Phase 2 Environmental Site Assessment, Parcel 14

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Hydro Aluminium Kurri Kurri Pty Ltd

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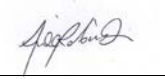
Signature:  Date:21/4/15

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Acronyms and Abbreviations

ACM	Asbestos Containing Materials
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ANZECC	Australian and New Zealand Environment and Conservation Council
B(a)P	Benzo(a)pyrene
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes (Monocyclic aromatic Hydrocarbons)
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
Mercury	Inorganic mercury unless noted otherwise
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Fe: Iron, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury, Se: Selenium
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
m TOC	Metres below top of casing
ML	Megalitre, one million litres
mg/L	Micrograms per Litre
NATA	National Association of Testing Authorities
NC	Not Calculated
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
PAH	Polycyclic Aromatic Hydrocarbons
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
US EPA	United States Environment Protection Authority
µg/L	Micrograms per Litre
VENM	virgin excavated natural material
-	On tables is "not calculated", "no criteria" or "not applicable"

Executive Summary

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 14. Parcel 14 is a rural property comprising approximately 12ha and is accessed from Bowditch Avenue, Kurri Kurri and located within the buffer zone and to the north east of the Hydro aluminium smelter. Parcel 14 comprises open farmland with scattered trees. One dwelling is situated on the western boundary in the south western portion of the Parcel 14. A coal railway line also extends along the western boundary.

The objectives of the assessment were to assess the potential for contamination at Parcel 14 based on historical and current landuse and to assess the suitability of Parcel 14 for Low Rural Residential (R2) and environmental conservation (E2) land use.

A Phase 1 Environmental Site Assessment has previously been completed for the Hydro owned lands including Parcel 14 (ENVIRON (22 October 2013) Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter). The Phase 1 identified that contamination of Parcel 14 may have occurred from dust deposition due to the proximity of the Hydro smelter, illegal dumping due to the remoteness of the area, the construction of dwelling possibly using asbestos containing construction materials, and the activities of the tenant.

To assess the potential contaminants of concern on Parcel 14, a site walkover was completed and surface soil samples were collected on an approximate grid across the parcel.

The site walkover identified concrete footings and hummocky ground associated with at least three former poultry sheds in the southern portion of the parcel, low lying swampy land in the northern portion of the parcel and a dwelling surrounded by waste stockpiles, car bodies and trucks.

The dwellings and associated sheds were assessed separately in a Hazardous Materials Audit, which identified the presence of asbestos containing materials within the building construction materials and the presence of light fittings potentially containing polychlorinated biphenyls (PCBs).

The waste stockpiles included oil drums and a stockpile of asbestos roof sheeting, trucks and car bodies and were located on a portion of Parcel 14 that is leased to a tenant and are considered the responsibility of the tenant.

Intrusive investigations into the footprints of the former poultry sheds identified compacted clay fill material underlain by red/brown clay. No waste materials and no contamination associated with heavy metals, heavy metals, petroleum hydrocarbons (TPH/BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), organochlorine Pesticides (OCPs), organophsphorous pesticides (OPPs) and asbestos were identified within the compacted clay fill material.

Parcel 14 is suitable for Low Rural Residential (R2) and environmental conservation (E2) land use.

ENVIRON makes the following recommendations:

- Once the tenant related issues have been addressed, confirmation of the removal of waste stockpiles should be undertaken via a site walkover.
- The recommendations of the Hazardous Materials Audit should be followed.

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 14. Parcel 14 is located off Bowditch Avenue, Loxford, New South Wales (2326). The location of Parcel 14 is shown in **Figure 1**.

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

Hydro is currently evaluating options for the divestment of land parcels for a range of land uses following the closure of the site in May 2014. A Rezoning Masterplan has been developed that identifies Parcel 14 to comprise land suitable for Low Rural Residential (R2) and environmental conservation (E2) 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 14 may have occurred from dust deposition due to the proximity of the Hydro smelter and the presence of a dwelling with the potential to contain asbestos.

It is noted that at the time of the fieldwork, this land parcel was named Employment Land Subarea 14 and as such the soil samples reference this name. The name of the land parcel as referenced in this report changed to Parcel 14 following the completion of the Rezoning Masterplan.

The location of Parcel 14 in the context of the Rezoning Masterplan 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 14 based on historical and current land use and to assess the suitability of Parcel 14 for the purposes of Low Rural Residential (R2) and environmental conservation (E2) 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 14 suitable for the proposed land use.

2 Site Description

2.1 Site Location

Parcel 14 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 14 is accessed from Bowditch Avenue. The location of Parcel 14 is shown in **Figure 1**.

Parcel 14 is located within the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter, to the east of the smelter. The Buffer Zone is an area of land surrounding the smelter that provides a buffer between the smelter and surrounding communities. The site comprises open farmland covered in grasses and other scattered small trees and shrubs. One dwelling is situated on the western boundary in the south western portion of the site. A coal railway line also extends along the western boundary.

Parcel 14 is located within the Cessnock Local Government Area and is zoned RU2 – Rural Landscape under the Cessnock Local Environment Plan.

Parcel 14 is approximately 12 hectares (ha) in area and comprises the lot numbers and deposited plans (DP) listed in **Table 1**:

Table 1: Lot and Deposited Plans for Parcel 14.

Subarea	Lot/ DP	Area (ha)	Total Area (ha)
Parcel 14	Lot 10 DP553543	12.3	12.3

Landuses surrounding Parcel 14 are as follows:

- North: A dedicated coal railway line then farmland;
- South: Rural residential properties and bushland;
- East: Farmland and bushland;
- West: A dedicated coal railway line then farmland.

Parcel 14 is approximately 830m to the east of the Smelter boundary.

2.2 Site Setting

2.2.1 Topography

Parcel 14 is located in a low lying area of the Buffer Zone at approximately 12 mAHD. The highest point on the site is the western boundary adjacent to the railway line. The natural topography slopes north east towards a tributary of Swamp Creek located in low lying swampy land on the eastern site boundary.

2.2.2 Regional Geology

According to the review of the regional geology described on the Sydney Basin Geological Sheet, Parcel 14 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 14 associated with surface water bodies. Quaternary sediments which are associated with Swamp Creek (approximately 100m west of Parcel 14) and the Hunter River consist of gravel, sand, silt and clay.

2.2.3 Site Hydrology

Surface water from Parcel 14 discharges primarily via infiltration and overland flow to a tributary of Swamp Creek located on the eastern site boundary. Swamp Creek discharges into Wentworth Swamp immediately north of the site. Wentworth Swamp in turn discharges to the Hunter River approximately 6km northeast of Parcel 14 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 north towards the surface water bodies that discharge to the Hunter River. Locally, groundwater beneath Parcel 14 is expected to flow east towards a tributary of Swamp Creek, located on the eastern site boundary.

According to the NSW Office of Environment and Heritage (Natural Resource Atlas), there are 21 licensed groundwater abstractions (bores) located within 2km of Parcel 14. The majority of the groundwater bores are located within the aluminium smelter and buffer zone.

Information for 11 bores located in a 1km radius from Parcel 14 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 14 with respect to surface water and groundwater is considered to be moderate based on the following:

- Surface water and groundwater discharge into a tributary of Swamp Creek located on the eastern site boundary, which discharges to the Hunter River via Swamp Creek and Wentworth Swamp within the Fishery Creek Catchment, approximately 6km northeast of Parcel 14 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 14 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 about Parcel 14:

- The earliest records (aerial photograph from 1951) shows that Parcel 14 comprised bushland with a dense tree cover at that time.
- A dwelling was constructed on a portion of Lot 10 in DP 553542 in the early 1970s. Historical aerial photographs indicate the dwelling remains as current. Current aerial photographs indicate a large number of vehicles are stored around the dwelling.
- Parcel 14 is located approximately 1km north east of the smelter boundary and may be impacted from smelter dust deposition;
- The remoteness of Parcel 14 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.

The location of the farm building is included in **Figure 3**.

4 Sampling and Analytical Quality Plan

4.1 Potential Areas and Contaminants of Concern

Based on Parcel 14 historical information as discussed in **Section 3**, the following areas of concern were identified:

- Construction of a dwelling.
- Smelter dust deposition.
- Illegal dumping.
- Activities at the dwelling, particularly in relation to the large numbers of vehicles.

Contaminants of concern associated with the presence of the dwelling, smelter stack particulate fallout and the activities of the tenant include the following:

- Asbestos;
- Fluoride;
- Hydrocarbons;
- Pesticides; and
- Heavy metals

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. Where fill was identified during the site walkover, a second round of field investigations was completed to assess subsurface soils. No potential contamination sources to surface water or groundwater have been identified. Where these are identified in soils, analysis of surface or groundwater is undertaken.

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 will allow for identification of whether or not dust deposition is an issue; 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 a grid pattern across open areas of Parcel 14. 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 14, a site walkover of accessible areas was completed.

The location and type of dumped wastes were detailed on Field Information Sheets and logged by GPS. Where asbestos was confidently identified by the field personnel, no

sampling was completed. If not, a sample of potential asbestos containing material (ACM) was collected for laboratory analysis. ACM fragments were collected into a zip-lock bag using dedicated disposable gloves.

ACM fragments were analysed for asbestos identification by a laboratory NATA accredited for the analysis.

4.3.1 Potential Fill

The site walkover identified the potential for fill material at Parcel 14 along the southern boundary. As such, a second round of fieldwork was completed to assess the potential fill material and its potential for contamination.

A back hoe was used to excavate three test pits into areas of potential fill identified at Parcel 14. The test pits were logged by an ENVIRON environmental scientist and soil samples were collected for analysis.

Soil samples were collected into laboratory-supplied acid-rinsed glass jars using dedicated disposable gloves. The soil samples were 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 a range of potential contaminants, including heavy metals, total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphorous pesticides (OPPs) and asbestos. The laboratory was 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:

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

The variation to the National Environmental Protection (Assessment of Site Contamination) Measure (NEPM 2013) was approved on 19 June 2013 by the NSWEPA under the *Contaminated Land Management Act 1997*. NEPM (2013) provide revised health-based soil investigation levels (HILs) and ecological-based investigation levels (EILs) for various land uses, as follows:

- HIL A - residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children day care centres, preschools and primary schools

- HIL B - residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats

- HIL C - public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate

- HIL D - commercial/industrial such as shops, offices, factories and industrial sites.

The NEPM 2013 also introduces health-based and ecological screening levels and management limits for petroleum hydrocarbons (HSLs and ESLs). The levels have been derived from recent assessments that more accurately define the exposure mechanisms and risks from sites contaminated with petroleum hydrocarbons.

The objective of the Phase 2 ESA is to assess soil and surface water contamination at Parcel 14 in relation to risks posed to human health and the environment under the proposed future land use of low rural residential. As such, soil investigation results will be compared against the HIL/HSL A (residential) management limits and the EILs/ESLs (urban residential/public open space).

The HILs are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types and apply generally to a depth of 3 m below the surface for residential use.

- HSLs for soil vapour intrusion from petroleum hydrocarbons - guidelines that prevent accumulation of vapours at concentrations that may represent a health risk. The HSLs are derived for various depths and are for the same generic land uses as for the HILs. The guidelines are relevant where soils are beneath building or structures such as confined spaces;

- EILs for urban residential/ public open space, applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and generally apply to the top 2 m of soil.
- ESLs for urban residential/ public open space, developed for selected petroleum hydrocarbon compounds and fractions and are applicable for assessing risk to terrestrial ecosystems. These are also generally applicable to the top 2m of soil.
- Management Limits where concentrations above these limits may indicate poor aesthetics, high odour and potentially explosive vapour. Management limits are to be applied after consideration of relevant ESLs and HSLs.

The applicable assessment criteria for heavy metals and PAHs in soil are presented in Table 2:

Table 2: Soil Assessment Criteria (mg/kg) – Health and Ecological Investigation Levels

	HIL A	EIL
Fluoride	Ref Table 5	Ref Table 5
Carcinogenic PAHs (as BaP TEQ)	3	-
Total PAHs	300	-

The applicable assessment criteria for petroleum hydrocarbons in soil are presented in Table 3 and Table 4:

Table 3: Soil Assessment Criteria for Vapour Intrusion - HSL A & HSL B (mg/kg) - Sand

	0 to <1m	1m to <2m	2m to <4m	4m+
Toluene	160	220	310	540
Ethylbenzene	55	NL	NL	NL
Xylenes	40	60	95	170
Naphthalene	3	NL	NL	NL
Benzene	0.5	0.5	0.5	0.5
F1[4]	45	70	110	200
F2[5]	110	240	440	NL

1 Land use settings are equivalent to those described in Section 5.1 (above). HSLs for vapour intrusion for high density residential assume residential occupation of the ground floor. If communal car parks or commercial properties occupy the ground floor, HSL D should be used.

2 The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.

3 (For soil texture classification undertaken in accord with AS 1726, the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit <50% and fine with liquid limit>50% respectively, as the underlying properties to develop the HSLs may reasonably be selected to be similar. Where there is uncertainty, either a conservative approach may be adopted or laboratory analysis should be carried out.

4 To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

5 To obtain F2 subtract naphthalene from the >C10-C16 fraction.

Table 4: ESLs and Management Limits for Petroleum Hydrocarbons in Soil			
TPH fraction	**Soil texture**	**ESLs (mg/kg dry soil)**	**Management Limits[1] (mg/kg dry soil)**
		Urban residential and public open space	**Residential, parkland and public open space**
F1 C6- C10	Fine	180*	800
F2 >C10-C16	Fine	120*	1000
F3 >C16-C34	Fine	1300	3500
F4 >C34-C40	Fine	5600	10000
Benzene	Fine	65	-
Toluene	Fine	105	-
Ethylbenzene	Fine	125	-
Xylenes	Fine	45	-
Benzo(a)pyrene	Fine	0.7	-

[1] Management limits are applied after consideration of relevant ESLs and HSLs.

[2] Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

[3] ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.

[4] To obtain F1, subtract the sum of BTEX from C6-C10 fraction and subtract naphthalene from >C10-C16 to obtain F2.

NEPM (2013) do not provide criteria for fluoride in soils in Australia. Therefore, 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 are protective of the range of human receptors and are provided in Table 5:

Table 5: Site Specific Soil Assessment Criteria (mg/kg) for Fluoride	
Preliminary screening levels	
Land Use	**Preliminary screening level**
Residential - soil	F 440mg/kg
Recreational - soil	F 1,200mg/kg
Commercial/ Industrial - soil	F 17,000mg/kg

Soil investigation results for the samples taken from a grid formation across Parcel 14 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 'low rural residential' land use because the exposure pathways (including vegetable ingestion) and behavioural assumptions (e.g. soil ingestion rate) for the child are considered to be identical under residential and low rural residential land use scenarios.

There is a possibility that the rural residential 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 2012 levels, with all fluoride measurements below the toxic threshold; and all cattle examined were in good health and body condition. Consequently, the residential site-specific fluoride criteria is considered to be suitably protective of rural residential land use that may contain a low density of domestic livestock.

The HSLs for asbestos are applicable for assessing human health risk via the exposure pathway of inhalation of airborne asbestos and are presented in Table 6. The HSLs are generic to all soil types.

Table 6. Health screening levels for asbestos contamination in soil Health Screening Level (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.

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 14. The entrance to Parcel 14 is from Bowditch Avenue, which borders the southern boundary. The site comprises one rural residential lot, Lot 10, with one dwelling located near the central western boundary. The remainder of the parcel comprised open farmland with stands of mature trees. Several low lying water bodies, including a dam, are located in the north of the parcel and are associated with Wentworth Swamp, which is located immediately north of Parcel 14.

A driveway extends from the southern boundary along the western boundary to the dwelling. The driveway and area immediately surrounding the dwelling contained numerous trucks and truck bodies and waste stockpiles, including oil drums, asbestos roof sheeting, old car engines, wooden pallets, a television, tyres, 44 gallon drums and steel waste.

It is noted that the dwelling has been assessed separately in a Hazardous Materials Audit which identified the presence of asbestos containing materials within the building construction and the potential for PCBs to be present in light fittings.

The site walkover identified hummocky ground close to the southern boundary, where concrete slabs indicated old foundations for poultry sheds. The hummocky ground appeared to be localised cut to fill to create a level platform for the former poultry sheds. The square concrete foundations, which were 2m by 2m in size, indicated that at least three poultry sheds were located on Parcel 14.

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

The locations of hummocky ground identified during the field investigation are shown in **Figure 3**. Photographs are included in **Appendix B**. Field Information Sheets are included in **Appendix C**.

6.2 Soil Investigations

6.2.1 Fluoride and Asbestos

Two surface soil samples were collected from across Parcel 14 to assess the potential for fluoride in soil from dust deposition from the Hydro Aluminium Kurri Kurri Smelter as shown in **Figure 3**. A generalised lithology of the surface soils encountered at Parcel 14 is as follows:

- Topsoil: Sandy silt, brown, moist.

One fragment of asbestos containing material (ACM) was collected from a stockpile of roof sheeting located to the north of the dwelling. This fragment was collected into a zip-lock plastic bag using dedicated disposable gloves for asbestos analysis.

6.2.1 Potential Fill

Three test pits were excavated in areas of potential fill, as shown in **Figure 3**. In general, the test pits identified compacted clay fill to a maximum depth of 2.0m bgs. The fill material was underlain by residual red/ brown high plasticity clay.

Three soil samples were collected from the test pits for analysis. These three samples were analysed for asbestos, heavy metals, total petroleum hydrocarbons (TPH), benzene, toluene, ethyl benzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs) and organophosphorous pesticides (OPPs).

The location of the test pits are shown in **Figure 3**. Test pit logs are included in **Appendix C**.

6.3 Soil Results

A summary of the soil analytical results are presented in **Table 7**. Soil analytical results are presented in **Appendix D** and laboratory reports are included in **Appendix E**.

Table 7: Summary of Soil Results

Analyte	No. of Samples	Maximum Concentration (mg/kg)	No. exceeding Site Criteria	Criteria Exceeded (mg/kg)
Fluoride	2	17	0	-
Arsenic	3	7	0	-
Cadmium	3	<1	0	-
Chromium	3	17	0	-
Copper	3	<5	0	-
Lead	3	15	0	-
Nickel	3	2	0	-
Zinc	3	6	0	-
Mercury	3	<0.1	0	-
BaP TEQ	3	<0.5	0	-
Total PAHs	3	<0.5	0	-
Benzene	3	<0.2	0	-
Toluene	3	<0.5	0	-
Ethyl benzene	3	<0.5	0	-
Xylene	3	<0.5	0	-
TRH C6-C10	3	<10	0	-
TRH >C10-C16	3	<50	0	-
TRH >C16-C34	3	<100	0	-
TRH >C34-C40	3	<100	0	-
OCPs	3	<0.2	0	-
OPPs	3	<0.2	0	-
Asbestos	4	1 – Chrysotile and crocidolite	1	Present

The results of surface soil sampling for fluoride demonstrate that the conditions at Parcel 14 were not impacted by stack particulate fallout from the Hydro aluminium smelter.

The results of the fill sampling indicate that the compacted clay fill is not impacted by contamination associated with heavy metals, TPH, BTEX, PAHs, OCPs, OPPs and asbestos.

Chrysotile and crocidolite asbestos was identified in the ACM fragment collected from the stockpile of roof sheeting located to the north of the dwelling.

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 14 consists of cleared land for cattle grazing and comprises low lying swampy land, a farm dam and a dwelling. Parcel 14 is bounded by the a dedicated coal railway line on the western boundary, farm land on the northern boundary and rural land on the eastern and southern boundary, and is located in the east of the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter.

Parcel 14 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 for residential landuse. It is noted that there is currently no source of aerial fluoride emissions, as the smelter is in a care and maintenance mode.

Parcel 14 was developed for residential landuse with a single dwelling constructed near the western boundary in the early 1970s. This use remains to the present day. It is noted that there is a range of wastes stored on the land in close proximity to the dwelling, including oil drums, asbestos roof sheeting, old car engines, wooden pallets, a television, tyres, 44 gallon drums and steel. Numerous car bodies and trucks were also parked along the driveway and around the dwelling. Chrysotile and crocidolite asbestos were identified in a fragment of the roof sheeting. The car bodies, trucks and wastes around the dwelling are considered to be the responsibility of the tenant.

The dwellings and associated sheds were assessed separately in a Hazardous Materials Audit, which identified the presence of asbestos containing materials within building construction and the potential for PCBs in light fittings. Recommendations for the appropriate handling of hazardous materials were provided and should be followed.

In addition to the dwelling, the walkover identified concrete footings from at least three poultry sheds near the southern boundary. Hummocky ground was also identified, indicating that cut to fill has likely occurred to create level platforms for the sheds. No construction debris was evident in this area. Intrusive investigations identified compacted clay fill material within the shed footprints to a depth of 2m underlain by red/brown clay. No waste materials were identified within the compacted clay fill material. The timing of the use of this portion of Parcel 14 for poultry farming is unknown.

Concentrations of potential contaminants of concern were not identified at levels that are likely to impact on surface water or groundwater. No analysis of these media is warranted.

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 14. Parcel 14 is a rural property comprising approximately 12ha and is accessed from Bowditch Avenue, Kurri Kurri and located within the buffer zone and to the north east of the Hydro aluminium smelter. Parcel 14 comprises open farmland with scattered trees. One dwelling is situated on the western boundary in the south western portion of the Parcel 14. A coal railway line also extends along the western boundary.

The objectives of the assessment were to assess the potential for contamination at Parcel 14 based on historical and current landuse and to assess the suitability of Parcel 14 for Low Rural Residential (R2) and environmental conservation (E2) land use.

A Phase 1 Environmental Site Assessment has previously been completed for the Hydro owned lands including Parcel 14 (ENVIRON (22 October 2013) Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter). The Phase 1 identified that contamination of Parcel 14 may have occurred from dust deposition due to the proximity of the Hydro smelter, illegal dumping due to the remoteness of the area, the construction of dwelling possibly using asbestos containing construction materials, and the activities of the tenant.

To assess the potential contaminants of concern on Parcel 14, a site walkover was completed and surface soil samples were collected on an approximate grid across the parcel.

The site walkover identified concrete footings and hummocky ground associated with at least three former poultry sheds in the southern portion of the parcel, low lying swampy land in the northern portion of the parcel and a dwelling surrounded by waste stockpiles, car bodies and trucks.

The dwellings and associated sheds were assessed separately in a Hazardous Materials Audit, which identified the presence of asbestos containing materials within the building construction materials and the presence of light fittings potentially containing polychlorinated biphenyls (PCBs).

The waste stockpiles included oil drums and a stockpile of asbestos roof sheeting, trucks and car bodies and were located on a portion of Parcel 14 that is leased to a tenant and are considered the responsibility of the tenant.

Intrusive investigations into the footprints of the former poultry sheds identified compacted clay fill material underlain by red/brown clay. No waste materials and no contamination associated with heavy metals, heavy metals, petroleum hydrocarbons (TPH/BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), organochlorine Pesticides (OCPs), organophsphorous pesticides (OPPs) and asbestos were identified within the compacted clay fill material.

Parcel 14 is suitable for Low Rural Residential (R2) and environmental conservation (E2) land use.

ENVIRON makes the following recommendations:

- Once the tenant related issues have been addressed, confirmation of the removal of waste stockpiles should be undertaken via a site walkover.
- The recommendations of the Hazardous Materials Audit should be followed.

9 References

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

ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality;

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.

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 14. 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 14 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.

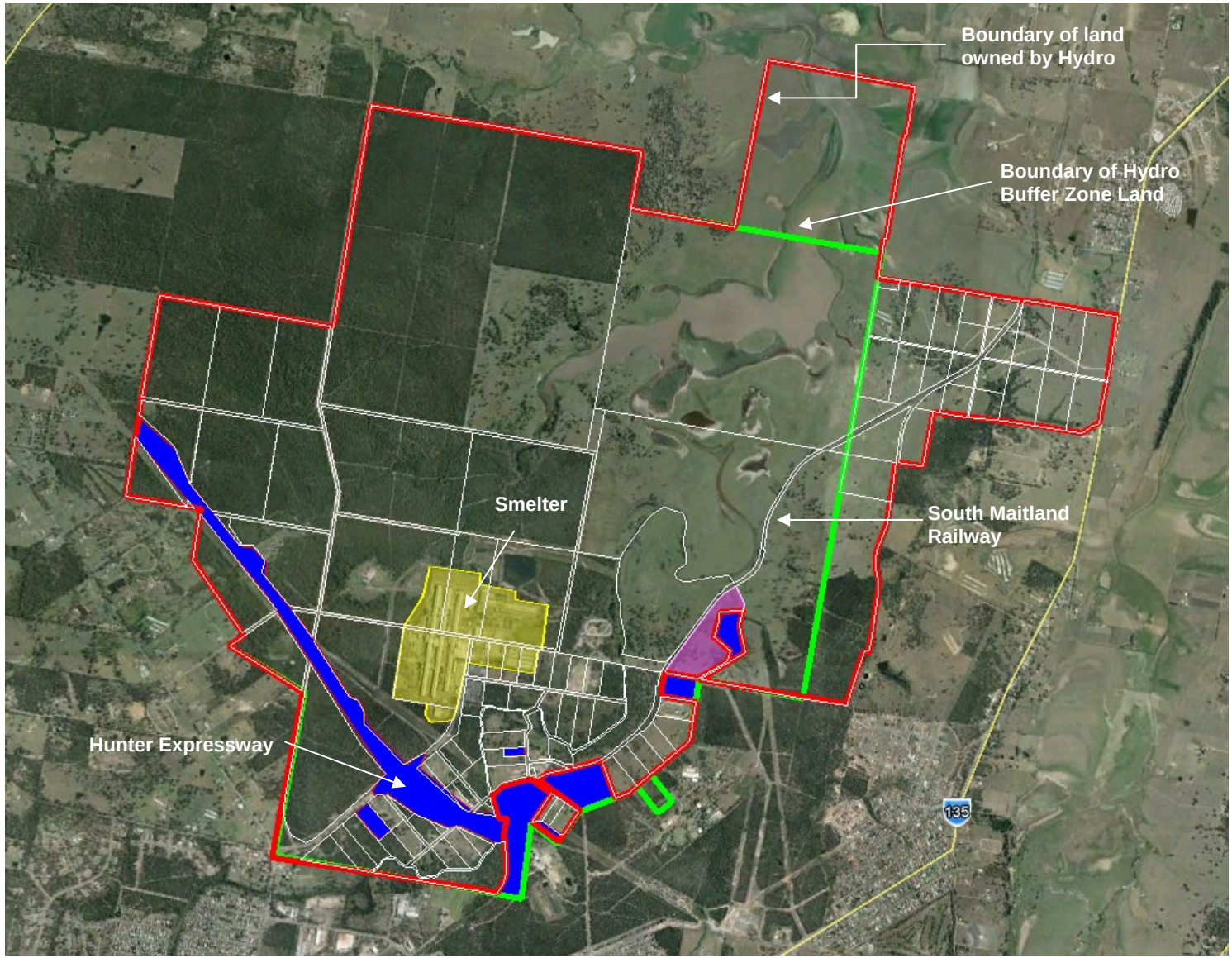
ENVIRON did not independently verify all of the written or oral information provided to ENVIRON during the course of this investigation. While ENVIRON has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided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



Approximate Location of land owned by Hydro

Approximate Location of Buffer Zone

Land not owned by Hydro

Employment Parcel 14

N

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

Hydro Aluminium Kurri Kurri – Phase 2 Environmental Site Assessment

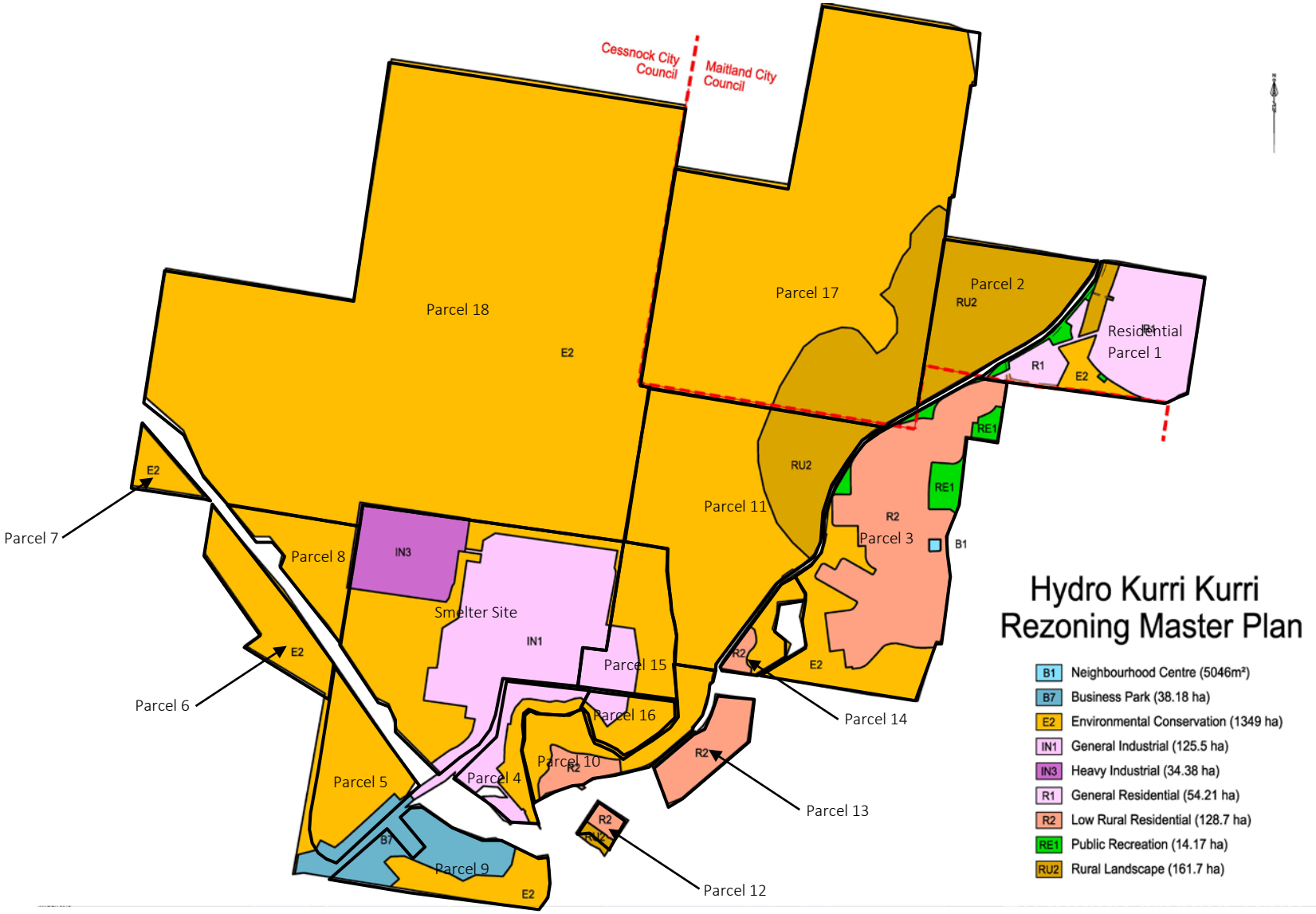
Parcel 14 - Site Location

ENVIRON

JOB NO: AS130348

DATE: August 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
- ACM — ACM Stockpile
- Oil drums
- TP — Test Pits

N

Google Earth Pro: Licensed til 5/2/15

Hydro Aluminium Kurri Kurri – Phase 2 Environmental Site Assessment

Parcel 14 – Soil Sampling Locations

ENVIRON

JOB NO: AS130348

DATE: August 2014

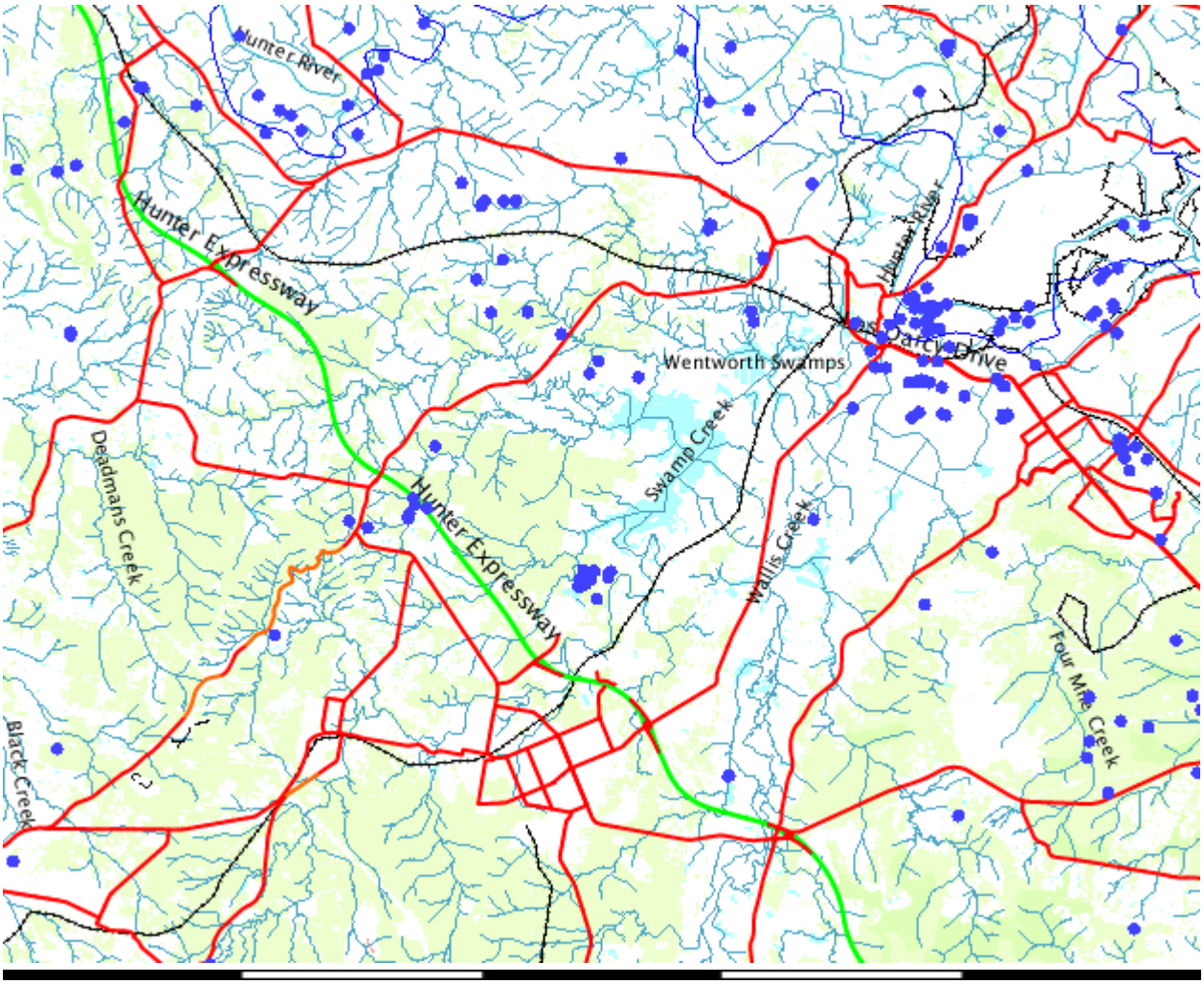
FIGURE 3

Appendix A

Surrounding Groundwater Bores

Registered groundwater bores in the vicinity of the site

Map created with NSW Natural Resource Atlas - http://www.nratlas.nsw.gov.au
Tuesday, April 29, 2014



0 24 Km

Legend

Symbol	Layer	Custodian
	Cities and large towns	
Cowra	Populated places	
	Towns	
	Groundwater Bores	
	Catchment Management Authority boundaries	
	Major rivers	
Primary/arterial road Motorway/freeway Railway Runway Contour Background	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: Photograph showing the concrete foundations of the former poultry sheds in the southern portion of Parcel 16, facing east.

Photo 2: Photograph showing hummocky ground associated with the former poultry sheds.

Photo 3: Photograph showing the general farm land at Parcel 16.

Photo 4: Photograph showing the general farm land at Parcel 16.

Photo 5: Photograph of low lying swampy land (dry) on the northern portion of Parcel 16, facing north.

Photo 6: Photograph of low lying swampy land (dry) on the northern portion of Parcel 16, facing west.

Photo 7: Photograph of the dwelling on Parcel 16, with 44 gallon drums and other wastes in the foreground, facing north.

Photo 8: Photograph of a stockpile of asbestos roof sheeting located north of the dwelling.

Photo 9: Photograph of truck and car bodies located in the vicinity of the dwelling.

Photo 10: Photograph of the general condition of Parcel 16 in close proximity to the dwelling.

Appendix C

Test Pit Logs

Site Walkover Checklist

Project No.: AS130348	**Date and Time:** 1/11/13
Land Parcel: EMP14	**Weather:** Fine, mild.
Lot and DP: Lot 10	**Environ Personnel:** SC

Site Description

Topography	Generally W → E Slope.
Surface Geology	
Fill evident?	Large rect. area on Bowditch Rd ~100 x 20 no ACM of other wastes.
Hummocky ground?	
Structures on site?	
Location of structures	
Building materials used in structures	
Asbestos debris on site?	
Location of asbestos debris?	
Volume of asbestos debris?	

GPS Locations of Interest

photos 50/51

Point of Interest	Easting	Northing
Oil Drums / Rubbish pile on E. driveway (leaking).	151.49535.	32.79034
ACM Pile.	151.49629	32.78933

Description of Photographs Taken

38-39 - old building F/print? on fill foundation at W. end (near driveway) x 100 x 20 m. E-W
40-43 " " " " " from east looking west + c/e of slab.
44-71 - From front gate - up driveway to house.
69 - Stacked roofing ACM out side N. gate of house block ~ 0.8 m high x 1.2 m long.
70-71 house area.
73-77 Pan from SE anr E - N - W.
79-83 Pan from NW - S - E - N. showing pond/dam.
84-87 from N. anr - N → S.

Miscellaneous Field Comments

Either side of driveway old vehicles, engines + oil drums (some leaking oil.) wood & steel waste
around house - many old vehicles / engines etc.

Appendix D

Results Tables

TABLE A: Soil Analytical Results - Grid Sampling

Sample Depth: 0.0m - 0.01m

Sampling Date: 1/11/13

Laboratory PQL: 0.5 mg/kg

Site Specific HIL - Fluoride: 440mg/kg

Sample Identification	Soluble Fluoride mg/kg (1:5 soil:water)
EMP14 - SF1	17
EMP 14 - SF2	17

TABLE B: Soil Analytical Results - Intrusive Investigations

Sample Identification	PQL	Guideline					P14 TP1	P14 TP2	P14 TP3
Sample Depth (m)							0.3-0.5	0.3-0.5	0.2-0.4
Date		HIL 'A' [A]	HSL 'A' Sand 0m to 1m	EIL Residential [B]	ESL Residential (Coarse Soil)	Mgt Limits Residential	19/03/2014	19/03/2014	19/03/2014
Sample Profile							FILL	FILL	FILL
Sample collected by							SC	SC	SC
Asbestos									
Asbestos Identification							No	No	No
Metals									
Arsenic	5	100		100			7	7	<5
Cadmium	1	20					<1	<1	<1
Chromium	2	100		190			17	10	9
Copper	5	6000		60			<5	<5	<5
Nickel	5	400		30			12	12	15
Lead	2	300		1100			2	<2	<2
Zinc	5	7400		70			6	<5	6
Mercury	0.1	10					<0.1	<0.1	<0.1
Polycyclic Aromatic Hydrocarbons (PAH)									
Naphthalene	0.1			170			<0.5	<0.5	<0.5
Acenaphthylene	0.1						<0.5	<0.5	<0.5
Acenaphthene	0.1						<0.5	<0.5	<0.5
Fluorene	0.1						<0.5	<0.5	<0.5
Phenanthrene	0.1						<0.5	<0.5	<0.5
Anthracene	0.1						<0.5	<0.5	<0.5
Fluoranthene	0.1						<0.5	<0.5	<0.5
Pyrene	0.1						<0.5	<0.5	<0.5
Benz(a)anthracene	0.1						<0.5	<0.5	<0.5
Chrysene	0.1						<0.5	<0.5	<0.5
Benzo(b)&(k)fluoranthene	0.2						<0.5	<0.5	<0.5
Benzo(a) pyrene	0.05				0.7		<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	0.1						<0.5	<0.5	<0.5
Dibenz(a,h)anthracene	0.1						<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	0.1						<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ	0.5	3					<0.5	<0.5	<0.5
Total +ve	--	300					<0.5	<0.5	<0.5
Total Recoverable Hydrocarbons (TRH) - NEPM (2013)									
TRH C6 - C10	25		45		180	700	<25	<25	<10
vTPH C6 - C10 less BTEX	25		45		-	-	<25	<25	<10
TRH >C10-C16	50		110		120	1000	<50	<50	170
TRH >C16-C34	100		NL		300	2500	<100	<100	1080
TRH >C34-C40	100		NL		2800	10,000	<100	<100	240
BTEX									
Benzene	0.2		0.5		50		<0.2	<0.2	<0.2
Toluene	0.5		160		85		<0.5	<0.5	<0.5
Ethylbenzene	1		35		70		<1	<1	<1
m+p-xylene	2		40		105		<2	<2	<2
o-Xylene	1		40				<1	<1	<1
OC/ OP Pestcides									
Sum of Aldrin + Dieldrin	0.05	6					<0.05	<0.05	<0.05
Sum of DDD + DDT + DDE	0.05	240					<0.05	<0.05	<0.05
Remainder of OCPs	0.05						<0.05	<0.05	<0.05
OPPs	0.05						<0.05	<0.05	<0.05

All results are in mg/kg

[A] HIL A - Residential landuse

[D] EILs represent the most conservative value possible as the lowest value for added contaminant limit (ACL) was used, irrespective of soil properties and ambient background concentration.

Results shaded grey are in excess of the investigation criteria.

Benzo(a)pyrene TEQ is indicative of carcinogenic PAHs: the HIL is based on the 8 carcinogenic PAHs and their TEFs (potency relative to B(a)P) adopted by CCME 2008. The B(a)P TEQ is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its B(a)P TEF and summing these products.

TABLE C: Soil Quality Assurance/ Quality Control Results

Sample Identification	P14 TP2	QA3	RPD %
Sample Depth (m)	0.3-0.5		
Duplicate Type	Intralaboratory		
Sample Profile	FILL		
Sample collected by	SC		
Metals			
Arsenic	7	9	25
Cadmium	<1	<1	NC
Chromium	10	11	10
Copper	<5	<5	NC
Lead	12	13	8
Nickel	<2	<2	NC
Zinc	<5	6	NC
Mercury	<0.1	<0.1	NC
Polycyclic Aromatic Hydrocarbons (PAH)			
Naphthalene	<0.5	<0.5	NC
Acenaphthylene	<0.5	<0.5	NC
Acenaphthene	<0.5	<0.5	NC
Fluorene	<0.5	<0.5	NC
Phenanthrene	<0.5	<0.5	NC
Anthracene	<0.5	<0.5	NC
Fluoranthene	<0.5	<0.5	NC
Pyrene	<0.5	<0.5	NC
Benz(a)anthracene	<0.5	<0.5	NC
Chrysene	<0.5	<0.5	NC
Benzo(b)&(k)fluoranthene	<0.5	<0.5	NC
Benzo(a) pyrene	<0.5	<0.5	NC
Indeno(1,2,3-c,d)pyrene	<0.5	<0.5	NC
Dibenz(a,h)anthracene	<0.5	<0.5	NC
Benzo(g,h,i)perylene	<0.5	<0.5	NC
Benzo(a)pyrene TEQ	<0.5	<0.5	NC
Total +ve	<0.5	<0.5	NC
Total Recoverable Hydrocarbons (TRH) - NEPM (2013)			
TRH C6 - C10	<25	<25	NC
vTPH C6 - C10 less BTEX	<25	<25	NC
TRH >C10-C16	<50	<50	NC
TRH >C16-C34	<100	<100	NC
TRH >C34-C40	<100	<100	NC
BTEX			
Benzene	<0.2	<0.2	NC
Toluene	<0.5	<0.5	NC
Ethylbenzene	<1	<1	NC
m+p-xylene	<2	<2	NC
o-Xylene	<1	<1	NC
OC/ OP Pestcides			
Sum of Aldrin + Dieldrin	<0.05	<0.05	NC
Sum of DDD + DDT + DDE	<0.05	<0.05	NC
Remainder of OCPs	<0.05	<0.05	NC
OPPs	<0.05	<0.05	NC

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	: **ES1324139**	Page	: 1 of 3
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	: 08-NOV-2013
Sampler	: SC	Issue Date	: 15-NOV-2013
Site	: ----		
		No. of samples received	: 3
Quote number	: SY/285/10	No. of samples analysed	: 3

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
- Descriptive 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
Christopher Owler	Team Leader - Asbestos	Newcastle - Asbestos

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

- **EA200 Legend**
- **EA200 'Am' Amosite (brown asbestos)**
- **EA200 'Ch' Chrysotile (white asbestos)**
- **EA200 'Cr' Crocidolite (blue asbestos)**
- **EA200 'Trace' - Asbestos fibres detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres**
- **EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.**
- **EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.**
- **EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EMP14-SF1	EMP14-SF2	EMP14-ID3	-----	-----
			Client sampling date / time	01-NOV-2013 15:00	01-NOV-2013 15:00	01-NOV-2013 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1324139-001	ES1324139-002	ES1324139-003	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**17.0**	**17.0**	----	----	----
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	**Yes**	----	----
Asbestos Type	1332-21-4	0.1	--	----	----	**Ch + Cr**	----	----
Sample weight (dry)	----	0.01	g	----	----	**300**	----	----
APPROVED IDENTIFIER:	----	-	--	----	----	**S.SPOONER**	----	----
EK040: Fluoride								
Fluoride	16984-48-8	1	mg/kg	**4**	**3**	----	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	EMP14-ID3 - 01-NOV-2013 15:00	One piece of bonded asbestos cement sheeting approximately 280 x 150 x 5 mm.

QUALITY CONTROL REPORT

Work Order	: **ES1324139**	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	: 08-NOV-2013
Sampler	: SC	Issue Date	: 15-NOV-2013
Order number	: AS130348		
		No. of samples received	: 3
Quote number	: SY/285/10	No. of samples analysed	: 3

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
Christopher Owler	Team Leader - Asbestos	Newcastle - Asbestos

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: 3154223)									
ES1324139-002	EMP14-SF2	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	17.0	16.8	1.1	0% - 50%
ES1324140-011	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	11.0	11.0	0.0	0% - 50%
EK040S: Fluoride Soluble (QC Lot: 3154258)									
ES1324139-001	EMP14-SF1	EK040S: Fluoride	16984-48-8	1	mg/kg	4	3	38.7	No Limit
ES1324140-008	Anonymous	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: 3154258)								
EK040S: Fluoride	16984-48-8	1.0	mg/kg	<1	25.0 mg/kg	79.4	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: 3154258)							
ES1324139-001	EMP14-SF1	EK040S: Fluoride	16984-48-8	25.0 mg/kg	91.0	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: 3154258)										
ES1324139-001	EMP14-SF1	EK040S: Fluoride	16984-48-8	25.0 mg/kg	91.0	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1324139**	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	: 08-NOV-2013
Sampler	: SC	Issue Date	: 15-NOV-2013
Order number	: AS130348		
		No. of samples received	: 3
Quote number	: SY/285/10	No. of samples analysed	: 3

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							
Snap Lock Bag (EA055-103)							
EMP14-SF1, EMP14-SF2	**01-NOV-2013**	**----**	----	----	**12-NOV-2013**	15-NOV-2013	✓
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples							
Snap Lock Bag (EA200)							
EMP14-ID3	**01-NOV-2013**	**---**	30-APR-2014	----	**13-NOV-2013**	12-MAY-2014	✓
EK040: Fluoride							
Snap Lock Bag (EK040S)							
EMP14-SF1, EMP14-SF2	**01-NOV-2013**	**12-NOV-2013**	08-NOV-2013	×	**14-NOV-2013**	10-DEC-2013	✓

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	2	20	**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).
Asbestos Identification in bulk solids	EA200	SOIL	AS 4964 - 2004 Method for the qualitative identification of asbestos in bulk samples
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.

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK040: Fluoride						
Snap Lock Bag						
EMP14-SF1, EMP14-SF2	12-NOV-2013	08-NOV-2013	**4**	----	----	----

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 →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

☐BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

☐NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

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

☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: Environ Australia	**TURNAROUND REQUIREMENTS :** ☐ Standard TAT (List due date):	**FOR LABORATORY USE ONLY (Circle)**	
OFFICE: 19B, 50 Glebe Road, The Junction, NSW 2291	(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes No N/A
PROJECT: Hydro Buffer Zone **PROJECT NO.:**	**ALS QUOTE NO.:**	Free Ice / frozen Ice bricks present upon receipt?	Yes No N/A
ORDER NUMBER: AS130348 **PURCHASE ORDER NO.:**	**COUNTRY OF ORIGIN:**	Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: Steve Cadman **CONTACT PH:** 4962 5444	**COC SEQUENCE NUMBER (Circle)** COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Other comment:	
SAMPLER: Steve Cadman **SAMPLER MOBILE:** 0423 583 538	**RELINQUISHED BY:**	**RECEIVED BY:**	**RELINQUISHED BY:**
COC Emailed to ALS? (YES / NO) **EDD FORMAT (or default):**			
Email Reports to (will default to PM if no other addresses are listed): scadman@environcorp.com	DATE/TIME: 8/11/13	DATE/TIME: 8/11/13 1120	DATE/TIME: 8/11/13 1700
Email Invoice to (will default to PM if no other addresses are listed): scadman@environcorp.com			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Asbestos e EN:

RECEIVED BY:	DATE/TIME:
Steve	11/11/13 7:00

ALS USE ONLY	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 BOTTLES	Soluble Fluoride	Asbestos ID							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	EMP14-SF1	1/11/2013	S	Pulp Bag	1	✓								
2	EMP14-SF2	1/11/2013	S	Pulp Bag	1	✓								
3	EMP14-ID3	1/11/2013		ziploc bag			✓							log as EA2008
				TOTAL	2									

Environmental Division
Sydney
Work Order
ES1324139

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; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

CERTIFICATE OF ANALYSIS

Work Order	: **ES1408819**	Page	: 1 of 8
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: STEVE CADMAN	Contact	: Client Services
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road | PO Box 435 | The Junction NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scadman@environcorp.com	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: HYDRO BUFFER ZONE INVESTIGATION	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: AS130348		
C-O-C number	: ----	Date Samples Received	: 20-MAR-2014
Sampler	: KW, SC	Issue Date	: 29-APR-2014
Site	: ----		
		No. of samples received	: 4
Quote number	: SY/433/13	No. of samples analysed	: 4

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
- Descriptive Results
- Surrogate Control Limits

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

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
Pabi Subba	Senior Organic Chemist	Sydney Organics
Shaun Spooner	Asbestos Identifier	Newcastle - Asbestos
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	P14 TP1 0.3-0.5	P14 TP2 0.3-0.5	P14 TP3 0.2-0.4	QA03	----
			Client sampling date / time	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	----
Compound	CAS Number	LOR	Unit	ES1408819-001	ES1408819-002	ES1408819-003	ES1408819-004	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	4.6	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	10.5	11.4	12.5	11.6	----
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	No	No	No	No	----
Asbestos Type	1332-21-4	-	--	-	-	-	-	----
Sample weight (dry)	----	0.01	g	45.4	43.5	35.5	38.7	----
APPROVED IDENTIFIER:	----	-	--	S.SPOONER	S.SPOONER	S.SPOONER	S.SPOONER	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	0.5	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	5.3	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	0.2	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	2.2	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	8.1	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	7	7	<5	9	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg	17	10	9	11	----
Copper	7440-50-8	5	mg/kg	<5	<5	<5	<5	----
Lead	7439-92-1	5	mg/kg	12	12	15	13	----
Nickel	7440-02-0	2	mg/kg	2	<2	<2	<2	----
Zinc	7440-66-6	5	mg/kg	6	<5	6	6	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP004: Organic Matter								
Organic Matter	----	0.5	%	----	<0.5	----	----	----
Total Organic Carbon	----	0.5	%	----	<0.5	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	P14 TP1 0.3-0.5	P14 TP2 0.3-0.5	P14 TP3 0.2-0.4	QA03	----
			Client sampling date / time	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	----
Compound	CAS Number	LOR	Unit	ES1408819-001	ES1408819-002	ES1408819-003	ES1408819-004	----
EP068A: Organochlorine Pesticides (OC) - Continued								
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	P14 TP1 0.3-0.5	P14 TP2 0.3-0.5	P14 TP3 0.2-0.4	QA03	----
				Client sampling date / time	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	----
Compound	CAS Number	LOR	Unit		ES1408819-001	ES1408819-002	ES1408819-003	ES1408819-004	----
EP068B: Organophosphorus Pesticides (OP) - Continued									
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	P14 TP1 0.3-0.5	P14 TP2 0.3-0.5	P14 TP3 0.2-0.4	QA03	----
				Client sampling date / time	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	19-MAR-2014 15:00	----
Compound	CAS Number	LOR	Unit		ES1408819-001	ES1408819-002	ES1408819-003	ES1408819-004	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	<50	<50	<50	----
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		120	101	96.0	84.3	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		120	82.7	79.4	94.8	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		99.2	101	98.5	96.7	----
2-Chlorophenol-D4	93951-73-6	0.1	%		97.7	98.3	96.6	92.5	----
2.4.6-Tribromophenol	118-79-6	0.1	%		65.1	63.0	63.6	67.8	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		84.5	85.9	85.2	81.9	----
Anthracene-d10	1719-06-8	0.1	%		107	106	104	102	----
4-Terphenyl-d14	1718-51-0	0.1	%		76.3	75.0	75.0	76.5	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		122	132	128	137	----
Toluene-D8	2037-26-5	0.1	%		93.4	108	112	105	----
4-Bromofluorobenzene	460-00-4	0.1	%		87.9	104	102	99.0	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	P14 TP1 0.3-0.5 - 19-MAR-2014 15:00	Mid red - brown clay soil with grey and red rocks plus a trace of vegetation.
EA200: Description	P14 TP2 0.3-0.5 - 19-MAR-2014 15:00	Mid red - brown clay soil with grey and red rocks plus a trace of vegetation.
EA200: Description	P14 TP3 0.2-0.4 - 19-MAR-2014 15:00	Pale off white clay soil with grey rocks plus a trace of vegetation.
EA200: Description	QA03 - 19-MAR-2014 15:00	Pale brown clay soil with red rocks plus a trace of vegetation.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0

QUALITY CONTROL REPORT

Work Order	: **ES1408819**	Page	: 1 of 7
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: STEVE CADMAN	Contact	: Client Services
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road | PO Box 435 | The Junction NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scadman@environcorp.com	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: HYDRO BUFFER ZONE INVESTIGATION	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 20-MAR-2014
Sampler	: KW, SC	Issue Date	: 29-APR-2014
Order number	: AS130348		
		No. of samples received	: 4
Quote number	: SY/433/13	No. of samples analysed	: 4

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

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

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
Pabi Subba	Senior Organic Chemist	Sydney Organics
Shaun Spooner	Asbestos Identifier	Newcastle - Asbestos
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics

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 (%)*
EA002 : pH (Soils) (QC Lot: 3400690)									
ES1408818-002	Anonymous	EA002: pH Value	----	0.1	pH Unit	4.7	4.4	6.6	0% - 20%
ED008: Exchangeable Cations (QC Lot: 3403155)									
ES1408817-001	Anonymous	ED008: Exchangeable Calcium	----	0.1	meq/100g	4.8	4.8	0.0	0% - 20%
		ED008: Exchangeable Magnesium	----	0.1	meq/100g	2.5	2.5	0.0	0% - 20%
		ED008: Exchangeable Potassium	----	0.1	meq/100g	0.3	0.3	0.0	0% - 20%
		ED008: Exchangeable Sodium	----	0.1	meq/100g	0.1	0.1	0.0	0% - 20%
		ED008: Cation Exchange Capacity	----	0.1	meq/100g	7.7	7.7	0.0	0% - 20%
EP004: Organic Matter (QC Lot: 3402744)									
ES1408817-001	Anonymous	EP004: Organic Matter	----	0.5	%	<0.5	<0.5	0.0	No Limit
		EP004: Total Organic Carbon	----	0.5	%	<0.5	<0.5	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 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
ED008: Exchangeable Cations (QCLot: 3403155)								
ED008: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1 meq/100g	100	90	128
ED008: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.67 meq/100g	100	86	120
ED008: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.51 meq/100g	100	85	135
ED008: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.87 meq/100g	100	86	128
ED008: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	----	----	----	----
EG005T: Total Metals by ICP-AES (QCLot: 3400304)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	114	92	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	108	87	121
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	105	80	136
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	112	93	127
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	106	86	124
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	109	93	131
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	115	81	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3400305)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	91.1	70	105
EP004: Organic Matter (QCLot: 3402744)								
EP004: Organic Matter	----	0.5	%	<0.5	4.58 %	94.5	85	105
EP004: Total Organic Carbon	----	0.5	%	<0.5	2.66 %	94.4	84	106
EP068A: Organochlorine Pesticides (OC) (QCLot: 3399558)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	88.8	71	113
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	93.0	66	122
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	92.6	69	119
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	89.0	71	115
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	82.5	65	113
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	92.1	68	116
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	90.3	68	118
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	93.6	68	116
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	107	68	120
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	90.7	69	119
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	93.0	67	121
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	90.3	66	118
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	93.8	69	117
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	96.8	67	123
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	93.6	76	120

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
EP068A: Organochlorine Pesticides (OC) (QCLot: 3399558) - continued								
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	97.4	76	120
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	66.4	57.3	115
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	81.9	60	124
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	95.1	67	127
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	83.1	65	123
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	90.0	65	129
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3399558)								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	0.5 mg/kg	87.1	56	126
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	84.0	64	128
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	0.5 mg/kg	78.0	54	122
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	0.5 mg/kg	80.7	64	124
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	0.5 mg/kg	81.5	73	117
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	0.5 mg/kg	90.5	55	119
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	0.5 mg/kg	76.2	69	123
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	0.5 mg/kg	87.9	70	120
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	0.5 mg/kg	86.6	71	115
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	96.5	68	114
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	0.5 mg/kg	89.1	68	122
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	0.5 mg/kg	97.6	69	115
EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	0.5 mg/kg	86.8	70	118
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	0.5 mg/kg	91.6	68	116
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	0.5 mg/kg	92.1	64	120
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	0.5 mg/kg	93.9	68	116
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	0.5 mg/kg	91.8	70	118
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	93.1	67	123
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	0.5 mg/kg	62.3	42	126
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3399562)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	4 mg/kg	91.0	80	124
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	4 mg/kg	92.9	77	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	4 mg/kg	89.9	79	123
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	4 mg/kg	93.0	77	123
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	4 mg/kg	92.2	79	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	4 mg/kg	90.3	79	123
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	4 mg/kg	93.2	79	123
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	4 mg/kg	93.9	79	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	4 mg/kg	86.8	73	121
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	4 mg/kg	91.0	81	123
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	4 mg/kg	85.4	70	118
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	4 mg/kg	97.3	77	123

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
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3399562) - continued								
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	4 mg/kg	83.3	76	122
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	4 mg/kg	82.6	71	113
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	4 mg/kg	80.9	71.7	113
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	4 mg/kg	82.8	72.4	114
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3399559)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	90.1	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3399561)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	96.0	71	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	104	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	105	64	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3399559)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	84.5	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3399561)								
EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	250 mg/kg	96.8	70	130
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	106	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
		50	mg/kg	----	150 mg/kg	101	63	131
EP080: BTEXN (QCLot: 3399559)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	86.1	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	84.3	62	128
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	78.7	58	118
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	79.2	60	120
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	79.7	60	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	91.9	62	138

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**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP004: Organic Matter (QCLot: 3402744)							
ES1408817-001	Anonymous	EP004: Organic Matter	----	4.58 %	104	----	----
		EP004: Total Organic Carbon	----	2.66 %	103	----	----

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*
EP004: Organic Matter (QCLot: 3402744)										
ES1408817-001	Anonymous	EP004: Organic Matter	----	4.58 %	104	----	----	----	----	----
		EP004: Total Organic Carbon	----	2.66 %	103	----	----	----	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1408819**	Page	: 1 of 8
Client	: ENVIRON AUSTRALIA PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: STEVE CADMAN	Contact	: Client Services
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road | PO Box 435 | The Junction NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: scadman@environcorp.com	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: HYDRO BUFFER ZONE INVESTIGATION	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 20-MAR-2014
Sampler	: KW, SC	Issue Date	: 29-APR-2014
Order number	: AS130348		
		No. of samples received	: 4
Quote number	: SY/433/13	No. of samples analysed	: 4

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
EA002 : pH (Soils)							
Soil Glass Jar - Unpreserved (EA002)							
P14 TP2 0.3-0.5	**19-MAR-2014**	**22-APR-2014**	26-MAR-2014	×	**25-MAR-2014**	22-APR-2014	✓
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**----**	----	----	**25-MAR-2014**	02-APR-2014	✓
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples							
Snap Lock Bag (EA200)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**---**	15-SEP-2014	----	**23-APR-2014**	20-OCT-2014	✓
ED008: Exchangeable Cations							
Soil Glass Jar - Unpreserved (ED008)							
P14 TP2 0.3-0.5	**19-MAR-2014**	**24-APR-2014**	16-APR-2014	×	**26-MAR-2014**	16-APR-2014	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**22-APR-2014**	15-SEP-2014	✓	**22-APR-2014**	15-SEP-2014	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**22-APR-2014**	16-APR-2014	×	**22-APR-2014**	16-APR-2014	×
EP004: Organic Matter							
Soil Glass Jar - Unpreserved (EP004)							
P14 TP2 0.3-0.5	**19-MAR-2014**	**23-APR-2014**	16-APR-2014	×	**28-MAR-2014**	16-APR-2014	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**24-MAR-2014**	02-APR-2014	✓	**19-APR-2014**	03-MAY-2014	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**24-MAR-2014**	02-APR-2014	✓	**19-APR-2014**	03-MAY-2014	✓

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
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved (EP071)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**24-MAR-2014**	02-APR-2014	✓	**20-APR-2014**	03-MAY-2014	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**24-MAR-2014**	02-APR-2014	✓	**19-APR-2014**	03-MAY-2014	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**24-MAR-2014**	02-APR-2014	✓	**28-APR-2014**	02-APR-2014	×
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved (EP080)							
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	**19-MAR-2014**	**24-MAR-2014**	02-APR-2014	✓	**28-APR-2014**	02-APR-2014	×

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)							
Exchangeable Cations with pre-treatment	ED008	1	3	**33.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Organic Matter	EP004	1	3	**33.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	1	3	**33.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Exchangeable Cations with pre-treatment	ED008	1	3	**33.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Organic Matter	EP004	1	3	**33.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Exchangeable Cations with pre-treatment	ED008	1	3	**33.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Organic Matter	EP004	1	3	**33.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	16	**6.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Organic Matter	EP004	1	3	**33.3**	**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
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
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).
Asbestos Identification in bulk solids	EA200	SOIL	AS 4964 - 2004 Method for the qualitative identification of asbestos in bulk samples
Exchangeable Cations with pre-treatment	ED008	SOIL	Rayment & Higginson (1992) Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Organic Matter	EP004	SOIL	AS1289.4.1.1 - 1997., Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (2013) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (2013) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 501)

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method	ED007PR	SOIL	Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
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.

Preparation Methods	Method	Matrix	Method Descriptions
Organic Matter	EP004-PR	SOIL	AS1289.4.1.1 - 1997., Dichromate oxidation method after Walkley and Black. This method is compliant with NEPM (2013) Schedule B(3) (Method 105)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial 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

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP080S: TPH(V)/BTEX Surrogates	ES1408819-004	QA03	**1.2-Dichloroethane-D4**	17060-07-0	137 %	72.8-133.2 %	**Recovery greater than upper data quality objective**

Outliers : Analysis Holding Time Compliance

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

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002 : pH (Soils)						
Soil Glass Jar - Unpreserved						
P14 TP2 0.3-0.5	22-APR-2014	26-MAR-2014	**27**	----	----	----
ED008: Exchangeable Cations						
Soil Glass Jar - Unpreserved						
P14 TP2 0.3-0.5	24-APR-2014	16-APR-2014	**8**	----	----	----
EG035T: Total Recoverable Mercury by FIMS						
Soil Glass Jar - Unpreserved						
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	22-APR-2014	16-APR-2014	**6**	22-APR-2014	16-APR-2014	**6**
EP004: Organic Matter						
Soil Glass Jar - Unpreserved						
P14 TP2 0.3-0.5	23-APR-2014	16-APR-2014	**7**	----	----	----
EP080/071: Total Petroleum Hydrocarbons						
Soil Glass Jar - Unpreserved						
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	----	----	----	28-APR-2014	02-APR-2014	**26**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013						
Soil Glass Jar - Unpreserved						
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	----	----	----	28-APR-2014	02-APR-2014	**26**
EP080: BTEXN						
Soil Glass Jar - Unpreserved						
P14 TP1 0.3-0.5, P14 TP2 0.3-0.5, P14 TP3 0.2-0.4, QA03	----	----	----	28-APR-2014	02-APR-2014	**26**

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.**

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 14.

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, uses of Parcel 14 appear to be limited to farmland and one dwelling. This use of Parcel 14 requires 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 14 consistent with site observations?
- Has Parcel 14 been impacted by fluoride from dust deposition from the Hydro smelter?
- Has Parcel 14 been impacted by other contaminants from historical site use?
- Is Parcel 14 suitable for Low Rural Residential (R2) and environmental conservation (E2) landuse?

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

The inputs required to make the above decisions as 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 14, as shown on Figure 1.

Vertical boundaries – as areas of concern at Parcel 14 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 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 14 for Low Rural Residential (R2) and environmental conservation (E2) landuse, then an assessment of the suitability of Parcel 14 for Low Rural Residential (R2) and environmental conservation (E2) 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 14 for Low Rural Residential (R2) and environmental conservation (E2) 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 14.

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 14 to assess the impact of particulate fallout from Hydro Aluminium Smelter.
Sampling Density	Twenty-one soil samples were collected from a grid across the entire site which is approximately 150 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 Parcel 14 from the soil surface.
Sample Collection Method	Surface soil samples across Parcel 14 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 14 were collected directly from the ground surface using using dedicated disposable gloves and a hand trowel. The hand trowel was generally used to loosen the soil prior to sampling and was brushed clean between sample locations.
Sample handling and containers	All soil samples were placed into laboratory-supplied, acid-rinsed glass jars. Soil 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.

Table A: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling Methodology	**ENVIRON Assessment**
Calibration of field equipment	No equipment requiring calibration was used.
Sampling Logs	Field Information Sheets 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	No intra-laboratory or inter-laboratory duplicate soil samples were collected at Parcel 14. Duplicate samples were collected as part of the overall field program for the buffer zone investigations at a rate of 1:20 at a minimum. No rinsate blank samples were collected.
Field quality control results	Not applicable.
NATA registered laboratory and NATA endorsed methods	ALS was the primary laboratory. ALS laboratory certificates are NATA stamped and both labs are 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 were below Parcel 14 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.

Appendix G

Hazardous Materials Audit

Hazardous Materials Audit
Parcel 14

Prepared for:
Hydro Aluminium Kurri Kurri Pty Limited

Prepared by:
ENVIRON Australia Pty Ltd

Date:
April 2015

Project Number:
AS130348

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VERSION CONTROL RECORD

Document File Name	**Date Issued**	**Version**	**Author**	**Reviewer**
Hydro Parcel 14 HMA Report	20/04/15	Final	S Taylor	F Robinson

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Acronyms and Abbreviations

ACM:	Asbestos containing material
EMP:	Employment Parcel
LBP:	Lead based paint
PCB:	Polychlorinated biphenyl compounds
SMF:	Synthetic mineral fibre

1 Introduction

ENVIRON Australia Pty Ltd (ENVIRON) was engaged by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to undertake a hazardous materials audit of the buildings located within Parcel 14, within the buffer zone of the former Hydro Aluminium smelter at Kurri Kurri, NSW.

1.1 Objectives and Scope of Work

The survey was undertaken in order for Hydro Aluminium to effectively manage its compliance obligations with respect to asbestos containing materials (ACM), and to identify and manage risks associated with other hazardous materials potentially present in the buildings to an acceptable level.

Hazardous materials other than ACM were polychlorinated biphenyl compounds (PCB), synthetic mineral fibre (SMF), and lead based paint (LBP).

1.2 Legislative Requirements, Standards and Codes of Practice

In NSW, management of asbestos is governed by the following principal legislation and guidance documents:

- Workplace Health and Safety Regulation 2011 (Part 8)
- *Code of Practice for the Management and Control of Asbestos in Workplace* (NOHSC, 2005a).
- *NOHSC Code of Practice for the Safe Removal of Asbestos 2nd Edition* (NOHSC, 2005b).

The following codes of practice and standards apply to the other hazardous materials:

- *National Code of Practice for the Safe Use of Synthetic Mineral Fibres* (NOHSC, 1990).
- *Identification of PCB-Containing Capacitors* (ANZECC, 1997).
- Australian Standard *AS4361.2 Guide to Lead Paint Management – Residential and Commercial Buildings*.

1.3 Survey Methodology

The hazardous materials survey was undertaken of structures within Parcel 14.

The survey methodology involved the following:

- An inspection of the accessible sections of the outside and inside of all buildings, as well as any accessible power boxes on power poles within the properties.
- Wherever possible, confirmation of the presence or absence of asbestos in a material was via identification in the field.
- Where the presence or absence of asbestos could not be determined in the field, a sample was taken for laboratory analysis.
- The age of the building and the condition of any fluorescent lights was observed and the likelihood for them to contain PCB noted.
- Visual confirmation of SMF.
- The age of the building and the condition of the paint was observed and the likelihood of lead-based paint being present noted.

1.4 Survey Limitations

Any restrictions or limitations on the survey, such as access not gained to areas or areas not accessible due to safety restrictions, are outlined in Section 2.2 of this report. The reader is also referred to ENIVRON's limitations in Appendix Section 6.

2 Surveys Details

2.1 Buildings Descriptions

The hazardous materials survey was undertaken on 10 June 2014 and 26 March 2015 by ENVIRON Senior Environmental Scientist Shaun Taylor. At the time of preparation of this report the interior of the house at the property could not be accessed so only the exterior was examined.

Table 1 describes the following:

- The building type (such as residential home, shed, garage).
- Main construction materials used in construction of the building.
- An estimate as to whether the structure was build prior to 1990 (1990 is commonly regarded as a 'cut-off date' for asbestos in construction materials. It is also a good indicator as to the likelihood of PCBs being used in fluorescent lighting capacitors).
- Any areas not accessible within the building.

A total of two buildings within one property were inspected for hazardous materials. Mobile equipment (such as vehicles and caravans) was not inspected.

2.2 Survey Methodology

The methodology undertaken for the survey is described as follows.

Develop Project OHS Plan, and Survey Protocol and Survey Templates

A Health and Safety Plan was developed for the contamination and hazardous materials investigations within the buffer zone in advance of the works commencing and endorsed internally.

A hazardous materials protocol and data collection template specific to the project was developed, to ensure a consistent approach to the surveys and data collection.

Project Scheduling and Communications

Tenants' contact details were provided by Hydro and a scheduled date for the survey agreed to between ENVIRON and the tenant. Each tenant was notified of the survey program and process by Hydro (via the real estate agent) in advance. Prior to the scheduled date, ENVIRON contacted the tenant to confirm the date, arrival time, and any likely access issues or restricted areas.

Conduct Hazardous Materials Survey

The survey included a thorough visual inspection of all accessible areas of the buildings and structures, and collection of representative samples for the purpose of analytical confirmation where materials could not be visually identified.

Data Collection

Survey data collected included the type, form, location, extent/ quantity, condition and accessibility of ACM and synthetic mineral fibre products, the likely presence of PCB in

fluorescent light fittings, and the likely presence of LBP. Photographs were also taken of the observed potential/ confirmed hazardous materials.

In addition, any other observations of concern (such as potential for contamination in the surrounding area) were documented.

Sample Analysis

Any asbestos sample analysis was undertaken using polarised light microscopy, in conjunction with dispersion staining techniques. Where possible, the presence of asbestos (but not the type of asbestos) was confirmed in the field.

SMF was visually identified during the surveys. The presence of lead in paint and PCB in the capacitor to fluorescent lights was assumed based on the likely age of the building and the condition of painted surfaces and the lights.

Areas not Accessed

During the audit, all areas of the buildings and structures within the area which were both readily accessible and safe to access were inspected. Where access was not available to areas which could potentially hazardous materials, the locations and the reasons inaccessibility were noted. Any areas not accessed are documented within Section 2 of this report.

Other Observations

In addition to the survey of structures within the property, the surveyor also noted potential issues of concern, such as:

- Evidence of subsurface hazardous materials (such as ACM service conduits).
- Evidence of hazardous material fragments/ waste in soils or elsewhere within the property.
- Other potential issues of concern (such as possible soil contamination).

2.3 Sample Collection and Laboratory Analysis

During the survey one sample was collected and analysed for the presence of asbestos (all forms) at a NATA accredited asbestos identification facility. The results of the analysis is summarised in Section 3, with the supporting laboratory analytical certificate contained in Appendix C.

The remaining ACM were confirmed through visual confirmation of the presence of asbestos (but not the type of asbestos) in the field.

Table 1: Hazardous Materials Audit Building Details				
Property	**Building Type/s**	**Main Construction Materials**	**Estimated Pre or Post 1990 construction**	**Any Inaccessible Areas**
Parcel 14				
22 Bowditch Avenue	House	Weatherboard Timber Brick Cement sheeting Concrete Corrugated iron	Pre-1990	Wall and ceiling cavity
	Garage	Steel Corrugated iron Concrete	Pre-1990	N/A

3 Findings

3.1 Hazardous Materials Register

The results of the survey are presented in Appendix B.

The following provides a summary of the hazardous materials identified. Representative photographs of the identified hazardous materials are provided in Appendix A.

3.2 Asbestos Containing Materials

Asbestos cement sheeting was found in the following locations:

- The southern wall of and upper panels to the carport at the front of the house.
- Gable end and eaves to the north side of the house.
- Panelling around the base of the verandah.
- Underside of the verandah cover.
- Infill panels between the house and the ground on the west side of the house.
- Fragments under the northwestern corner of the house.
- Backing boards to power boxes servicing the house and the garage.
- The majority of internal walls and the ceiling.

One sample was collected for laboratory analysis from sheeting used around the base of the verandah. The results showed that the sheeting did not contain asbestos. One sample was taken of the internal wall lining in the living area. The results showed that the sheeting did contain asbestos. The laboratory certificates are presented in Appendix C.

3.3 Synthetic Mineral Fibre Materials

There is potential that SMF was used as insulation to wall and ceiling cavities in the house.

3.4 Polychlorinated Biphenyls

There is potential that fluorescent light fittings observed within and to the exterior of the house and in the garage have capacitors that contain PCBs.

3.5 Lead Based Paint

Due to the age of the house it is likely that lead based paint has been used. Most of this is on weatherboards while some of it may be present on the ACM sheeting.

AS4361.2 Guide to Lead Paint Management – Residential and Commercial Buildings notes that lead based paint was used mainly on exterior surfaces and to a lesser extent on interior doors and architraves, especially in undercoats and primers where concentrations of up to 20% lead were commonly used. It also notes that while paints produced for Australian dwellings from the 1970s onwards (and therefore applicable for this property) contain less than 1% lead, it is possible that industrial paints, having higher concentrations of lead, may have been applied to housing and commercial buildings.

3.6 Other Observations

Since the initial inspection on 10 June 2014 the tenant of 22 Bowditch Avenue had vacated. At the subsequent inspection 26 March 2015 much of the material in the yard that was of potential concern appeared to have been removed.

A caravan and other miscellaneous items still remained.

4 Recommendations

The following are general management measures to be implemented for hazardous materials management, either in the event that the building is to be retained and occupied, or the building is to be demolished.

4.1 Asbestos Containing Materials

4.1.1 Building Maintenance/ Retention

- The asbestos containing materials identified on site generally do not pose a significant health risk and may remain in situ if they remain undamaged and sealed (by paint).
- Damaged ACM should be removed and replace. Where damage is minor (such as minor cracks, drilled holes or worn edges to sections of the walls and ceilings within the former dairy shed and to laundry walls to the house) any cracks should be sealed with a PVA glue and painted (no sanding of materials prior to painting) as a temporary measure. However it is recommended that a program for removal of these materials also be developed and implemented.
- A copy of the asbestos and hazardous materials register is to be kept at the Hydro Aluminium Smelter and made available to employees or contractors undertaking work on the buildings.
- No sanding, blasting, drilling, or similar abrasive activity is to be undertaken on any identified ACMs.
- The *National Code of Practice for the Management and Control of Asbestos in Workplaces* recommends, and the Work Health and Safety Regulation 2011 requires, labelling of any identified ACM in the workplace where practicable.

  While such labelling is not required in a rental property under the regulation (and notification of tenants on the presence of asbestos is not required by the NSW Department of Fair Trading), Hydro should consider labelling the ACM, or advising tenants of the presence of ACM, particularly those in locations where it is easily accessible and more likely to be damaged or impacted (such as the walls).
- If installed, periodically reinspect asbestos warning labels to ensure they are legible and in good condition.

4.1.2 Building Demolition

- If demolition or refurbishment works are to be undertaken, remove identified ACMs under controlled conditions using an appropriately licensed removal contractor.
- Any asbestos work is carried out in accordance with the *Code of Practice for the Management and Control of Asbestos in the Workplace [NOHSC: 2018 (2005)].*
- Appropriately licensed removalists are to be used for any planned removal, and that any removal works are undertaken in accordance with the *NOHSC Code of Practice for the Safe Removal of Asbestos 2nd Edition [NOHSC:2002(2005)].*

4.2 Synthetic Mineral Fibre Materials

- Apply caution when entering ceiling voids and ensure contractors or persons entering ceiling voids or performing work on synthetic mineral fibre materials wear appropriate PPE, particularly if they have breathing disorders such as asthma.
- Remove any SMF debris as part of routine site housekeeping.
- Ensure contractors or persons performing work on SMF materials adhere to the guidelines outlined in the *National Code of Practice for Synthetic Mineral Fibres [NOHSC 1004 (1990)], May 1990*; and the *Industry code of Practice for the Safe Use of Glass Wool and Rock Wool Insulation Products, April, 2003.*

4.3 Polychlorinated Biphenyls

- Undamaged capacitors (containing PCBs) are unlikely to pose a health risk. Therefore they are unlikely to pose a risk if they remain in-situ.
- In the event that the light fittings are to be removed, the presence of PCB should be confirmed.
- If it is confirmed that the capacitors contain PCBs, the requirements of the *Identification Of PCB-Containing Capacitors* should be implemented for removal, temporary storage, transportation and disposal.

4.4 Lead Based Paint

- The vast majority of the interior paints (which could potentially be LBP) were applied to ACM. Therefore:
  - In the event that the building is to be demolished, these materials would be managed in accordance with **Section 4.1.2** as asbestos containing materials. These management procedures are considered appropriate for LBP.
  - If the building is to be retained and surfaces repainted, no abrasion (mechanical or manual) should be applied to these surfaces. This is required to avoid both the generation of airborne asbestos fibres and potentially lead bearing particles.
- Abrasion should not be used on any of the remaining paint on non-asbestos containing material surfaces to avoid the potential generation of lead bearing particles without previously testing to confirm that LBP are absent.
- In the event that the building is demolished, the PPE to be worn when managing ACM and SMF would appropriately protect demolition personnel from LBP.

5 References

Australian and New Zealand Council Environment Conservation Council (ANZECC). 1997. “Identification Of PCB-Containing Capacitors”.

National Occupational Health and Safety Council. (NOHSC). 1990. “National Code of Practice for the Safe Use of Synthetic Mineral Fibres”.

National Occupational Health and Safety Council. (NOHSC). 2005a. “Code of Practice for the Management and Control of Asbestos in Workplace.

National Occupational Health and Safety Council. (NOHSC). 2005b. “Code of Practice for the Safe Removal of Asbestos 2nd Edition”.

Standards Australia. 1998. “AS4361.2 Guide to Lead Paint Management – Residential and Commercial Buildings”

6 Limitations

ENVIRON Australia prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Pty Limited 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 the site. 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 the site 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 judgement 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.

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

6.1 General Limitations regarding Sampling

It is not always possible to locate all hazardous materials in the course of an inspection, due to factors such as:

- Restrictions on access to internal construction components and other inaccessible parts of structures.
- Restrictions to access due to presence of tenant's belongings.
- The need to avoid damage in occupied buildings, such as when attempting to inspect behind wall panels or under carpets.
- Minimising inconvenience when premises are occupied or are in use whilst an inspection is being conducted.
- The availability of building/plant construction plans.

6.2 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

Figure 1. Part of Parcel 14 (containing structures)

Appendix A

Photographs

Photo 1: Part of the corrugated AC sheeting southern wall to the carport on the western side of the house (sheets on the northern side of the carport appeared to be have been removed). Also note the ACM panelling above the corrugated sheeting

Photo 2: Part of the ACM panelling around the top of the carport.

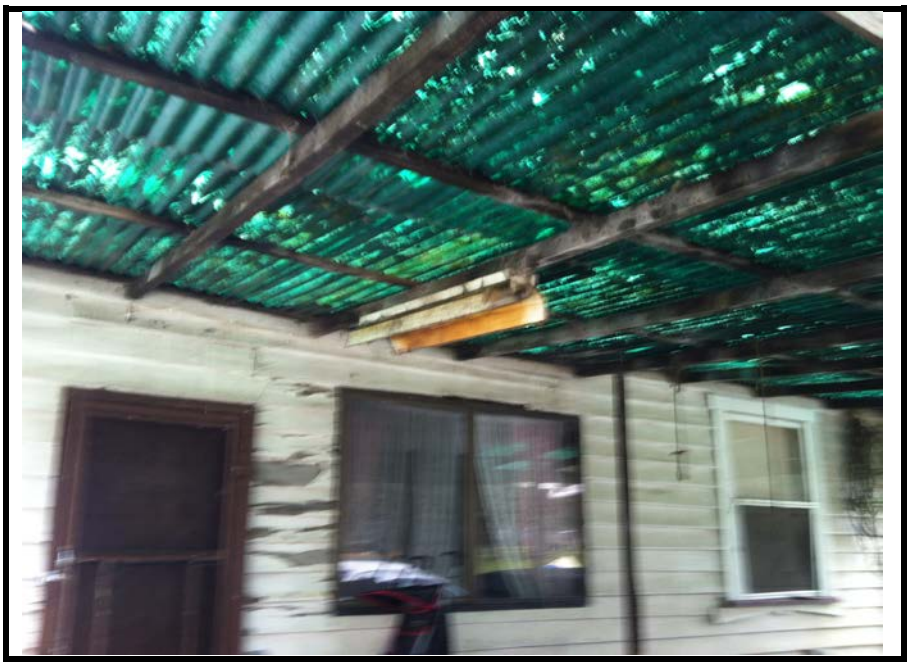

Photo 3: Fluorescent light beneath the carport.

Photo 4: Gable end and eaves to the north side of the house

Photo 5: A section of the panels that are around the base of the verandah on the back and southern side of the house**.** Laboratory analysis concluded these are not ACM.

Photo 6: A section of the ACM sheeting used on the underside to the verandah on the back and southern side of the house

Photo 7: Fluorescent light attached to the rear wall of the house

Photo 8: Arrows pointing to some of the fragments of corrugated ACM sheeting under the northwestern corner of the house

Photo 9: One of the sections of ACM sheeting used as infill panels between the house and the ground on the western side of the house

Photo 10: The garage which contains four fluorescent lights that appeared to be of an age that could contain PCB-containing capacitors (note that the contents of the garage have since been removed).

Photo 11: The electrical power box in the garage with a zelemite backing board.

Photo 12: The electrical power box to the house with a zelemite backing board.

Photo 13: ACM walls in living area.

Photo 14: Section of the ACM wall in the kitchen area.

Photo 15: Section of the ACM lined ceiling in the main section of the house.

Photo 16: Fluorescent light fitting in the living area that potentially includes a PCB-containing capacitor.

Photo 17: Fluorescent light fitting in to the kitchen wall that potentially includes a PCB-containing capacitor.

Photo 18: Fluorescent light fitting in to the laundry that potentially includes a PCB-containing capacitor.

Appendix B

Hazardous Materials Register

Glossary of Terms and Abbreviations Used in Registers

The following provides an explanation of terms and abbreviations used in the registers.

Location	The location within the building (e.g bathroom) and the use of the material (e.g. floor covering, soffit lining, pipe lagging)
ACM	Asbestos containing material
Bonded	Refers to ACM with its fibres firmly bound within the host media.
AC sheeting	Asbestos cement sheeting
Condition	Refers to the physical state or condition of the material in accordance with the following: • Good – material shows no, or very minor damage and/or deterioration • Fair – material shows signs of minor damage and/or deterioration • Poor – material shows sign of significant damaged and/or deterioration or the material is partly or wholly unserviceable for its intended use.
Description	Description of the material identified e.g. vinyl tile, fibre cement sheeting etc.
Friable	ACM that may be crumbled pulverised or reduced to powder by hand pressure.
LBP	Lead based paint:
Result	Refers to result of ACM or LBP analysis. • For asbestos, this is the type identified during laboratory analysis. The three main commercial asbestos types found in Australia area: chrysotile (CH-white), amosite (A-brown or grey), and crocidolite (C-blue). • NAD means no asbestos was detected during laboratory analysis. • Materials shown as 'Refer to.....' have not been sampled but visually appear the same as other material previously sampled. • 'Assumed' refers to those materials not sampled (e.g. for safety reasons or restricted access) and which are not similar to previously sampled materials; or refers to paint that is assumed to be LBP due to building age and paint condition. • 'Field' means ACM where asbestos fibres identified in field but the type of asbestos not confirmed. • 'Potential' refers to fluorescent lights where it is assumed that PCBs are present due to their apparent age.
PCB	Polychlorinated Biphenyls
Risk	Refers to the level of risk posed by the material based on its condition. friability, accessibility and other factors such as exposure to disturbance. The levels of risk adopted for the survey are Urgent (U), High (H), Medium (M) and low (L) as defined in Appendix C of this report.
SMF	Synthetic mineral fibre
Type of Material	The type of hazardous material (ACM, SMF, PCB or LBP).

Date of Audit	Parcel	Property Address	Building Name/ No.	Type of Haz Mat	Form of Haz Mat	Location	Description/ Condition	Accessibility	Est. Quantity	Photo Ref	Sample No.	Result
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheet (Corrugated)	Southern wall to carport to house	Significant damage, painted but worn and mouldy	Ground - 3m above ground level	4m2	1	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Upper panel to west, north and south sides of carport	Edge damage, painted but mouldy	3m above ground level	8m2	1 and 2	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent light to underside of carport roof	Rusted and damaged	3m above ground level	1	3	Assumed	PCB
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Gable end to north side of house	Paint peeling, no damage	5m above ground level	3m2	4	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Eaves to gable end of house	Good, painted, no damage	5m above ground level	1m2	4	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	N/A	Sheeting	Infill panels around the base of the back and southern side verandah	Fair: painted, some damage	.6m above ground level	10m2	5	LP14-ACM-01	NAD
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Underside of back and southern side verandah cover (including eaves and lip)	Painted, edges covered by strips, some minor damage	2.4m above ground level	100m2	6	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent light attached to back wall under back verandah	Rusted and damaged	2m above ground level	1	7	Assumed	PCB
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheet (Corrugated)	Under house, northwestern corner	Fragments of varying sizes, appears similar to that used on the carport	At ground level	1m2 (apparent)	8	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	In sections as infill between ground and base of house at front (west) side of house	Painted but damaged	At ground level	2m2	9	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent lights in open corrugated iron garage	Older with minor damage (1 partially fallen)	3.5m above ground level	4	10	Assumed	PCB
10/06/2014	14	22 Bowditch Avenue	House	ACM	Zelemite	Backing board to power box in open garage	Fair, drilled holes	1.5m above ground level	1m2	11	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Zelemite	Backing board to power box on northern wall	Fair, drilled holes	1.5m above ground level	1m2	12	Field	ACM
26/03/2015	14	22 Bowditch Avenue	House	ACM	Sheeting	Walls to all rooms excluding North Room (neclosed verandah), southwest bedroom and timber veneer in living area	Painted, generally in faire condition, there is some damage and holes. Timber strips to uppoer sections, none to lower sections	Ground - 4m above ground level	500m2	13 & 14	22B-ACM-01	ACM
26/03/2015	14	22 Bowditch Avenue	House	ACM	Sheeting	High ceiling to main section of building	Good, painted with edge strips	4m above ground level	200m2	15	Refer to 22B-ACM-01	ACM
26/03/2015	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent light to ceiling in living area	Double 1.2m in length in living area	4m above ground level	1	16	Assumed	PCB
26/03/2015	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent lights in three locations	Asingle 60cm on wall in kitchen and in laundry	1.2m above ground level (kitchen) and 3m above ground level (laundry)	2	17 & 18	Assumed	PCB

Appendix C

Laboratory Certificates

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1402090**	Page	: 1 of 3
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: FIONA ROBINSON	Contact	: Peter Keyte
Address	: PO BOX 564 MAITLAND NSW, AUSTRALIA 2320	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: frobinson@environcorp.com.au	E-mail	: peter.keyte@als.com.au
Telephone	: +61 02 49344354	Telephone	: 61-2-4968-9433
Facsimile	: +61 02 49344359	Facsimile	: +61-2-4968 0349
Project	: AS130348 - HYDRO ALUMIUM BUFFER ZONE	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 18-JUN-2014
Sampler	: SHAUN TAYLOR	Issue Date	: 25-JUN-2014
Site	: ----		
		No. of samples received	: 1
Quote number	: SY/578/14	No. of samples analysed	: 1

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
- Descriptive Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

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*
Christopher Owler	Team Leader - Asbestos	Newcastle - Asbestos

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

- **EA200 Legend**
- **EA200 'Am' Amosite (brown asbestos)**
- **EA200 'Ch' Chrysotile (white asbestos)**
- **EA200 'Cr' Crocidolite (blue asbestos)**
- **EA200 'Trace' - Asbestos fibres detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres**
- **EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.**
- **EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.**
- **EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.**

Analytical Results

Sub-Matrix: **SOLID** (Matrix: **SOIL**)			Client sample ID	**LP14-ACM-01**	----	----	----	----
			Client sampling date / time	10-JUN-2014 15:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN1402090-001**	**----**	**----**	**----**	**----**
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**No**	----	----	----	----
Asbestos Type	1332-21-4	-	--	**-**	----	----	----	----
Sample weight (dry)	----	0.01	g	**0.84**	----	----	----	----
APPROVED IDENTIFIER:	----	-	--	**C.OWLER**	----	----	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOLID**

Method: Compound	*Client sample ID - Client sampling date / time*	*Analytical Results*
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	LP14-ACM-01 - 10-JUN-2014 15:00	Several pieces of organic fibre board approximately 10 x 10 x 2mm

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1511008**	Page	: 1 of 2
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: FIONA ROBINSON	Contact	: Peter Keyte
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
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Telephone	: +61 02 49344354	Telephone	: +61 2 4014 2500
Facsimile	: +61 02 49344359	Facsimile	: +61 2 4967 7382
Project	: AS130328 - Hydro Alumium Buffer Zone	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 26-Mar-2015 13:12
C-O-C number	: ----	Date Analysis Commenced	: 30-Mar-2015
Sampler	: SHAUN TAYLOR	Issue Date	: 30-Mar-2015 19:50
Site	: ----		
		No. of samples received	: 4
Quote number	: ----	No. of samples analysed	: 4

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive 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*
Christopher Owler	Team Leader - Asbestos	Newcastle - Asbestos

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
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: **SOLID** (Matrix: **SOLID**)			Client sample ID	**2D/ACM/1**	**2D/ACM/2**	**8D/ACM/1**	**22B/ACM/01**	**----**
			Client sampling date / time	26-Mar-2015 12:00	26-Mar-2015 12:00	26-Mar-2015 12:00	26-Mar-2015 12:00	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN1511008-001**	**EN1511008-002**	**EN1511008-003**	**EN1511008-004**	**--------**
				Result	Result	Result	Result	Result
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**Yes**	**Yes**	**Yes**	**Yes**	**----**
Asbestos Type	1332-21-4	-	--	**Ch**	**Ch**	**Ch**	**Ch**	**----**
Sample weight (dry)	----	0.01	g	**1.49**	**0.56**	**0.64**	**6.30**	**----**
APPROVED IDENTIFIER:	----	-	--	**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**	**----**

Analytical Results

Descriptive Results

Sub-Matrix: **SOLID**

Method: Compound	*Client sample ID - Client sampling date / time*	*Analytical Results*
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	2D/ACM/1 - 26-Mar-2015 12:00:00	Several pieces of friable asbestos fibre board approximately 20 x 20 x 4mm
EA200: Description	2D/ACM/2 - 26-Mar-2015 12:00:00	Several pieces of friable asbestos fibre board approximately 20 x 5 x 4mm
EA200: Description	8D/ACM/1 - 26-Mar-2015 12:00:00	Several pieces of friable asbestos fibre board approximately 10 x 10 x 4mm
EA200: Description	22B/ACM/01 - 26-Mar-2015 12:00:00	One piece of friable asbestos cement sheeting approximately 40 x 35 x 4mm

Date of Audit	Parcel	Property Address	Building Name/ No.	Type of Haz Mat	Form of Haz Mat	Location	Description/ Condition	Accessibility	Est. Quantity	Photo Ref	Sample No.	Result
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheet (Corrugated)	Southern wall to carport to house	Significant damage, painted but worn and mouldy	Ground - 3m above ground level	4m2	1	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Upper panel to west, north and south sides of carport	Edge damage, painted but mouldy	3m above ground level	8m2	1 and 2	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent light to underside of carport roof	Rusted and damaged	3m above ground level	1	3	Assumed	PCB
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Gable end to north side of house	Paint peeling, no damage	5m above ground level	3m2	4	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Eaves to gable end of house	Good, painted, no damage	5m above ground level	1m2	4	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	N/A	Sheeting	Infill panels around the base of the back and southern side verandah	Fair: painted, some damage	.6m above ground level	10m2	5	LP14-ACM-01	NAD
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	Underside of back and southern side verandah cover (including eaves and lip)	Painted, edges covered by strips, some minor damage	2.4m above ground level	100m2	6	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent light attached to back wall under back verandah	Rusted and damaged	2m above ground level	1	7	Assumed	PCB
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheet (Corrugated)	Under house, northwestern corner	Fragments of varying sizes, appears similar to that used on the carport	At ground level	1m2 (apparent)	8	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Sheeting	In sections as infill between ground and base of house at front (west) side of house	Painted but damaged	At ground level	2m2	9	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent lights in open corrugated iron garage	Older with minor damage (1 partially fallen)	3.5m above ground level	4	10	Assumed	PCB
10/06/2014	14	22 Bowditch Avenue	House	ACM	Zelemite	Backing board to power box in open garage	Fair, drilled holes	1.5m above ground level	1m2	11	Field	ACM
10/06/2014	14	22 Bowditch Avenue	House	ACM	Zelemite	Backing board to power box on northern wall	Fair, drilled holes	1.5m above ground level	1m2	12	Field	ACM
26/03/2015	14	22 Bowditch Avenue	House	ACM	Sheeting	Walls to all rooms excluding North Room (neclosed verandah), southwest bedroom and timber veneer in living area	Painted, generally in faire condition, there is some damage and holes. Timber strips to uppoer sections, none to lower sections	Ground - 4m above ground level	500m2	13 & 14	22B-ACM-01	ACM
26/03/2015	14	22 Bowditch Avenue	House	ACM	Sheeting	High ceiling to main section of building	Good, painted with edge strips	4m above ground level	200m2	15	Refer to 22B-ACM-01	ACM
26/03/2015	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent light to ceiling in living area	Double 1.2m in length in living area	4m above ground level	1	16	Assumed	PCB
26/03/2015	14	22 Bowditch Avenue	House	PCB	Capacitor	Fluorescent lights in three locations	Asingle 60cm on wall in kitchen and in laundry	1.2m above ground level (kitchen) and 3m above ground level (laundry)	2	17 & 18	Assumed	PCB