Phase 2 Environmental Site Assessment, Parcel 5

Prepared for:
Hydro Aluminium Kurri Kurri Pty Ltd

Prepared by:
ENVIRON Australia Pty Ltd

Date:
April 2015

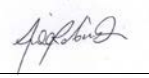
Project Number:
AS130348

ENVIRON

Prepared by:

Name: Kirsty Greenfield
Title: Environmental Scientist
Phone: 02 4962 5444
Email: kgreenfield@environcorp.com
Signature:  Date:21/4/15

Authorised by:

Name: Fiona Robinson
Title: Manager - Hunter
Phone: 02 4962 5444
Email: frobinson@environcorp.com
Signature:  Date:21/4/15

VERSION CONTROL RECORD

Document File Name	Date Issued	Version	Author	Reviewer
AS130348 Parcel5_Phase 2_D1	April 2014	Draft 1	K Greenfield	F Robinson
AS130348 Phase 2 ESA Parcel 5	May 2014	Final	K Greenfield	F Robinson
AS130348 Phase 2 ESA Parcel 5_FINAL_V1	April 2015	Final	K Greenfield	F Robinson

Contents

List of Figures

List of Tables

List of Appendices

Acronyms and Abbreviations

ACM	Asbestos Containing Materials
AHD	Australian Height Datum
ALS	Australian Laboratory Services
BGL	Below Ground Level
CT	Certificate of Title
DEC	NSW Department of Environment and Conservation, now EPA
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EPA	NSW Environment Protection Authority
ESA	Environmental Site Assessment
F	Fluoride
GMU	Groundwater Management Unit
GPS	Global Positioning System
Ha	Hectare
HIL	Health Investigation Level
HSL	Health Screening Level
HRA	Health Risk Assessment
km	Kilometres
LOR	Limit of Reporting
m	Metres
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
m AHD	Metres relative to the Australian Height Datum
m BGL	Metres below ground level
mg/L	Micrograms per Litre
NATA	National Association of Testing Authorities
ND	Not Detected
NEHF	National Environmental Health Forum
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NSW	New South Wales
n	Number of Samples
OH&S	Occupational Health & Safety
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
UCL	Upper Confidence Limit
µg/L	Micrograms per Litre
VENM	virgin excavated natural material
-	On tables is "not calculated", "no criteria" or "not applicable"

Executive Summary

ENVIRON completed a Phase 2 Environmental Site Assessment at Parcel 5, located in the south of the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter. Parcel 5 is owned by Hydro Aluminium and currently comprises dense undeveloped bushland.

The objectives of the assessment were to assess the potential for contamination at Parcel 5 based on historical and current landuse and to assess the suitability of Parcel 5 for the proposed Environmental Conservation (E2) and Business Park (B7) land use.

A Phase 1 Environmental Site Assessment has previously been completed for the Hydro owned lands including Parcel 5 (ENVIRON (22 October 2013) Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter). The Phase 1 identified that contamination of Parcel 5 may have occurred from dust deposition due to the proximity of the Hydro smelter and illegal dumping due to the remoteness of the area.

To assess the potential for illegal waste dumping and for soil contamination a site walkover was completed and surface soil samples were collected from across the parcel. The walkover identified the presence of illegally dumped domestic waste, a rusted gas cylinder and car bodies. Surface soil samples from across Parcel 5 were analysed for soluble fluoride and found concentrations to below the preliminary screening level for the current and proposed landuse.

Parcel 5 is suitable for the current land use and for the purposes of Environmental Conservation (E2) and Business Park (B7) land use.

Hydro has separately engaged a NSW EPA-accredited Site Auditor to issue a Site Audit Statement certifying that the site is suitable for the proposed use.

ENVIRON considers that interim management is required to remove of illegally dumped wastes and secure the site, as follows:

- Dumped wastes at Parcel 5, including a rusted gas cylinder, two car bodies and domestic waste products should be removed and disposed of for aesthetic reasons.
- The portion of new fence in the north western corner that was incomplete should be completed to prevent unauthorised access to the parcel.

1 Introduction

1.1 Background

This report presents the findings of a Phase 2 Environmental Site Assessment undertaken on part of the Hydro Aluminium Kurri Kurri Pty Limited (Hydro) owned land known as Parcel 5. Parcel 5 is located off Bishop's Bridge Road, Loxford, New South Wales (2326). The location of Parcel 5 is shown in **Figure 1**. The site is currently vacant bushland with no current use.

The work has been performed at the request of Hydro Aluminium Kurri Kurri Pty Limited (the "Client").

Hydro is evaluating options for the divestment of land parcels for a range of proposed uses following the closure of the smelter in May 2014. A Rezoning Masterplan has been developed that identifies Parcel 5 to comprise land suitable for environmental conservation (E2) and business park (B7) land use.

A Phase 1 Environmental Site Assessment has previously been prepared for all Hydro owned lands and evaluated the potential for contamination. The Phase 1 identified that contamination of Parcel 5 may have occurred from dust deposition due to the proximity of the Hydro smelter and from illegal dumping due to the remoteness of the area.

It is noted that at the time of the fieldwork, this land parcel was named Employment Land Subarea 5 and as such the soil samples reference this name. Since this time the parcel has been renamed Parcel 5.

The location of Parcel 5 in the context of the Rezoning Masterplan and proposed future land use is shown in **Figure 2**.

1.2 Objectives and Scope of Work

The objectives of the assessment were to assess the potential for contamination at Parcel 5 based on historical and current land use and to assess the suitability of Parcel 5 for the purposes of environmental conservation (E2) and business park (B7) land use.

The scope of work performed to meet the objectives comprised:

- A review of available information relating to land use to assess the potential for soil, groundwater or surface water contamination arising from historic and current activities;
- A review of published geological, hydrogeological and hydrological data to establish the environmental setting and sensitivity;
- Field work comprising:
  - Collection of surface soil samples to provide a coarse grid assessment to assess the potential for dust deposition from the smelter operations;
  - A site walkover to evaluate other potential locations of buried waste or illegal dumping.
- Data interpretation including comparison against relevant guidelines and a discussion of the findings in terms of human health and environment risk under the current and future land use scenarios.

- Review of options available for remediation or management to render Parcel 5 suitable for the proposed land use, if required. It is noted that the site is currently fenced and there is no current land use.

2 Site Description

2.1 Site Location

Parcel 5 is owned by Hydro Aluminium Kurri Kurri Pty Limited and is located approximately 35km north west of the city of Newcastle and 150km north of Sydney, in the suburb of Loxford, Kurri Kurri, New South Wales, Australia. Parcel 5 is accessed from Hart Road. The location of Parcel 5 is shown in **Figure 1**.

Parcel 5 is located within the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter, to the south west of the smelter. The Buffer Zone is an area of land surrounding the smelter that provides a buffer between the smelter and surrounding communities. Parcel 5 comprises dense undeveloped bushland.

Parcel 5 is located within the Cessnock Local Government Area and is zoned RU2 – Rural Landscape under the Cessnock Local Environment Plan.

Parcel 5 is approximately 82 hectares (ha) and comprises the lot numbers and development plans listed in **Table 1**:

Table 1: Lot and Development Plans for Parcel 5.

Subarea	Lot/ DP	Area (ha)	Total Area (ha)
Parcel 5	Lot 16 DP1082775 Pt 2	82.2	82.2

Land uses surrounding Parcel 5 are as follows:

- North east: Hunter Expressway then dense bushland;
- South west: Hart Road the rural residential land;
- West: Bishops Bridge Road then farmland.

Parcel 5 is located approximately 400m to the south west of the smelter site boundary.

2.2 Site Setting

2.2.1 Topography

Parcel 5 is located in an area of the Buffer Zone that is of higher elevation at approximately 30 mAHD. The topography of the site is relatively flat, with a gentle slope to the north. The natural topography slopes towards the north of the site, where an ephemeral tributary of Black Waterholes Creek bisects the site. The creek was dry at the time of the investigations.

2.2.2 Regional Geology

According to the review of the regional geology described on the Sydney Basin Geological Sheet, Parcel 5 is underlain by siltstone, marl and minor sandstone from the Permian aged Rutherford Formation (Dalwood Group) in the Sydney Basin.

Undifferentiated Quaternary alluvium occurs on the surface of Parcel 5 associated with surface water bodies. Quaternary sediments which are associated with Black Waterholes Creek, an unnamed tributary of which flows through the site; Swamp Creek (approximately 200m south east of Parcel 5) and the Hunter River consist of gravel, sand, silt and clay.

2.2.3 Site Hydrology

Surface water from Parcel 5 discharges primarily via infiltration and overland flow to Black Waterholes Creek via an unnamed tributary which flows through the site. The creek was observed to be dry at the time of the investigation. Black Waterholes Creek discharges into Wentworth Swamp, which in turn discharges to the Hunter River approximately 11km northeast of Parcel 5 near Maitland.

The Wentworth Swamp system is within the Fishery Creek Catchment, where declining stream water quality and a reduction in diversity of native plants and animals has occurred due to population growth and development pressures in the last ten years (Hunter-Central Rivers Catchment Management Authority).

2.2.4 Regional Hydrogeology

Regional groundwater is expected to follow topography and flow northeast towards the surface water bodies that discharge to the Hunter River. Locally, groundwater beneath Parcel 5 is expected to flow north east and south west towards the centre of the site, where a tributary of Black Waterholes Creek bisects the site.

According to the NSW Office of Environment and Heritage (Natural Resource Atlas), there are 21 licensed groundwater abstractions (bores) located within 2km of Parcel 5. The majority of the groundwater bores are located within the aluminium smelter and buffer zone.

Information for 11 bores located in a 2km radius from Parcel 5 has been included in **Appendix A**. The bores are used for monitoring purposes. No further information, such as depth to water or logging information was provided.

The Hunter River Alluvium Groundwater Management Unit (GMU) is an important groundwater resource to the region. Groundwater extraction for irrigation, urban supply, drought supply, stock, domestic and commercial/ industrial use occurs, with volumes in excess of 10,000ML per annum extracted from the Hunter River Alluvium GMU. Aquifer storage and recovery is also an important use of this GMU. It is noted that the Hunter River GMU is not the primary drinking water supply in the region, although the protection of drinking water is a water quality objective for the Hunter River (NSW Water Quality and River Flow Objectives)(www.environment.nsw.gov.au/ieo/Hunter/index.htm).

2.3 Site Sensitivity

The sensitivity of Parcel 5 with respect to surface water and groundwater is considered to be moderate based on the following:

- Surface water and groundwater discharge into an unnamed tributary of Black Waterholes Creek, which bisects Parcel 5, and discharges to the Hunter River via Wentworth Swamp within the Fishery Creek Catchment, approximately 11km northeast of Parcel 5 near Maitland.

- Declining stream water quality and a reduction in diversity of native plants and animals has occurred within the Fishery Creek Catchment and water quality down gradient of Parcel 5 has been impacted by historical coal mining;

- The Hunter River GMU is used for irrigation, urban supply, drought supply, stock, domestic and commercial/ industrial use but it is not the main drinking water supply in the region.

3 Site History

Site history investigations included in the Phase 1 ESA for the Hydro Aluminium Kurri Kurri Smelter, dated 26 August 2013 provided the following historical information relevant to Parcel 5:

- Earliest records (aerial photograph in 1951) showed Parcel 5 comprised bushland.
- No changes to development, clearing or use of Parcel 5 were observed in the historical aerial photograph review and Parcel 5 remains dense, undeveloped bushland.
- Parcel 5 is located approximately 400m south west of the smelter boundary and may be impacted from smelter dust deposition.
- The remoteness of Parcel 5 and surrounding bushland may also give rise to illegal dumping though it is noted that the Buffer Zone area is fenced and regularly monitored by Hydro personnel.

A site plan is included in **Figure 3**.

4 Sampling and Analytical Quality Plan

4.1 Potential Areas and Contaminants of Concern

Based on Parcel 5 historical information as discussed in **Section 3**, the following areas of concern were identified:

- Smelter dust deposition.
- Illegal dumping.

Potential contaminants of concern associated with the range of previous site activities are:

- Asbestos;
- Fluoride.

4.2 Data Quality Objectives and Data Quality Indicators

Data quality objectives (DQOs) and Data Quality Indicators (DQIs) were developed by ENVIRON using the US EPA seven-step DQO process. Completing the seven-step process helps to define the purpose of the assessment and the type, quality and quantity of data needed to inform decisions relating to the assessment of site contamination.

The seven-step DQO process and DQIs are included in **Appendix F**.

4.3 Sampling Design

The sampling design was optimised following the development of DQOs and DQIs. The sampling design is outlined below. ENVIRON notes that the historical site activities indicate potential contamination to surface soils only. No potential contamination sources to subsurface soils, surface water or groundwater have been identified.

4.3.1 Fluoride

To assess the potential for fluoride in soil from dust deposition from the Hydro Aluminium Kurri Kurri Smelter, surface soil samples were collected at a rate of one sample per 5ha.

The sample density is lower than that suggested in Table A of NSW EPA (1995) Contaminated Sites: Sampling Design Guidelines. The density is considered adequate for the purposes of this investigation for the following reasons:

- aerial dust deposition is likely to be relatively consistent over the surface of the parcel and therefore sampling on a low density provides a screening level assessment of impacts from dust deposition; and

- in the event that elevated or variable fluoride concentrations are identified, additional sampling will be completed.

Samples were collected by trowel from surface soils in accessible areas of Parcel 5. As Parcel 5 comprises inaccessible dense bushland, samples were collected around the perimeter of the bushland and in open areas, where accessible. Sample locations were logged by GPS.

Soil samples were placed into laboratory-supplied paper bags and stored in an ice-filled cooler for transportation to the laboratory. Soil samples were transported to the laboratory under chain of custody conditions. Intra-laboratory duplicate soil samples were collected at a rate of 10%.

Soil samples were analysed for soluble fluoride, as this is the portion of total fluoride that is available for uptake in receptors including biota, flora, fauna and humans. The laboratory was NATA accredited for the analysis.

4.3.2 Asbestos

To assess the potential for asbestos and other illegally dumped wastes to be present at Parcel 5, a site walkover of accessible areas was completed. ENVIRON consider that dense bushland that is not readily accessible by foot is unlikely to have been accessed for waste dumping.

The location and type of dumped wastes were detailed on Field Information Sheets and logged by GPS. Where asbestos or asbestos containing materials was confidently identified by the experienced field personnel, no sampling was completed. Where there was uncertainty about the nature of the materials, a sample was collected for laboratory analysis. Fragments were collected into a zip-lock bag using dedicated disposable gloves. Fragments were analysed for asbestos identification by a laboratory NATA accredited for the analysis.

5 Basis for Assessment Criteria

5.1 Soil

The criteria proposed for the assessment of soil contamination were sourced from the following references:

- NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM).

The objective of the Phase 2 ESA is to assess soil and surface water contamination at Parcel 5 in relation to risks posed to human health and the environment under the proposed future land use of rural landuse. As the contaminants of concern are fluoride and asbestos, guidelines for these contaminants under a rural and commercial/industrial land use scenario are provided below.

The Health Screening Levels (HSLs) for asbestos are applicable for assessing human health risk via the exposure pathway of inhalation of airborne asbestos and are presented in **Table 2.** The HSLs are generic to all soil types. As there is no HSL for rural landuse, the HSL for Residential A will be used and is conservative for both rural and commercial/ industrial land use.

Table 2: Health screening levels for asbestos contamination in soil (w/w)				
Form of asbestos	**Residential A[1]**	**Residential B[2]**	**Recreational C[3]**	**Commercial/ Industrial D[4]**
Bonded ACM	0.01%	0.04%	0.02%	0.05%
FA and AF[1] (friable asbestos)	0.001%			
All forms of asbestos	No visible asbestos for surface soil			

1. The screening level of 0.001% w/w asbestos in soil for FA and AF (i.e. non-bonded/friable asbestos) only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres.

NEPM (2013) do not provide criteria for fluoride in soils in Australia. ENVIRON (2013) conducted a preliminary level Human Health Risk Assessment (HRA) specific to fluoride in order to derive a specific preliminary screening level for fluoride for the Hydro Aluminium Kurri Kurri Smelter . The screening levels protective of the range of human receptors are provided in **Table 3**.

Table 3: Site Specific Soil Assessment Criteria (mg/kg) for Fluoride	
Preliminary screening levels	
Land Use	**Preliminary screening level**
Residential landuse	F 400mg/kg
Recreational landuse	F 1200mg/kg
Commercial/ Industrial landuse	F 17,000mg/kg

Soil investigation results for the samples taken from a grid formation across Parcel 5 have been compared against the residential land use screening level. The fluoride 'residential land use' screening level is considered to be suitably protective of both 'residential' and 'rural' land use because the exposure pathways (including vegetable ingestion) and behavioural assumptions (e.g. soil ingestion rate) for a child are considered to be identical under residential and rural land use scenarios.

There is a possibility that the rural plots may contain a low density of domestic livestock such as poultry and goats, however there is limited evidence of fluoride accumulation in milk and edible tissues of animals fed high levels of fluorides (ATSDR, 2003; NAS, 1971). Rather, fluoride accumulates primarily (up to approximately 99%) in the skeletal tissues of terrestrial animals that consume fluoride-containing foliage (WHO, 1997; ATSDR, 2003). This assumption is supported by site-specific data collected during the 29th annual cattle survey conducted in March 2012 on cattle located within the site's buffer zone, and surrounding areas (AECOM, 2013). The results of this survey concluded that cattle has had little or no exposure to excess environmental fluoride; skeletal fluoride levels decreased compared to 2011 levels, with all fluoride measurements below the toxic threshold; and all cattle examined were in good health and body condition. Consequently, the residential screening level is considered to be suitably protective of rural land use that may contain a low density of domestic livestock.

Consistent with the guidance provided in the NEPM, the data was assessed against the above adopted site guidelines by:

- Comparing individual concentrations against the relevant guidelines and if discrete samples are in excess of the relevant guideline then;
- Comparing the 95% upper confidence limit (UCL) of mean against the relevant guideline also ensuring that:
    - the standard deviation of the results is less than 50% of the relevant investigation or screening level, and
    - no single value exceed 250% of the relevant investigation or screening level.

6 Results

6.1 Site Walkover

A site walkover was completed to identify areas of environmental concern, such as illegally dumped wastes and fill at Parcel 5. The entrance to Parcel 5 is from Bishops Bridge Road, which borders the western boundary of the parcel. The parcel is almost fully fenced. A new fence has been constructed along the boundary with the Hunter Expressway and a portion of this fence in the north western corner was incomplete.

Parcel 5 comprised dense bushland. A dry creek bed was identified in the central portion of the parcel on a north/ south axis. An access track extends from the gate on Bishops Bridge Road east across the parcel, with a smaller track extending north from this track. A short access track was identified extending east from the south western corner of the parcel.

Illegally dumped wastes were identified on the southern side of the main access track, just past the smaller track extending north. The dumped wastes included domestic products such as a baby capsule, a washing basket, a pram, fitness equipment and other plastic items. A rusted gas cylinder was also observed adjacent to the track in this area.

A car body was observed in the dry creek bed on the northern side of the main access track. Another car body was observed on the smaller track extending north from the main access track.

No potentially asbestos containing materials were identified during the walkover.

No other signs of disturbed land or of land filling were observed during the walkover.

Photographs are included in **Appendix B**. Field Information Sheets are included in **Appendix C**.

6.2 Soil Investigations

Eight surface soil samples were collected from across Parcel 5 as per the sampling design to assess the potential for fluoride in soil from dust deposition from the Hydro Aluminium Kurri Kurri Smelter. Sample locations are shown in **Figure 3**.

A generalised lithology of the surface soils encountered at Parcel 5 is as follows:

- Topsoil: Silt and silty clay, brown, with some cobbles, slightly moist.

6.3 Soil Results

A summary of the soil results is presented in **Table 4**. Laboratory tables are included in **Appendix D** and laboratory reports are included in **Appendix E**.

Table 4: Summary of Soil Results				
Analyte	**No. of Samples**	**Maximum Concentration (mg/kg)**	**Criteria Exceeded (mg/kg)**	**No. exceeding Site Criteria**
Fluoride	8	3	400	0

The results of surface soil sampling for fluoride demonstrate that surface soils at Parcel 5 have not been impacted by stack particulate fallout from the Hydro Aluminium Smelter.

6.4 Quality Assurance/ Quality Control

A quality assurance assessment for this report is presented in **Appendix F**. An assessment was made of data completeness, comparability, representativeness, precision and accuracy based on field and laboratory considerations, as outlined in NSW DEC (2006) and NSW EPA (2007) guidelines. Overall it is considered that the completed investigation works and the data are of suitable quality to meet the project objectives.

7 Site Characterisation

7.1 Conceptual Site Model

Parcel 5 consists of dense undeveloped bushland and is bound by the Hunter Expressway on the north eastern boundary, Hart Road, then rural residential properties on the south eastern boundary and Bishops Bridge Road then farmland on the western boundary. Parcel 5 is located in the southern portion of the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter.

Historical information indicates that the bushland on Parcel 5 has not been developed and no evidence of development was identified during the site walkover.

Parcel 5 has not been affected by dust deposition of fluoride from the Hydro Aluminium Kurri Kurri Smelter, with fluoride concentrations in surface soil below the preliminary screening level applicable for the proposed rural landuse. It is noted that there is currently no source of aerial fluoride emissions, as the smelter is in a care and maintenance mode.

Two car bodies and illegally dumped domestic waste were identified during the walkover, indicating that accessible areas of Parcel 5 close to the access tracks are susceptible to illegal dumping brought from off site. The approximate locations of the car bodies and dumped wastes are shown in **Figure 3**.

No soil contamination issues were identified on Parcel 5.

8 Conclusions and Recommendations

This report presents the findings of a Phase 2 Environmental Site Assessment undertaken on part of the Hydro Aluminium Kurri Kurri (Hydro) owned land known as Parcel 5. Parcel 5 is a rural property comprising approximately 82ha and is accessed from Bishop's Bridge Road, Loxford and located within the buffer zone and to the south west of the Hydro Aluminium Kurri Kurri Smelter.

Parcel 5 comprises dense undeveloped bushland.

The objectives of the assessment were to assess the potential for contamination at Parcel 5 based on historical and current landuse and to assess the suitability of Parcel 5 for the proposed Environmental Conservation (E2) and Business Park (B7) land use.

A Phase 1 Environmental Site Assessment has previously been completed for the Hydro owned lands including Parcel 5 (ENVIRON (22 October 2013) Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter). The Phase 1 identified that contamination of Parcel 5 may have occurred from dust deposition due to the proximity of the Hydro smelter and illegal dumping due to the remoteness of the area.

To assess the potential for illegal waste dumping and for soil contamination a site walkover was completed and surface soil samples were collected from across the parcel. The walkover identified the presence of illegally dumped domestic waste, a rusted gas cylinder and car bodies. Surface soil samples from across Parcel 5 were analysed for soluble fluoride and found concentrations to below the preliminary screening level for the current and proposed landuse.

Parcel 5 is suitable for the current land use and for the purposes of Environmental Conservation (E2) and Business Park (B7) land use.

Hydro has separately engaged a NSW EPA-accredited Site Auditor to issue a Site Audit Statement certifying that the site is suitable for the proposed use.

ENVIRON considers that interim management is required to remove of illegally dumped wastes and secure the site, as follows:

- Dumped wastes at Parcel 5, including a rusted gas cylinder, two car bodies and domestic waste products should be removed and disposed of for aesthetic reasons.
- The portion of new fence in the north western corner that was incomplete should be completed to prevent unauthorised access to the parcel.

9 References

AECOM. 2013. Hydro Aluminum – 2012 Annual Environmental Management Review. 2 June 2013;

ANZECC & NHMRC (1992) Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites;

ENVIRON (2013) Preliminary Screening Level, Health Risk Assessment for Fluoride and Aluminium, Part of the Kurri Kurri Aluminium Smelter, Hart Road, Loxford;

ENVIRON (2013) Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter;

Hunter Catchment Management Trust (2000) Wallis and Fishery Creeks Total Catchment Management Strategy;

National Academy of Sciences. 1971a. Biologic effects of atmospheric pollutants: Fluorides. Washington, DC: National Academy of Sciences, National Research Council, Committee on Biologic Effects of Atmospheric Pollutants, 239.

National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure (NEPM);

NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme (Second Edition);

NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination;

NSW DECC (2008) Waste Classification Guidelines;

World Health Organisation (1997) Environmental Health Criteria for Fluorides and Fluorosis. 2nd ed. Internal Technical Report, International Program on Safety, WHO, Geneva.

10 Limitations

ENVIRON Australia prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Pty Ltd dated 18 September 2013 and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of Parcel 5. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous.

Site conditions may change over time. This report is based on conditions encountered at Parcel 5 at the time of the report and ENVIRON disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent ENVIRON's professional judgment based on information made available during the course of this assignment and are true and correct to the best of ENVIRON's knowledge as at the date of the assessment.

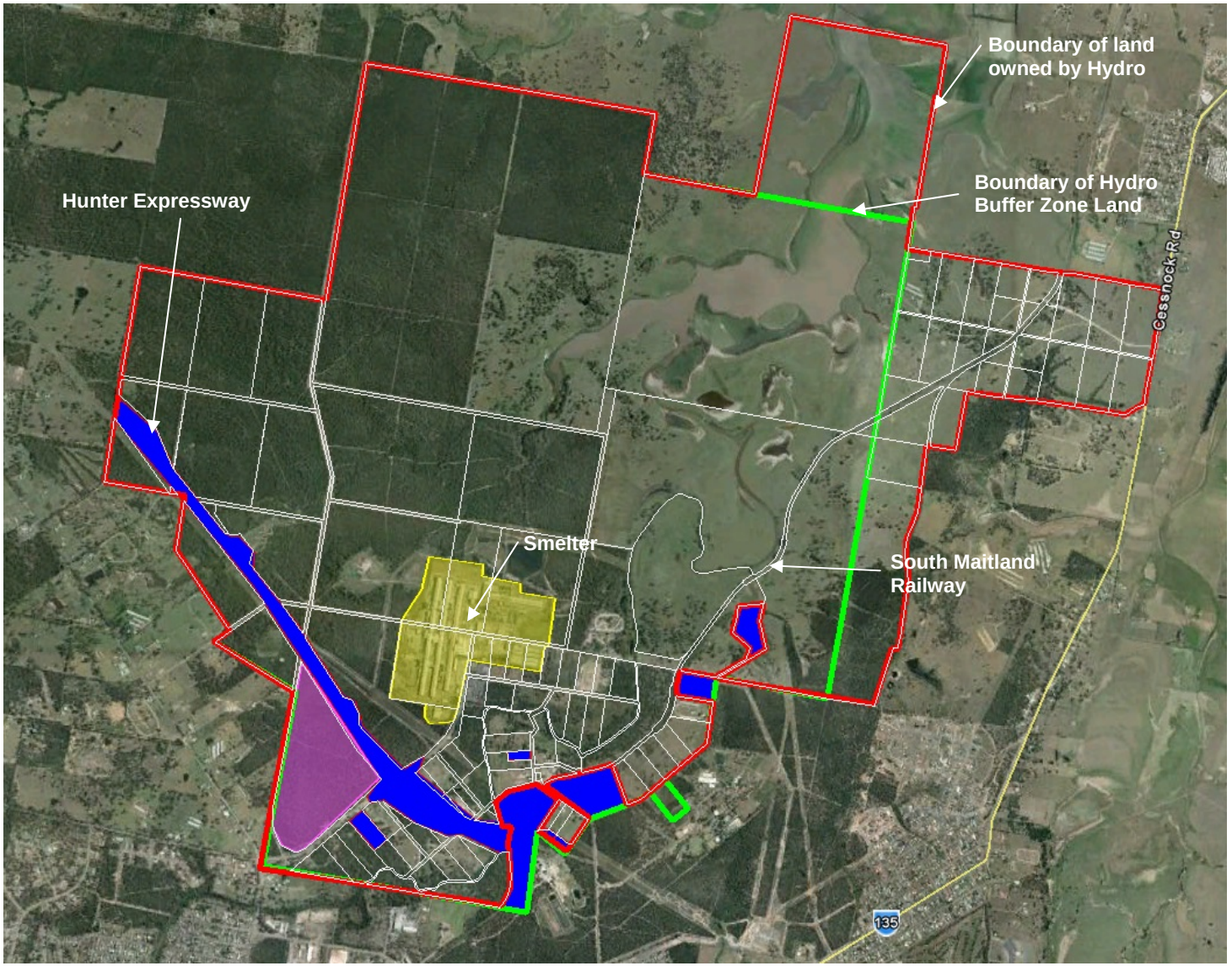
ENVIRON did not independently verify all of the written or oral information provided to ENVIRON during the course of this investigation. While ENVIRON has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to ENVIRON was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

10.1 User Reliance

This report has been prepared exclusively for Hydro Aluminium Kurri Kurri Pty Ltd and may not be relied upon by any other person or entity without ENVIRON's express written permission.

Figures



Google Earth Pro: Licence valid till 5/2/15.

Approximate Location of land owned by Hydro

Approximate Location of Buffer Zone

Land not owned by Hydro

Parcel 5

N

Hydro Aluminium Kurri Kurri – Phase 2 Environmental Site Assessment

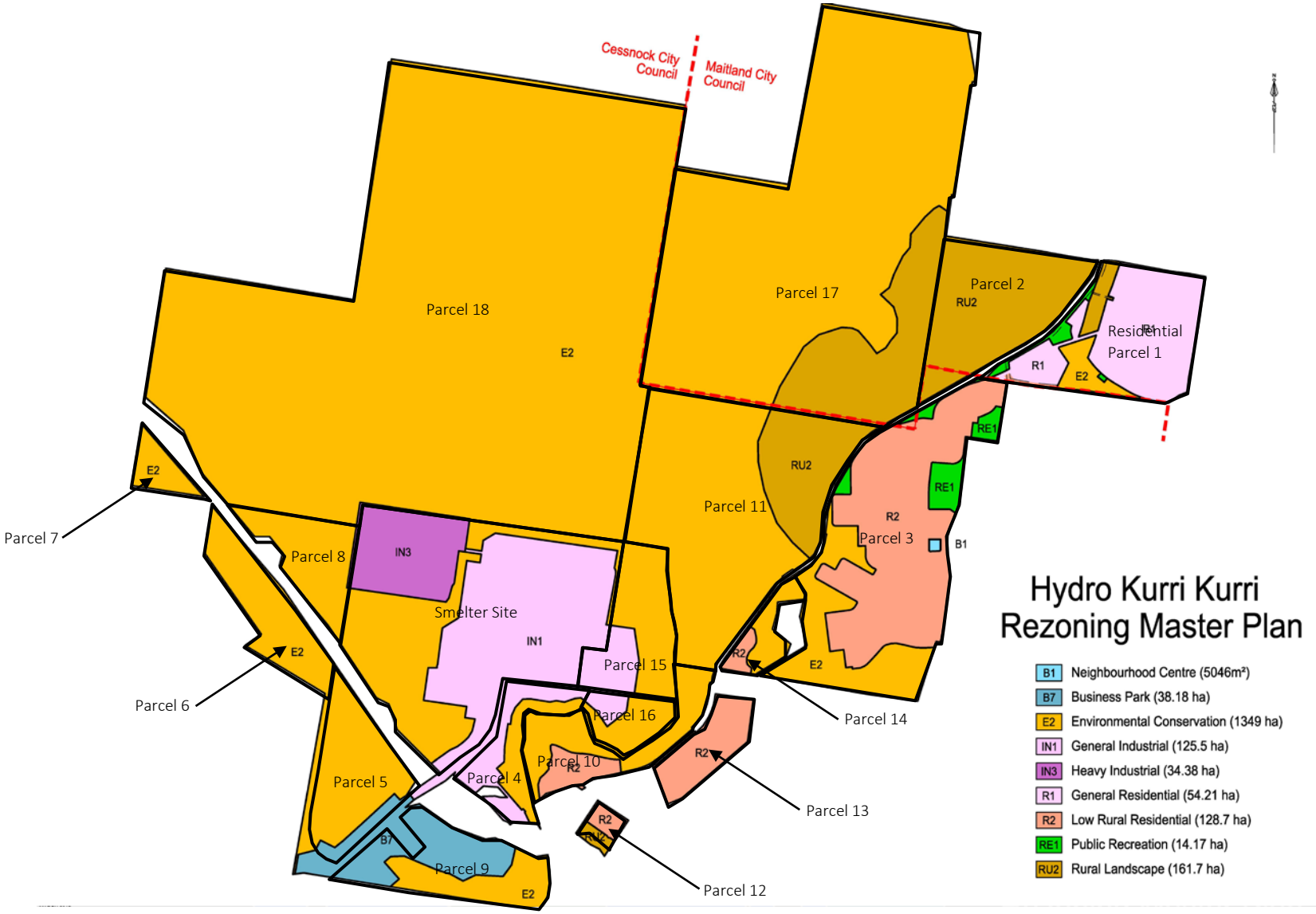
Parcel 5 - Site Location

ENVIRON

JOB NO: AS130348

DATE: March 2014

FIGURE 1



Proposed Land Zonings taken from
Hydro Kurri Kurri Preliminary Masterplan dated 26/3/15

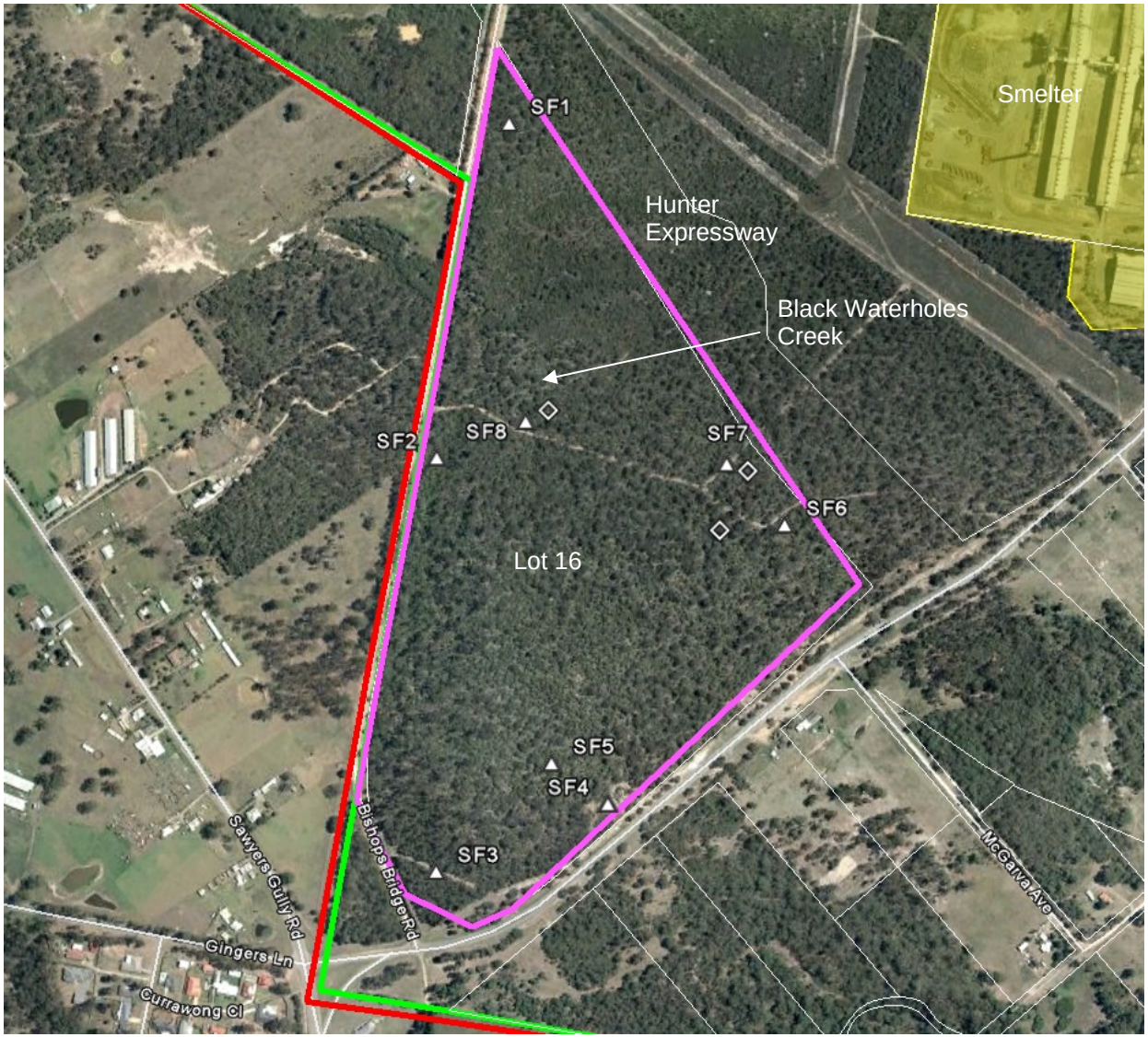
Hydro Aluminium Kurri Kurri – Phase 2 Buffer Zone investigations	Land Parcels and Proposed Land Zoning

ENVIRON

JOB NO: AS 130348

DATE: March 2015

FIGURE 2



KEY:

- Site Boundary
- △ SF — Soil Sample for Fluoride Analysis
- ◇ — Domestic waste and car bodies

N

Hydro Aluminium Kurri Kurri – Phase 2 Environmental Site Assessment

Parcel 5 – Site Layout and Sampling Locations

ENVIRON

JOB NO: AS130348

DATE: March 2014

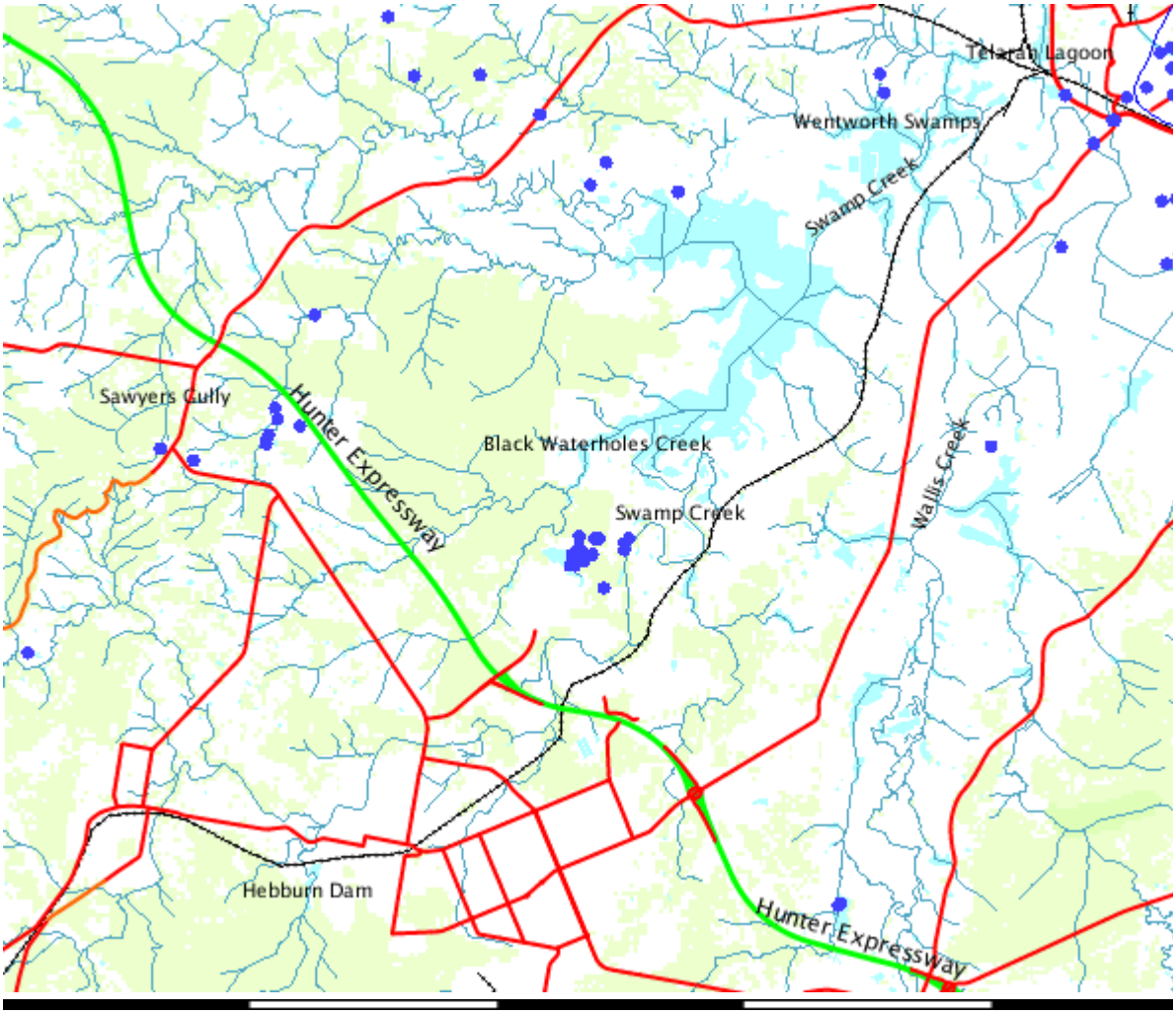
FIGURE 3

Appendix A

Surrounding Groundwater Bores

Groundwater Bores near Employment Land Subarea 5

Map created with NSW Natural Resource Atlas - http://www.nratlas.nsw.gov.au
Tuesday, January 07, 2014



0 14 Km

Legend

Symbol	Layer	Custodian
	Cities and large towns renderImage: Cannot build image from features	
Cowra	Populated places renderImage: Cannot build image from features	
	Towns	
	Groundwater Bores	
	Catchment Management Authority boundaries	
	Major rivers	

Topographic base map

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079088

Works Details (top)

GROUNDWATER NUMBER	GW079088
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371306.00
EASTING	358054.00
LATITUDE	32 47' 13"
LONGITUDE	151 29' 3"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079090

Works Details (top)

GROUNDWATER NUMBER	GW079090
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371368.00
EASTING	358105.00
LATITUDE	32 47' 11"
LONGITUDE	151 29' 5"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079092

Works Details (top)

GROUNDWATER NUMBER	GW079092
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371429.00
EASTING	358078.00
LATITUDE	32 47' 9"
LONGITUDE	151 29' 4"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079093

Works Details (top)

GROUNDWATER NUMBER	GW079093
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371460.00
EASTING	358078.00
LATITUDE	32 47' 8"
LONGITUDE	151 29' 4"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079094

Works Details (top)

GROUNDWATER NUMBER	GW079094
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371462.00
EASTING	358234.00
LATITUDE	32 47' 8"
LONGITUDE	151 29' 10"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079096

Works Details (top)

GROUNDWATER NUMBER	GW079096
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371707.00
EASTING	358152.00
LATITUDE	32 47' 0"
LONGITUDE	151 29' 7"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079097

Works Details (top)

GROUNDWATER NUMBER	GW079097
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371679.00
EASTING	358335.00
LATITUDE	32 47' 1"
LONGITUDE	151 29' 14"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079099

Works Details (top)

GROUNDWATER NUMBER	GW079099
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371003.00
EASTING	358448.00
LATITUDE	32 47' 23"
LONGITUDE	151 29' 18"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079101

Works Details (top)

GROUNDWATER NUMBER	GW079101
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371680.00
EASTING	358387.00
LATITUDE	32 47' 1"
LONGITUDE	151 29' 16"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079102

Works Details (top)

GROUNDWATER NUMBER	GW079102
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371685.00
EASTING	358725.00
LATITUDE	32 47' 1"
LONGITUDE	151 29' 29"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, January 6, 2014

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW079103

Works Details (top)

GROUNDWATER NUMBER	GW079103
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	(Unknown)
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6371530.00
EASTING	358675.00
LATITUDE	32 47' 6"
LONGITUDE	151 29' 27"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

no details

Licensed (top)

no details

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Appendix B

Site Photographs

Photo 1: Woodland and scrub in vicinity of sampling site EMP5-SF5. Typical of vegetation covering

Photo 2: Dumped municipal waste, approximately 300m east of Bishops Bridge Road access gate.

.

Photo 3: Photograph of the dam in the south eastern corner of Lot 15.

Appendix C

Field Information Sheets

Site Walkover Checklist

Project No.:	AS130348	**Date and Time:**	31/10/13 12:15-14:00
Land Parcel:	EMP5	**Weather:**	Fine 26°C. Rain 2 days prior
Lot and DP:	EMP5 Lot16 DP1082775	**Environ Personnel:**	M. Manditch

Site Description Pt 2

Topography	Eucalypts & scrub. Mainly level. Dry creek bed ~~with slope to north.~~ from S to NE.
Surface Geology	Brown soil, some sand near creek. Sandstone near Hart Rd
Fill evident?	No
Hummocky ground?	No
Structures on site?	Nil
Location of structures	N/A
Building materials used in structures	N/A
Asbestos debris on site?	None found
Location of asbestos debris?	None found
Volume of asbestos debris?	None found

GPS Locations of Interest Taken from Google Earth.

Point of Interest	Easting	Northing
Dumped household goods, soil and gas cylinder.	-32.796352	151.472453
Dumped car body in creek bed	-32.795070	151.469530
Dumped car body in bushland	-32.795790	151.472627

Description of Photographs Taken

- Each sampling site photographed 1647 → 1651, 1670, 1674.
- Typical woodland and scrub scene. 1658, 1660
- Dumped municipal waste 1661 → 1666
- Dumped gas cylinder 1667 → 1669
- Dumped car body 1675

Miscellaneous Field Comments

Soil samples for fluoride analysis collected from 8 locations.
10 x 10 m walkover west of Hart Rd
-32.799608, 151.470325.

Mk. M. Manditch

ENVIRON

PROJECT SAMPLE REGISTER

Project No	AS130348	**Project Name**	Hydro buffer zone	**Date commenced**	31/10/13
Location	Kurri Kurri EMP5 EMP7	Refer to Daily log for weather details		**Date completed**	31/10/13

Rain 2 days prior. All samples had some moisture, still low %.

#	Sample Name	Sampled by	Easting from Google Earth	Northing	Depth mm	**Description** (soil type, moisture, colour, foreign content, signs of contamination) or 'refer to log'	Quality Assurance	**Comments** (eg lab analyse)
1	EMP7-SF1	MM	-32.777678	151.457091	10	Cleared away grass. Downstream small alluvial soil, drainage line. Loose soil.		dan. Under power line. No trees
2	EMP7-SF2		-32.780774	151.460087	5	No trees. Under power line. Lichen. Spiky bushes. No leaf litter		
3	EMP7-SF3		-32.780808	151.458031	10	Mod coverage trees & scrub. Loose soil. Soil brown	Leaf litter	
4	EMP7-SF4		-32.778908	151.456866	10	Off track. Heavy coverage trees & scrub. Leaf litter. Soil red colouring		
5	EMP7-asbestos	adjacent			sampled 10	Soil adjacent to dumped roofing panels		
6	EMP5-SF1	MM	-32.791569	151.469440	10	Mod scrub & tree coverage. Lichen, brown soil. Moderately compacted		
7	EMP5-SF2		-32.795591	151.468403	10	Large eucalypts, scrub, leaf litter reedy grass. Loose brown soil. Low point.		
8	EMP5-SF3		-32.800563	151.468400	15	Large eucalypt and scrub trees. Heavy coverage trees & scrub. Leaf litter. Sandy soil.		yellow colouring in patches.
9	EMP5-SF4		-32.799751	151.470854	5	No trees. Low coverage scrub. Sandstone rocks ~~Sandy~~ Sand, compacted. Small rocks		
10	EMP5-SF5		-32.799256	151.470053	10	Mod leaf litter & tree coverage. Banksia bushes Burnt tree trunks. Brown, loose soil.		

Signed MA

Date 31/10/13

#	Sample Name	Sampled by	Easting	Northing	Depth mm	Description (soil type, moisture, colour, foreign content, signs of contamination) or 'refer to log'	Quality Assurance	Comments (eg lab analyse)
	EMP5 -SF6	MM	-32.796403	151.473376	10	Mod coverage trees & scrub Leaf litter moderate. Brown sand	duplicate 1	
	EMP5 -SF7	MM	-32.795670	151.472557	5	Compressed soil, sandy, small rocks Mod coverage trees, scrub, leaf litter. Dumped car.		Hydrostacks visit
	EMP5 -SF8	MM	-32.795155	151.469676	5	Compacted sand and small rocks. Moderate scrub, Eucalypt trees.	Dup 2	Adjacent to small creek
						Dumped car body at SF8.		

Page 2 of 2

Signed _____

Date 31/10/13

Appendix D

Results Tables

TABLE A: Soil Analytical Results - Grid Sampling, Parcel 5

Sample Depth: 0.005m - 0.01m

Sampling Date: 31/10/13

Laboratory PQL: 1 mg/kg

Site Specific HIL - Fluoride: 440 mg/kg

Sample Identification	Soluble Fluoride mg/kg (1:5 soil:water)
S1	2
S2	2
S3	3
S4	<1
S5	2
S6	2
S7	<1
S8	<1

TABLE B: Soil Quality Assurance/ Quality Control Results

Sample Identification	EMP5-SF6	EMP5-DUP1		EMP5-SF8	EMP5-DUP2	
Sample Depth (m)	0.05-0.1m			0.05-0.1m		
Duplicate Type	Intralaboratory		RPD %	Intralaboratory		RPD %
Sample Profile	TOPSOIL			TOPSOIL		
Sample collected by	MM			MM		
Metals						
Fluoride (1:5 soil:water)	2	2	0.0	1	1	0.0

Note all units in mg/kg

BOLD identifies where RPD results

intralaboratory	interlaboratory	
>50	>60	where both sample results exceed ten x PQL
>75	>85	where both sample results are within 5 to 10 x PQL
>100	>100	where both sample results are within 2 to 5 x PQL
AD>2.5 * PQL		where one or both sample results are <2 x PQL

BOLD identified where blanks >0

Where results are within two of the above ranges the most conservative criteria have been used to assess duplicate performance

Appendix E

Laboratory Reports

CERTIFICATE OF ANALYSIS

Work Order	: **ES1323624**	Page	: 1 of 5
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE CADMAN	Contact	: Client Services
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scadman@environcorp.com	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 99548114	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: HYDRO BUFFER ZONE	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: AS130348		
C-O-C number	: ----	Date Samples Received	: 04-NOV-2013
Sampler	: ----	Issue Date	: 11-NOV-2013
Site	: ----		
		No. of samples received	: 14
Quote number	: SY/285/10	No. of samples analysed	: 14

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

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.

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

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EMP7 - SF1	EMP7 - SF2	EMP7 - SF3	EMP7 - SF4	EMP5- SF1
			Client sampling date / time	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	ES1323624-001	ES1323624-002	ES1323624-003	ES1323624-004	ES1323624-005
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**10.7**	**16.1**	**19.6**	**18.9**	**10.4**
EK040: Fluoride								
Fluoride	16984-48-8	1	mg/kg	**2**	**2**	**4**	<1	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EMP5- SF2	EMP5- SF3	EMP5- SF4	EMP5- SF5	EMP5- SF6
			Client sampling date / time	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	ES1323624-006	ES1323624-007	ES1323624-008	ES1323624-009	ES1323624-010
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**18.8**	**16.1**	**3.3**	**12.2**	**11.2**
EK040: Fluoride								
Fluoride	16984-48-8	1	mg/kg	**2**	**3**	<1	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EMP5- SF7	EMP5- SF8	EMP5- DUP1	EMP5- DUP2	----
			Client sampling date / time	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00	31-OCT-2013 15:00	----
Compound	CAS Number	LOR	Unit	ES1323624-011	ES1323624-012	ES1323624-013	ES1323624-014	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**4.7**	**1.6**	**10.6**	**1.5**	----
EK040: Fluoride								
Fluoride	16984-48-8	1	mg/kg	<1	<1	**2**	<1	----

QUALITY CONTROL REPORT

Work Order	: **ES1323624**	Page	: 1 of 4
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE CADMAN	Contact	: Client Services
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scadman@environcorp.com	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 99548114	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: HYDRO BUFFER ZONE	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 04-NOV-2013
Sampler	: ----	Issue Date	: 11-NOV-2013
Order number	: AS130348		
		No. of samples received	: 14
Quote number	: SY/285/10	No. of samples analysed	: 14

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

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.

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 (%)*
EA055: Moisture Content (QC Lot: 3142480)									
ES1323571-012	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	16.9	16.6	2.2	0% - 50%
ES1323624-006	EMP5- SF2	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	18.8	18.8	0.0	0% - 50%
EA055: Moisture Content (QC Lot: 3142481)									
ES1323718-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	11.1	10.7	2.9	0% - 50%
ES1323791-002	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	5.9	5.7	3.3	No Limit
EK040S: Fluoride Soluble (QC Lot: 3142827)									
ES1323624-001	EMP7 - SF1	EK040S: Fluoride	16984-48-8	1	mg/kg	2	2	0.0	No Limit
ES1323624-010	EMP5- SF6	EK040S: Fluoride	16984-48-8	1	mg/kg	2	2	0.0	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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EK040S: Fluoride Soluble (QCLot: 3142827)								
EK040S: Fluoride	16984-48-8	1.0	mg/kg	<1	25.0 mg/kg	111	69	117

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK040S: Fluoride Soluble (QCLot: 3142827)							
ES1323624-001	EMP7 - SF1	EK040S: Fluoride	16984-48-8	25.0 mg/kg	115	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK040S: Fluoride Soluble (QCLot: 3142827)										
ES1323624-001	EMP7 - SF1	EK040S: Fluoride	16984-48-8	25.0 mg/kg	115	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1323624**	Page	: 1 of 5
Client	: ENVIRON AUSTRALIA PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE CADMAN	Contact	: Client Services
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scadman@environcorp.com	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 99548114	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: HYDRO BUFFER ZONE	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 04-NOV-2013
Sampler	: ----	Issue Date	: 11-NOV-2013
Order number	: AS130348		
		No. of samples received	: 14
Quote number	: SY/285/10	No. of samples analysed	: 14

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (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
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA055-103)								
EMP7 - SF1,	EMP7 - SF2,	**31-OCT-2013**	**----**	----	----	**05-NOV-2013**	14-NOV-2013	✓
EMP7 - SF3,	EMP7 - SF4,							
EMP5- SF1,	EMP5- SF2,							
EMP5- SF3,	EMP5- SF4,							
EMP5- SF5,	EMP5- SF6,							
EMP5- SF7,	EMP5- SF8,							
EMP5- DUP1,	EMP5- DUP2							
EK040: Fluoride								
Soil Glass Jar - Unpreserved (EK040S)								
EMP7 - SF1,	EMP7 - SF2,	**31-OCT-2013**	**06-NOV-2013**	07-NOV-2013	✓	**06-NOV-2013**	04-DEC-2013	✓
EMP7 - SF3,	EMP7 - SF4,							
EMP5- SF1,	EMP5- SF2,							
EMP5- SF3,	EMP5- SF4,							
EMP5- SF5,	EMP5- SF6,							
EMP5- SF7,	EMP5- SF8,							
EMP5- DUP1,	EMP5- DUP2							

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(where) 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)							
Fluoride - Soluble	EK040S	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Moisture Content	EA055-103	4	40	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Fluoride - Soluble	EK040S	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Fluoride - Soluble	EK040S	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Fluoride - Soluble	EK040S	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Fluoride - Soluble	EK040S	SOIL	APHA 21st ed., 4500 F--C Soluble Fluoride is determined after a 1:5 soil/water extract using an ion selective electrode.

Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

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

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

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

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2164 Ph 02 8784 8555 E: samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale, VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2/1 Burma Rd, Pooraka SA 5095 Ph:08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga, WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston, TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: ENVIRON Australia P/L
OFFICE: 19B 50 Clebe Rd The Junction 2291
PROJECT: Hydro Buffer Zone
PURCHASE ORDER NUMBER: AS130348
PROJECT MANAGER: Steve Cadman CONTACT PH: 49625444
SAMPLER: Michelle Mandich SAMPLER MOBILE: 0447677711
COC emailed to ALS? (YES / NO) EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): S. Cadman
Email Invoice to (will default to PM if no other addresses are listed): S. Cadman

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):

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)
COC: (1) 2 3 4 5 6 7
OF: 1 (2) 3 4 5 6 7

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:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
M. Mandich K.Woods	Ce	Ce	Fazi
DATE/TIME: 4/11/13 9:50am	DATE/TIME: 4/11/13 0950	DATE/TIME: 4/11/13 1700	DATE/TIME: 5/11/13 10:30

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL: scadman@environcorp.com

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	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Soluble Fluoride								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	EMP7 - SF1	31/10/13	S	unpreserved glass jar	1									
2	EMP7 - SF2													
3	EMP7 - SF3													
4	EMP7 - SF4													
5	EMP5 - SF1													
6	EMP5 - SF2													
7	EMP5 - SF3													
8	EMP5 - SF4													
9	EMP5 - SF5													
10	EMP5 - SF6													
11	EMP5 - SF7													
12	EMP5 - SF8													
					TOTAL	12	12							

Environmental Division
Sydney
Work Order
ES1323624

Telephone : +61-2-8784 8555

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.

155068

Appendix F

QA/QC Assessment

APPENDIX F

DATA QUALITY OBJECTIVES

To ensure that reliable data of adequate type was collected and assessed for the investigation, the seven-step Data Quality Objective (DQO) approach, endorsed in the NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme 2nd Edition, will be adopted. The DQOs set quality assurance and quality control parameters for the field and laboratory programs to ensure data of appropriate reliability will be used to assess the environmental conditions at Parcel 5.

ENVIRON has developed DQOs in accordance with the seven-step process, which is presented below.

Step 1 – State the Problem

Based on the information available from the Phase 1 ESA, Parcel 5 has not been developed and remains dense bushland. This use of Parcel 5 require confirmation via a site walkover and judgemental sampling. In addition, the potential for fluoride in surface soils from dust deposition from the Hydro smelter requires assessment.

Step 2 – Identification of the Goals (Decisions) of the Study

The following decisions are to be made from this study:

- Are the current and former uses of Parcel 5 consistent with site observations?
- Has Parcel 5 been impacted by fluoride from dust deposition from the Hydro smelter?
- Has Parcel 5 been impacted by other contaminants from historical site uses?
- Is Parcel 5 suitable for the purposes of environmental conservation (E2) and business park (B7) land use?

Step 3 – Identify Information Inputs to the Decision or Goal of the Study

The inputs required to make the above decisions are listed below:

- A site walkover, including collection of field notes and photographs;
- Results of surface soil samples collected for fluoride analysis;
- Results of other soil samples from fill/ hummocky ground collected for suitable analysis during the site walkover;
- Proposed land use;
- Appropriate NSW contamination guidelines.

Step 4 – Define the Study Boundaries

Spatial boundaries - the study boundaries have been defined as the spatial boundary of Parcel 5, as shown on Figure 1.

Vertical boundaries – as areas of concern at Parcel 5 are restricted to surface soils, the vertical boundary of the study is the top 200mm unless subsurface contamination issues are identified during the site walkover.

Temporal boundaries – the temporal boundary is limited to the data collected during the investigation works.

Constraints within the study boundaries – This investigation does not require investigation of subsurface soils or groundwater unless impacts to subsurface soils or groundwater are considered likely to have occurred from the historical site activities.

Step 5 – Develop a Decision Rule

The decision rules for this investigation are as follows:

- If it is determined that the data generated through this investigation is reliable for use in producing a site conceptual model and assessing the suitability of Parcel 5 for rural landuse, then an assessment of the suitability of Parcel 5 for the purposes of environmental conservation (E2) and business park (B7) landuse will be made;

- If it is determined that the data generated through this investigation is not suitable, comprehensive or reliable for use in producing a site conceptual model, then further investigations may be recommended prior to the development of a site conceptual model and assessment of the suitability of Parcel 5 for environmental conservation (E2) and business park (B7) landuse.

Step 6 – Specify Performance or Acceptance Criteria that the Data need to Achieve

Acceptable limits on decision errors have been developed based on the Data Quality Indicators (DQIs) of precision, accuracy, representativeness, comparability and completeness. The DQIs for this investigation are outlined below.

The potential for significant decision errors were minimized by:

- Completion of a QA/QC assessment of the investigation data to assess if the data satisfies the DQIs;

- Assessment of whether appropriate sampling and analytical densities were completed for the purpose of the investigation; and

- Ensuring that the criteria set for the investigation were appropriate for the proposed use of Parcel 5.

Minimization of the potential for significant decision errors limits the potential that a conclusive statement may be incorrect.

Step 7 – Optimisation of the Design of Collection of Data

The collection of data was optimized by the completion of a Phase 1 ESA, data gap review and development of a sampling design, which is included in Section 4.3. Attainment of the DQOs has been assessed by reference to the DQIs, presented below.

DATA QUALITY INDICATORS

The project Data Quality Indicators (DQIs) have been established to set acceptance limits on field and laboratory data collected as part of this investigation. Field and laboratory procedures acceptance limits are set at different levels for different projects and by different laboratories. Non-compliances with acceptance limits are to be documented and discussed in the report. The DQIs are presented in Table A.

Table A: Data Quality Indicators

DQI	Field	Laboratory	Acceptability Limits
Completeness	All critical locations sampled, including targeted sampling of areas of environmental concern identified during the site walkover. Fluoride soil sampling completed on a reduced density to identify if fluoride in surface soils is an issue. All samples collected Experienced sampler Documentation correct	All critical samples analysed and all analytes analysed according to Standard Operating Procedures (SOPs) Appropriate Practical Quantitation Limits (PQLs) Sample documentation complete Sample holding times complied with	As per NEPM (2013)
Comparability	Experienced sampler In the event of multiple sampling events: Same types of samples collected Same sampling methodologies used Climatic conditions	Same analytical methods used Same PQLs Same units Same primary and secondary laboratories	As per NEPM (2013)
Representativeness	Appropriate media sampled Relevant media sampled	All samples analysed according to SOPs	
Precision	Collection of duplicate samples Sampling methodologies appropriate and complied with	Analysis of: Blind duplicate samples at rate of 1 in 10 samples Split duplicate samples at rate of 1 in 20 samples Laboratory duplicate samples	 RPD of 30 to 50% RPD of 30 to 50% RPD of 30 to 50%

Accuracy	Sampling methodologies appropriate and complied with.	Analysis of: Method blanks Matrix spikes Surrogate spikes Laboratory control samples Reagent blanks Reference material	 Non-detect 70 to 130% 70-130% 70 to 130%

QUALITY ASSURANCE AND QUALITY CONTROL

A quality assurance assessment for this report is presented in Table A and B below. An assessment was made of data completeness, comparability, representativeness, precision and accuracy based on field and laboratory considerations, as outlined in NSW DEC (2006) and NSW EPA (2007) guidelines.

Table A: QA/QC – Sampling and Analysis Methodology Assessment

Sampling Methodology	ENVIRON Assessment
Sampling Pattern and Locations	Surface soil sampling was undertaken on a grid pattern across Parcel 5 to assess the impact of particulate fallout from Hydro Aluminium Smelter.
Sampling Density	Six soil samples were collected from a grid across the entire of Parcel 5 which is approximately 82 ha. The purpose of the sampling was to assess for impacts from smelter particulate fallout and therefore is considered suitable in density and spatial layout.
Sample depths	Surface soil samples were collected from a grid across the entire of Parcel 5 from the ground surface.
Sample Collection Method	Surface soil samples across Parcel 5 were collected directly from the ground surface using using dedicated disposable gloves and a hand trowel. The hand trowel was brushed clean prior to sample collection. Soil samples were collected into laboratory supplied, acid rinsed glass jars.
Decontamination Procedures	Surface soil samples across Parcel 5 were collected directly from the ground surface using using dedicated disposable gloves and a hand trowel. The hand trowel was brushed clean prior to sample collection.
Sample handling and containers	All soil samples were placed into laboratory-supplied paper bags. Soil and water samples were placed on ice following collection and during transportation to the laboratory.
Chain of Custody	Samples were transported to the laboratory under chain of custody conditions. The chain of custody forms were signed by the laboratory on receipt of the samples.
Detailed description of field screening protocols	Field screening for volatiles was not completed during soil sampling as volatile contaminants were not the main chemical of concern.
Calibration of field equipment	No field equipment requiring calibration was used during this

Table A: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling Methodology	**ENVIRON Assessment**
	investigation.
Sampling Logs	The lithology of surface soil samples was documented on the field information sheets, which are included in Appendix C.

Table B: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**ENVIRON Comments**
Field quality control samples	Intra-laboratory duplicate soil samples were analysed at a ratio of 1:4 for fluoride analysed for the grid samples across the entire of Parcel 5. No rinsate blank samples were collected.
Field quality control results	Intra-laboratory duplicate results are presented in Table B. There were no RPD exceedances for the intra-laboratory duplicates collected for this assessment.
NATA registered laboratory and NATA endorsed methods	ALS was used as the primary laboratory. ALS laboratory certificates are NATA stamped and the lab is accredited for the analyses performed for this assessment.
Analytical methods	A summary of analytical methods were included in the laboratory test certificates.
Holding times	Review of the COCs and laboratory certificates indicate that holding times were met.
Practical Quantitation Limits (PQLs)	PQLs for all soil analytes were below Parcel 5 assessment criteria.
Laboratory quality control samples	Laboratory quality control samples including duplicates, laboratory control samples, matrix spikes, surrogate spikes and blanks were undertaken by the laboratories at appropriate frequencies.
Laboratory quality control results	All results for laboratory soil duplicates, laboratory control samples, matrix spikes and surrogates were acceptable and no detections were made in blank samples.

Overall it is considered that the completed investigation works and the data obtained adequately complied with the requirements of NSW DEC (2006) and NSW EPA (2007) guidelines and that the data is of suitable quality to meet the project objectives.