.0	
		3.5								
		4.000					**Silty SAND** - black, fine grained, with few roots, spongy.	sat'd	BH26_4.0	No odour. No PACM.
		4.5								
		5.0			SM		Interbedded with sand from 5m.		BH26_5.0	
		5.5								
		5.900			SP		**SAND** - black, medium grained.	sat'd	BH26_6.0	No odour. No PACM.
							End of Hole at 6.000 m Target depth.			

Additional Comments

▽ Strike Groundwater Level

▼ Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

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Borehole Log

ARCADIS Design & Consultancy for natural and built assets

Hole ID.	**BH28**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Depth (mbgl)	USCS Symbol	Material Type	Material Description	Moisture	Sample ID No.	Observations / Comments
CC	0.100			**CONCRETE HARDSTAND**.			
	0.200		Fill	**FILL** - SAND, brown.			No odour. No PACM.
	0.300			**FILL** - SAND, grey.			No odour. No PACM.
	0.5			**FILL** - SAND, white, loose, medium grained.			No odour. No PACM.
	0.700			**FILL** - SAND, brown, loose, medium grained.		BH28_1.0	No odour. No PACM.
	1.0						
	1.200			**FILL** - SAND, white, loose, medium grained.			No odour. No PACM.
	1.400			**FILL** - SAND, brown, slight grey from 1.5m.			No odour. No PACM.
	1.5			**Silty SAND** - black / dark brown, dense, medium grained.		BH28_2.0	Slight hydrocarbon odour. No PACM.
	1.600	SP					
	2.0						
	2.200	SP		**SAND** - white.			No odour. No PACM.
	2.400			**Silty SAND** - black / dark brown, dense, medium grained.		BH28_3.0	No odour. No PACM.
	2.5	SP			sat'd		
	3.0			**Silty SAND** - grey / brown.	sat'd	BH28_4.0	No odour. No PACM.
	3.200	SP	Natural				
	3.5						
	4.0			**SAND** - golden brown.	sat'd		No odour. No PACM.
	4.200	SP					
	4.5			**PEAT, Sandy** - black, organic.		BH28_5.0	No odour. No PACM.
	4.700	OH					
	5.0			**SAND** - golden brown.	sat'd	BH28_6.0	No odour. No PACM. Brown groundwater.
	5.200						
	5.5	SP					
				End of Hole at 6.000 m Target depth.			

PT

Additional Comments

Strike Groundwater Level

Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tom Keatley** Date: **31/01/2019**
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Borehole Log

ARCADIS Design & Consultancy for natural and built assets

Hole ID.	**MW06**
Project Number:	**10026439**
Hole Depth:	**6.00 m**
Sheet:	**1 of 1**

Project Name:	**Qantas Environmental Site Assessment**	Date:	**31/01/2019**
Location / Site:	**297 King Street, Mascot NSW**	Ground Level :	**N/A**
Client:	**Qantas Airways Limited**	Top of Casing :	**N/A**
Drilling Company:	**Terratest Pty Ltd**	Easting:	**N/A**
Drill Method:	**CC, PT**	Northing:	**N/A**
		Zone:	**N/A**

Method	Water Level	Depth (mbgl)	RL (mAHD)	Graphic Log	USCS Symbol	Material Type	Material Description	Moisture	Sample ID No.	Observations / Comments
CC		0.130					**CONCRETE HARDSTAND**.			
		0.300				Fill	**FILL** - Reworked Silty SAND, light brown.			No odour. No PACM.
		0.500					**FILL** - SAND, white, loose, coarse grained.			No odour. No PACM.
		1.0					**FILL** - SAND, orange / brown, loose, coarse grained.		MW06_1.0	No odour. No PACM.
		1.100					**FILL** - SAND, brow / black.			No odour. No PACM.
		1.300					**FILL** - SAND, white.			No odour. No PACM.
		1.5								
		1.700					**SAND** - black, medium grained, possibly peat, becomes lighter in colour with depth.	moist		No odour. No PACM.
	▽	2.0			SP			sat'd	MW06_2.0	
		2.500					**SAND** - light brown, dense, medium grained.	sat'd		No odour. No PACM.
PT		3.0							MW06_3.0	
		3.5			SP	Natural	Rootlets at 3.6m. Slightly clayey (peat), organic layers (black lines) from 3.7-3.9m.			
		4.0							MW06_4.0	
		4.5								
		4.900								
		5.0			SP		**SAND** - black.	sat'd	MW06_5.0	No odour. No PACM.
		5.200			SP		**SAND** - golden.	sat'd		No odour. No PACM.
		5.500			OH		**Sandy PEAT** - black.	sat'd		Slight sulfur odour. No PACM.
							End of Hole at 6.000 m Target depth.		MW06_6.0	

Additional Comments

▽ Strike Groundwater Level

▼ Static Groundwater Level

Method

HA	Hand Auger	MR	Mud Rotary
CC	Concrete Corer	PT	Push Tube
CB	Concrete Breaker	AH	Air Hammer
SFA	Solid Flight Auger	EX	Excavator
HFA	Hollow Flight Auger	DC	Diamond Coring
SPT	Standard Penetometer Test	WB	Wash Bore
PCD	Polycrystalline Diamond		

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Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

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