Phase 2 Environmental Site Assessment, Parcel 3

Prepared for:
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This document is issued in confidence to Hydro Aluminium Kurri Kurri Australia Pty Ltd for the purposes of a Phase 2 Environmental Site Assessment. It should not be used for any other purpose. The scope of the Phase 2 Environmental Site Assessment was based on ENVIRON's proposal dated 25 July 2013.

Specific assumptions and limitations identified by ENVIRON as being relevant are set out in the report. The methodology adopted and sources of information used by ENVIRON are outlined in our scope of work. ENVIRON has made no independent verification of this information beyond the agreed scope of works.

This report should be read in full.

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Acronym and Abbreviations

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

Executive Summary

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 3. Parcel 3 is a rural property and is accessed from Cessnock Road, Kurri Kurri and located immediately east of the buffer zone for the Hydro aluminium smelter.

The objectives of the assessment were to assess the presence of contamination at Parcel 3 and to assess the suitability of that site for both current land uses and future uses for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use.

Parcel 3 is approximately 139Ha, comprising a number of lots within DP71130, DP998540 and DP62332. Parcel 3 predominantly comprises cleared land, mainly covered in grasses and small trees and shrubs and is used for cattle grazing, with a densely vegetated area in the south-east. Historical coal mining was undertaken on neighbouring land to the north and east. Coal was transported from the mine to Maitland by a short branch line connected to the South Maitland Railway line. The line was removed by the mid-1940s and ran through what is now an easement between Lot 2 and Lot 3 of DP62332 of Parcel 3.

To assess the potential for soil contamination in Parcel 3, soil samples were collected from within the remnant rail spur fill embankment and across the site in general. No other signs of disturbed land or of land filling were observed during the assessment.

Soil samples from the former rail spur were analysed for petroleum hydrocarbons (TPH), soluble fluoride, asbestos and polycyclic aromatic hydrocarbons (PAH). Surface soil samples from across Parcel 3 were analysed for soluble fluoride.

Samples collected from along the former railway embankment remnant in the northern area of Parcel 3 contained concentrations slightly in excess of the adopted site guideline for TPH >C10-C16 (3 samples) and the TPH >C16-C34 ecological screening level guidelines for urban residential land use (1 sample). The 95% Upper Confidence Limit (UCL) concentrations were below both guidelines. Concentrations of all other analytes tested were found to be below the adopted site guidelines. Although no surface water (from farm dams) was sampled during the investigation, it is considered that site conditions have minimal potential to impact surface waters.

Parcel 3 is suitable for the current land use and for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use.

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

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 designated as Parcel 3.

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 future land uses following the closure of the smelter in May 2014. A Rezoning Masterplan has been developed that identifies Parcel 3 to comprise land suitable for low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use.

A Phase 1 Environmental Site Assessment has previously been prepared for all Hydro owned lands and evaluated the potential for contamination. On Parcel 3, these investigations identified the presence of a former rail spur extending south from the South Maitland railway for approximately 350m along an easement between Lot 2 and Lot 3, DP 62332. The investigations also identified records of historical coal mining activities to the east and north of Parcel 3.

It is noted that at the time of the fieldwork, this land parcel was named Residential Parcel 3 and as such the soil samples reference this name. The parcel was renamed Parcel 3 during the Rezoning Masterplan process.

The location of Parcel 3 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 presence of contamination at Parcel 3 and to assess the suitability of that site for both current land uses and future uses for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) 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;
  - Collection of surface soil samples to assess the rail embankment area of the former rail spur;
  - A site walkover to evaluate other potential locations of buried waste or illegal dumping, or other site activities that may give rise to contamination.

- 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 3 suitable for the proposed land use.

2 Site Description

2.1 Site Location

Parcel 3 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 New South Wales, Australia. The address of Parcel 3 is Cessnock Road, Cliftleigh, New South Wales, Australia. The location of Parcel 3 is shown in **Figure 1**.

Parcel 3 is located immediately east of the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter, approximately 2.5km to the north-east of the smelter. The northern and south-western areas of Parcel 3 are predominantly covered in grasses and other scattered small trees and shrubs and are used for cattle grazing. The south-eastern area is covered with dense bush/vegetation and is fenced off from the rest of the parcel. The Buffer Zone is an area of land surrounding the smelter that provides a buffer between the smelter and surrounding communities.

Shallow sloped natural drainage lines traverse the mid and southern areas of the parcel and are typically more heavily vegetated by trees and shrubs.

The majority of Parcel 3 is located within the Cessnock Local Government Area and is zoned RU2 – Rural Landscape under the Cessnock Local Environment Plan. A small portion is located within the Maitland Local Government Area and is zoned RU1 – Rural Production under the Maitland Local Environment Plan.

The South Maitland Railway line extends north to south and forms the western and north-western boundary of Parcel 3. The line is privately owned and extends from Pelton, south of Cessnock to Maitland. Train movements along the line are infrequent (approximately twice a day).

Parcel 3 is approximately 139 hectares (ha) and comprises the Lot numbers and Deposited Plans listed in Table 1:

Table 1: Lot and Deposited Plans for Parcel 3.

Subarea	Lot/ DP	Area (ha)	Total Area (ha)
Parcel 3	Lot 1 DP71130 Lot 1 DP998540 Lot 2 DP62332 Lot 3 DP62332 Lot 1 DP 73597 Part 2	8.7 116.9 7.6 6 0.6	139.8

Land uses surrounding Parcel 3 are as follows:

- North: A dedicated coal railway line then farmland;
- South: Bushland and residential land;
- East: Farmland;

- West: A dedicated coal railway line then farmland.

Parcel 3 is located approximately 1.3km to the north east of the smelter site boundary.

2.2 Site Setting

2.2.1 Topography

Parcel 3 is located on slightly undulating ground from approximately 20 mAHD in the north and north-east to eastern section, to flats in the south and west below 10mAHD.

The land generally slopes from the north and east towards the lower flat areas in the south and west.

Wentworth Swamp is located approximately 1km north-west of Parcel 3 at an elevation of approximately 10 mAHD.

2.2.2 Regional Geology

According to the review of the regional geology described on the Hunter Coal Field Geological Sheet, most of Parcel 3 is underlain by the Lower Permian-aged Rutherford Formation comprising, sandstone and siltstone.

The south western low areas are underlain by Quaternary-aged undifferentiated alluvium (clays, sands and silts), associated with the modern surface water bodies.

Quaternary sediments which are associated with Wentworth Swamp (approximately 1km west of Parcel 3) and the Hunter River consist of gravel, sand, silt and clay.

2.2.3 Site Hydrology

Surface water from Parcel 3 generally discharges via man-made and natural drainage lines to the west site boundaries.

Surface water in the western portion of Parcel 3 is also directed via drainage lines towards the farm dams in the south western portion of Parcel 3 and into Wentworth Swamp. Wentworth Swamp in turn discharges to the Hunter River approximately 5km northeast of Parcel 3 near Maitland.

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

2.2.4 Regional Hydrogeology

Regional groundwater is expected to follow topography and flow northeast towards the surface water bodies that discharge to the Hunter River. Locally, groundwater beneath Parcel 3 is expected to flow north west to Wentworth Swamp located on the western site boundary.

According to the NSW Office of Environment and Heritage (Natural Resource Atlas), there are 31 licensed groundwater abstractions (bores) located approximately 7.5km north east of Parcel 3 at Maitland and South Maitland.

The groundwater bores are located within the coal measures or Quaternary Alluvium associated with Wentworth Swamp and other associated surface water bodies in the vicinity of Parcel 3.

Information for seven bores located in a 5km radius from Parcel 3 has been included in Appendix A. The bores are used for domestic, recreation, monitoring, irrigation and stock watering purposes. Information for a bore approximately 3km north east of Parcel 3 (GW066948) indicates a standing water level (SWL) for groundwater at 7.5m and a water bearing zone from 7.5m-14m. A bore approximately 3km north west of Parcel 3 (GW029088) indicates a SWL of 3m and a water bearing zone of 6m – 24m. The drillers log at this bore indicates the lithology as clayey sand (0m-6m) underlain by shale (6m-24m) and then sandstone (24m – 39m).

It is considered that impacts on groundwater by surface water are unlikely given the depth to groundwater (in excess of 5m below surface).

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 3 with respect to surface water and groundwater is considered to be moderate based on the following:

- surface water and groundwater discharge into Wentworth Swamp, approximately 1km north- west of Parcel 3, which discharges to the Hunter River within the Fishery Creek Catchment, approximately 5km northeast of Parcel 3 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 3 has been impacted by historical coal mining;
- depth to groundwater greater than 5m; and
- 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 indicate that Parcel 3 has (and continues to be) used for livestock grazing land.

Coal mining was identified on neighbouring land to the north and east and was known as the Glen Main colliery. The Glen Main colliery is one of a series of collieries that mined the Greta and Holmesville Coal Measures, coal seams that extend in a north-south direction between Cessnock Road and the South Maitland Railway line. The Glen Main Colliery is located on a portion of Hydro owned land that extends from South Maitland Railway line to Cessnock Road. The location of the Glen Main Colliery is shown in **Figure 3**. This area is immediately to the east of Parcel 3.

Mine rail tracks and the short branch line to the South Maitland Railway line were removed by the mid-1940s. The short branch line ran through what is now an easement between Lot 2 and Lot 3 of DP62332 of Parcel 3 (**Figures 3 and 4**).

The remoteness of Parcel 3 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.

4 Sampling and Analytical Quality Plan

4.1 Potential Areas and Contaminants of Concern

Based on Parcel 6 historical information as discussed in **Section 3**, the following areas of concern were identified as follows.

- The former branch line from the South Maitland Railway which includes the presence of a fill embankment and potential contamination related to movement of trains across this area.
- Smelter dust deposition.
- Illegal dumping.

Contaminants of concern associated with the range of previous site activities are:

- asbestos;
- polycyclic aromatic hydrocarbons (PAHs);
- petroleum hydrocarbons; and
- fluoride.

4.2 Data Quality Objectives and Data Quality Indicators

Data quality objectives (DQOs) and Data Quality Indicators (DQIs) were developed by ENVIRON using the US EPA seven-step DQO process. Completing the seven-step process

helps to define the purpose of the assessment and the type, quality and quantity of data needed to inform decisions relating to the assessment of site contamination.

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

4.3 Sampling Design

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

4.3.1 Fluoride

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

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

- aerial dust deposition is likely to be relatively consistent over the surface of the parcel and therefore sampling on a low density 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 on an approximate grid across open areas of Parcel 3. 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 3, 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.

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 3 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 3 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 assess Parcel 3 for areas of imported fill and whether further field investigations will be required.

The entrance to Parcel 3 is from Cessnock Road and through the north-eastern area of the Wangara rural holding. Parcel 3 comprises the southern four lots of this rural holding (see Section 2.1).

The northern and western portion of Parcel 3 was comprised of cleared, grass-covered land which generally gently sloped towards the west and south.

The South Maitland Railway line extends north and south of Parcel 3 and represents the western boundary.

Natural and man-made vegetated drainage lines were observed to extend across the site, generally following the topography. Several small farm dams were located over the four lots generally towards the western side. From observation, dams were typically formed from native materials (no imported fill). At several locations culverts beneath the rail embankment allowed drainage to flow west towards Swamp Creek and the Wentworth Swamp lands.

Evidence of the former rail spur, south from the South Maitland Line, was still visible on the north-south border between Lots 2 and 3, DP 62332. Approximately 350m in length, the former line was still visible as a linear, slightly raised mound following the line of the former rail embankment. In some locations, remnants of wooden sleepers and iron rail spikes were still evident. The remnant embankment fill comprised silty, sandy, gravelly fill, often with coal fragments. The former rail line was also delineated by a line of mature trees on its western side.

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

Photographs are included in **Appendix B** and field information sheets are included in **Appendix C.**

6.2 Soil Investigations

Ten near-surface soil samples were collected, using a trowel, from embankment fill along the line of the former rail spur, (samples S1 to S10). Generally the soils of the remnant rail embankment of the former mining rail spur comprised silty, sandy gravelly soils, containing some coal fragments. These soil samples were analysed for fluoride, TRH/BTEX, asbestos and PAHs. The extent of the embankment is shown in **Figure 4**. The sample locations are presented in **Figure 5**.

Twenty eight additional surface soil samples were collected from the other lots across Parcel 3 as per the sampling design to assess the potential for fluoride in soil from dust deposition from the Hydro Aluminium Kurri Kurri Smelter, as shown in **Figure 6**.

6.3 Soil Results

Soil analytical results are presented in **Tables A and B** in **Appendix E**. Laboratory reports are included in **Appendix F**. A summary of the soil results is presented in **Table 7.**

Table 7: Summary of Soil Results

Analyte	No. of Samples	Maximum Concentration (mg/kg)	No. exceeding Site Criteria	Criteria Exceeded (mg/kg)
Fluoride	28	4	0	-
BaP	10	<0.5	0	-
BaP TEQ	10	<0.5	0	-
Total PAHs	10	2.7	0	-
TRH C6-C10	10	160	0	-
TRH >C10-C16	10	<50	3	HSL “A” (110)--
TRH >C16-C34	10	1390	1	1300 (ESL)
TRH >C34-C40	10	660	0	-

Three embankment samples exceeded the HSL for TRH C10-C16 (“F2”), however the 95% Upper Confidence Limit (UCL) for 10 samples was 101 mg/kg, below the criteria.

One sample exceeded the ESL for TRH >C16-C34. The 95% UCL for the 10 samples was 839mg/kg, below the guideline. These concentrations were therefore not considered to represent a risk to human or ecological health.

The remaining results for TRH, BTEX and PAHs in the former rail embankment samples were all below Parcel 3 criteria.

Results for fluoride in surface soil samples collected from a grid across Parcel 3 were all below the specified criteria.

No asbestos was noted in the soil and no asbestos fragments were identified in the analysis.

6.4 Surface Water Investigations

No specific water sampling was undertaken for this assessment. However, Hydro routinely monitor surface water quality (conductivity, pH and fluoride) at several points along Swamp Creek (which is located to the west), and, into which, surface water from Parcel 3 flows.

The nearest relevant surface water location is Location “E”, immediately upstream from Wentworth Swamp. Location E is located downstream from any potential impacts from Parcel 3.

Also, as part of the investigations conducted for Parcel 1 (to the north of Parcel 3), samples of surface water, including samples from Wentworth Swamp were collected and analysed.

6.5 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 3 consists of cleared pasture land for cattle grazing and comprises farm dams, some vegetated drainage lines (riparian zones) and areas of bushland in the south-eastern areas.

Parcel 3 is bounded by the South Maitland Railway line on the western boundary, and other rural and rural/residential properties off Cessnock Road and rural land on the north and southern boundary, and forms part of the eastern Buffer Zone for the Hydro Aluminium Kurri Kurri Smelter.

The former railway embankment remnant in the northern area (easement between Lots 2 and 3, DP 62332), had sample concentrations slightly in excess of the criteria for TPH >C10-C16 HSL “A” criteria (3 samples) and for TPH >C16-C34 ESL urban residential criteria (1 sample). The 95% UCL concentrations for both TPH >C10-C16 and TPH >C16-C34 were below the respective criteria.

Parcel 3 is suitable for the current land use and for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use.

Although no surface water (from farm dams) was sampled during the investigation, it is considered that site conditions have minimal potential to impact surface waters.

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 3. Parcel 3 is a rural property and is accessed from Cessnock Road, Kurri Kurri and located immediately east of the buffer zone for the Hydro aluminium smelter.

The objectives of the assessment were to assess the presence of contamination at Parcel 3 and to assess the suitability of that site for both current land uses and future uses for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use.

Parcel 3 is approximately 139Ha, comprising a number of lots within DP71130, DP998540 and DP62332. Parcel 3 predominantly comprises cleared land, mainly covered in grasses and small trees and shrubs and is used for cattle grazing, with a densely vegetated area in the south-east. Historical coal mining was undertaken on neighbouring land to the north and east. Coal was transported from the mine to Maitland by a short branch line connected to the South Maitland Railway line. The line was removed by the mid-1940s and ran through what is now an easement between Lot 2 and Lot 3 of DP62332 of Parcel 3.

To assess the potential for soil contamination in Parcel 3, soil samples were collected from within the remnant rail spur fill embankment and across the site in general. No other signs of disturbed land or of land filling were observed during the assessment.

Soil samples from the former rail spur were analysed for petroleum hydrocarbons (TPH), soluble fluoride, asbestos and polycyclic aromatic hydrocarbons (PAH). Surface soil samples from across Parcel 3 were analysed for soluble fluoride.

Samples collected from along the former railway embankment remnant in the northern area of Parcel 3 contained concentrations slightly in excess of the adopted site guideline for TPH >C10-C16 (3 samples) and the TPH >C16-C34 ecological screening level guidelines for urban residential land use (1 sample). The 95% Upper Confidence Limit (UCL) concentrations were below both guidelines. Concentrations of all other analytes tested were found to be below the adopted site guidelines. Although no surface water (from farm dams) was sampled during the investigation, it is considered that site conditions have minimal potential to impact surface waters.

Parcel 3 is suitable for the current land use and for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use.

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

9 References

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;

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

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

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

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

NSW DECC (2008) Waste Classification Guidelines;

NSW EPA (1994) Guidelines for Assessing Service Station Sites.

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

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

WHO. 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 Residential Parcel 3. 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 Residential Parcel 3 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.

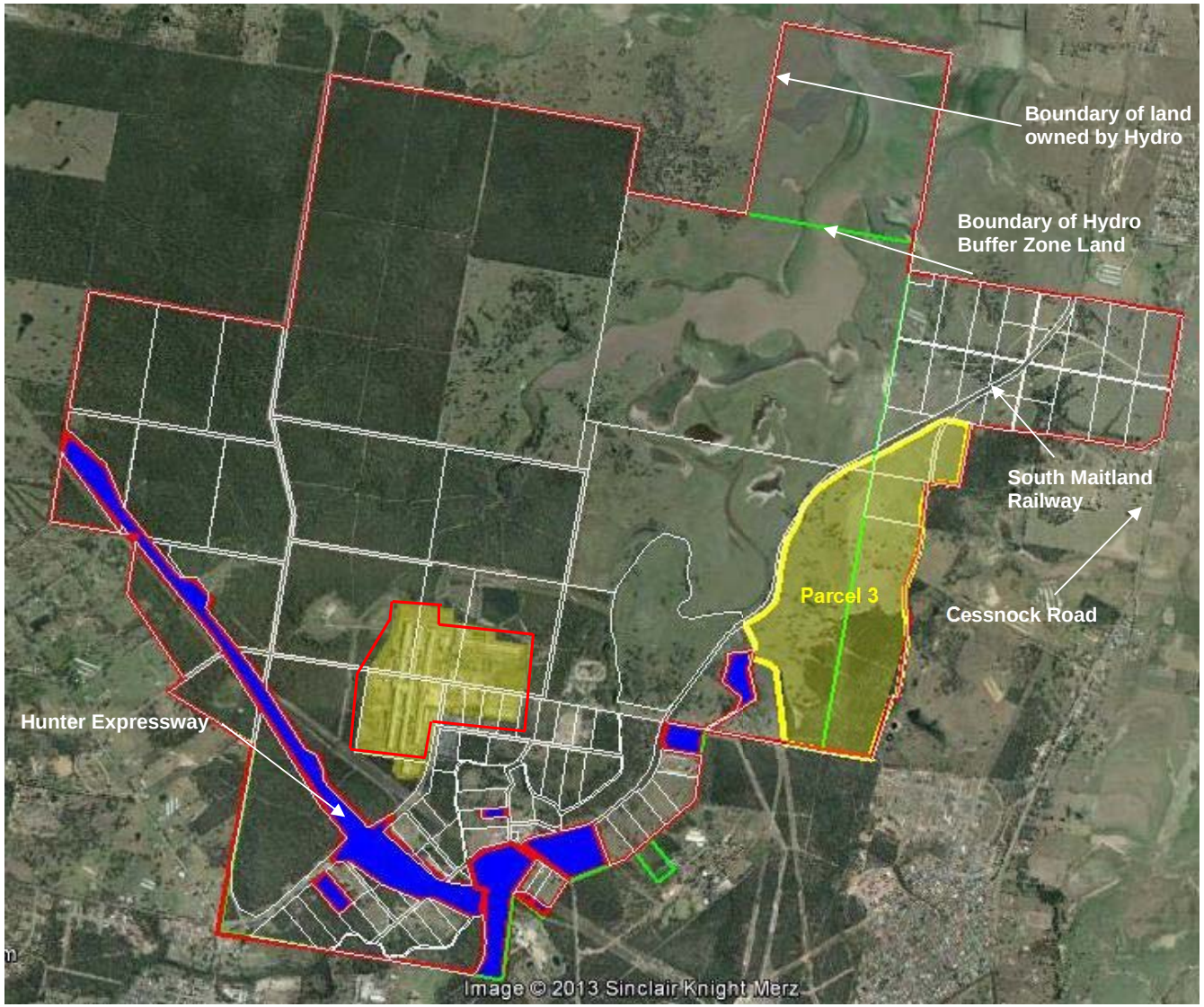
ENVIRON did not independently verify all of the written or oral information provided to ENVIRON during the course of this investigation. While ENVIRON has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided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

Approximate Location of Buffer

Land not owned by Hydro

Parcel 3

N

Hydro Aluminium Kurri Kurri – Buffer Zone Investigations: Parcel 3

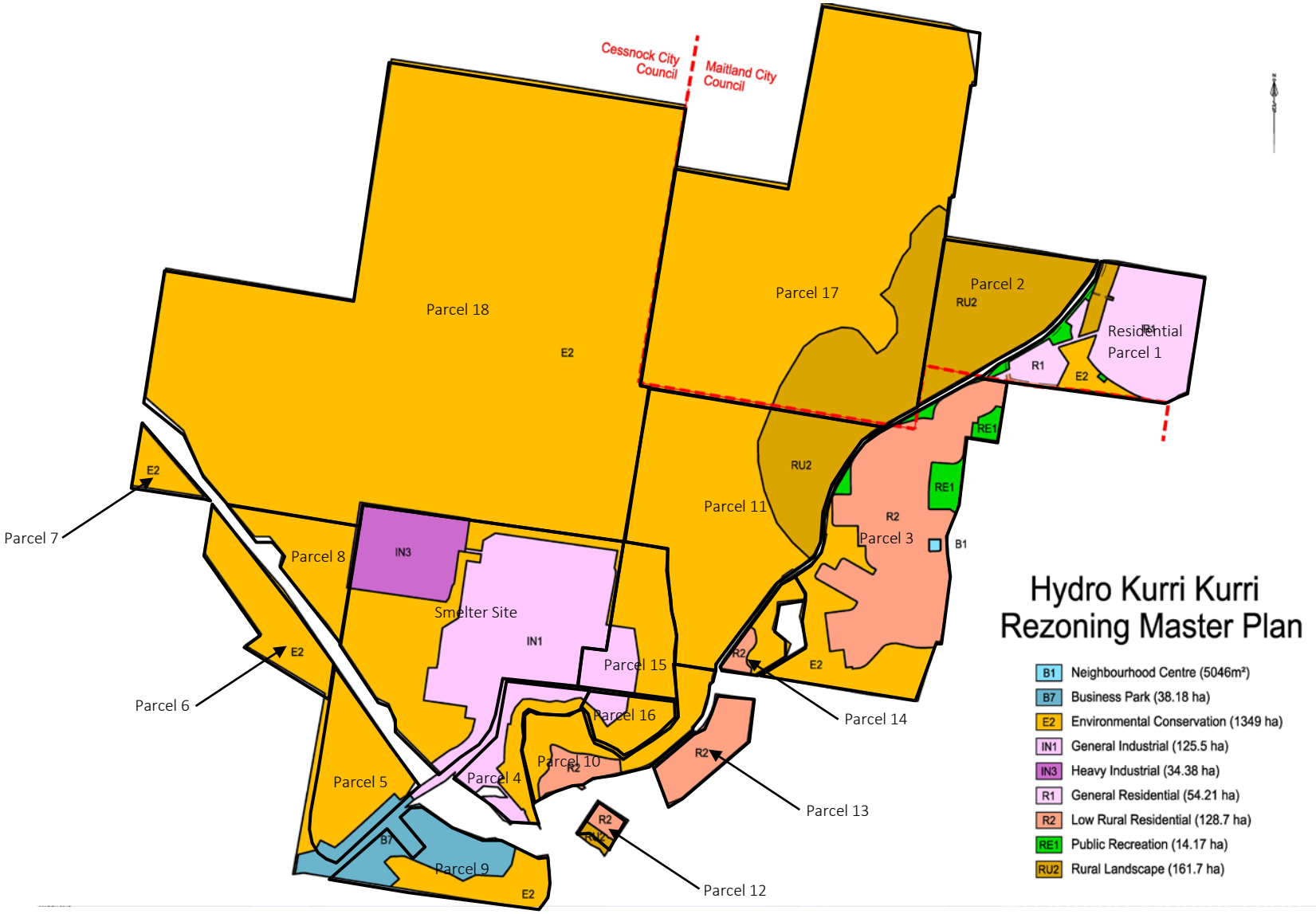
Parcel 3 Location

ENVIRON

JOB NO: AS130348

DATE: February 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

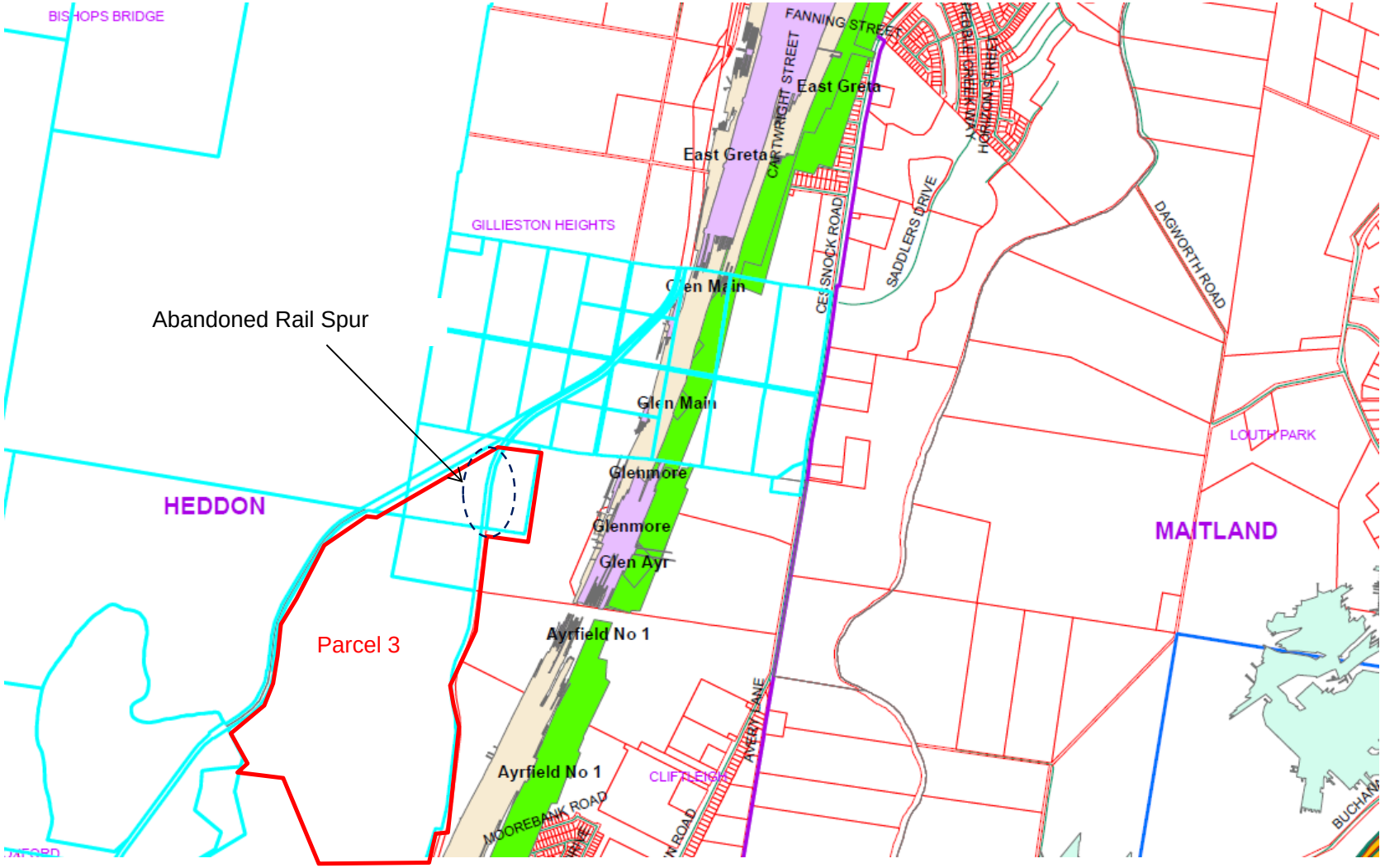
Land Parcels and Proposed Land Zoning

ENVIRON

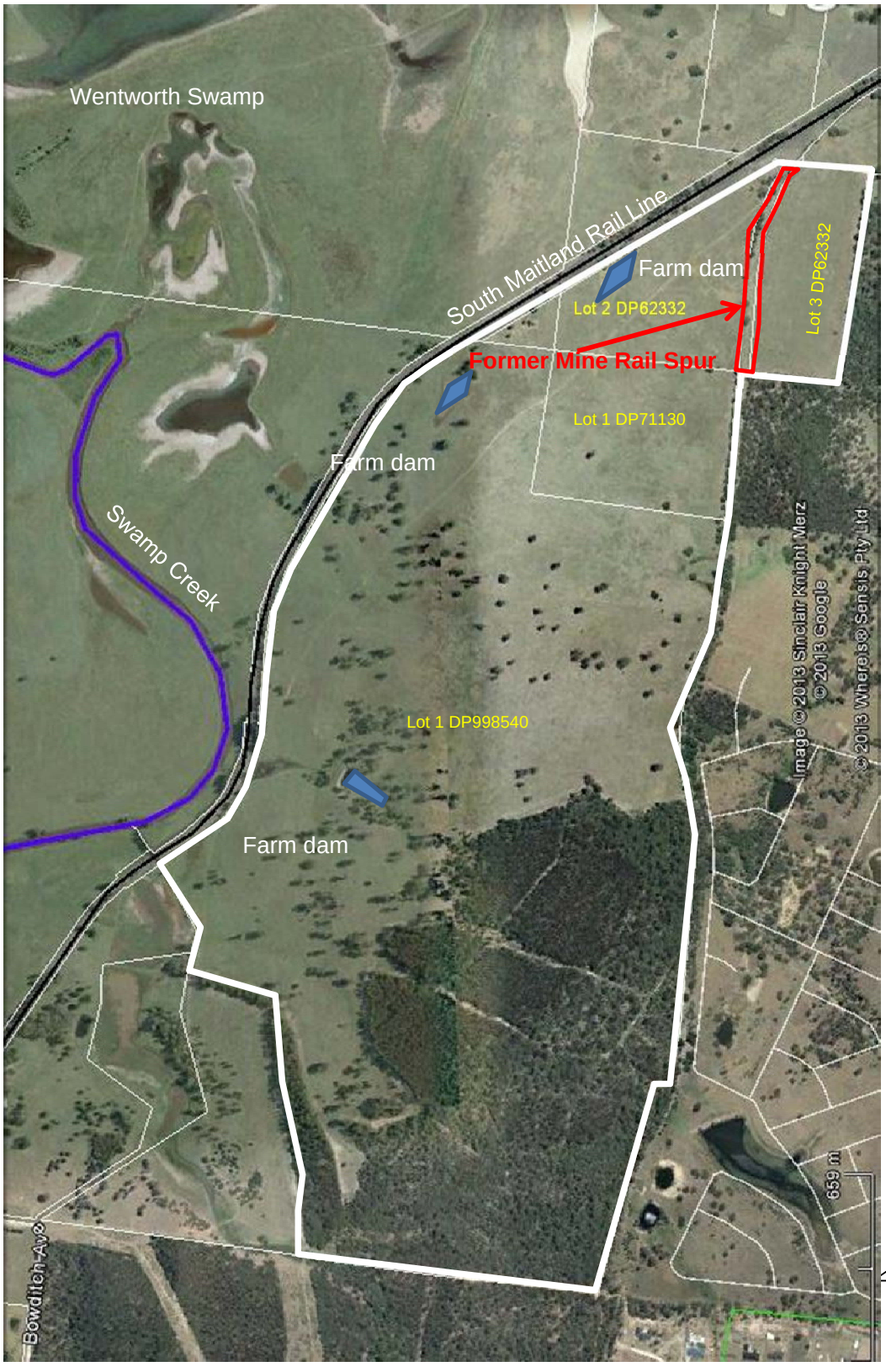
JOB NO: AS 130348

DATE: March 2015

FIGURE 2



Hydro Aluminium Kurri Kurri – Buffer Zone Investigations: Parcel 3	LOCATION OF FORMER GLEN MAIN COLLIERY
ENVIRON	JOB NO: AS130348 DATE: February 2014 FIGURE 3

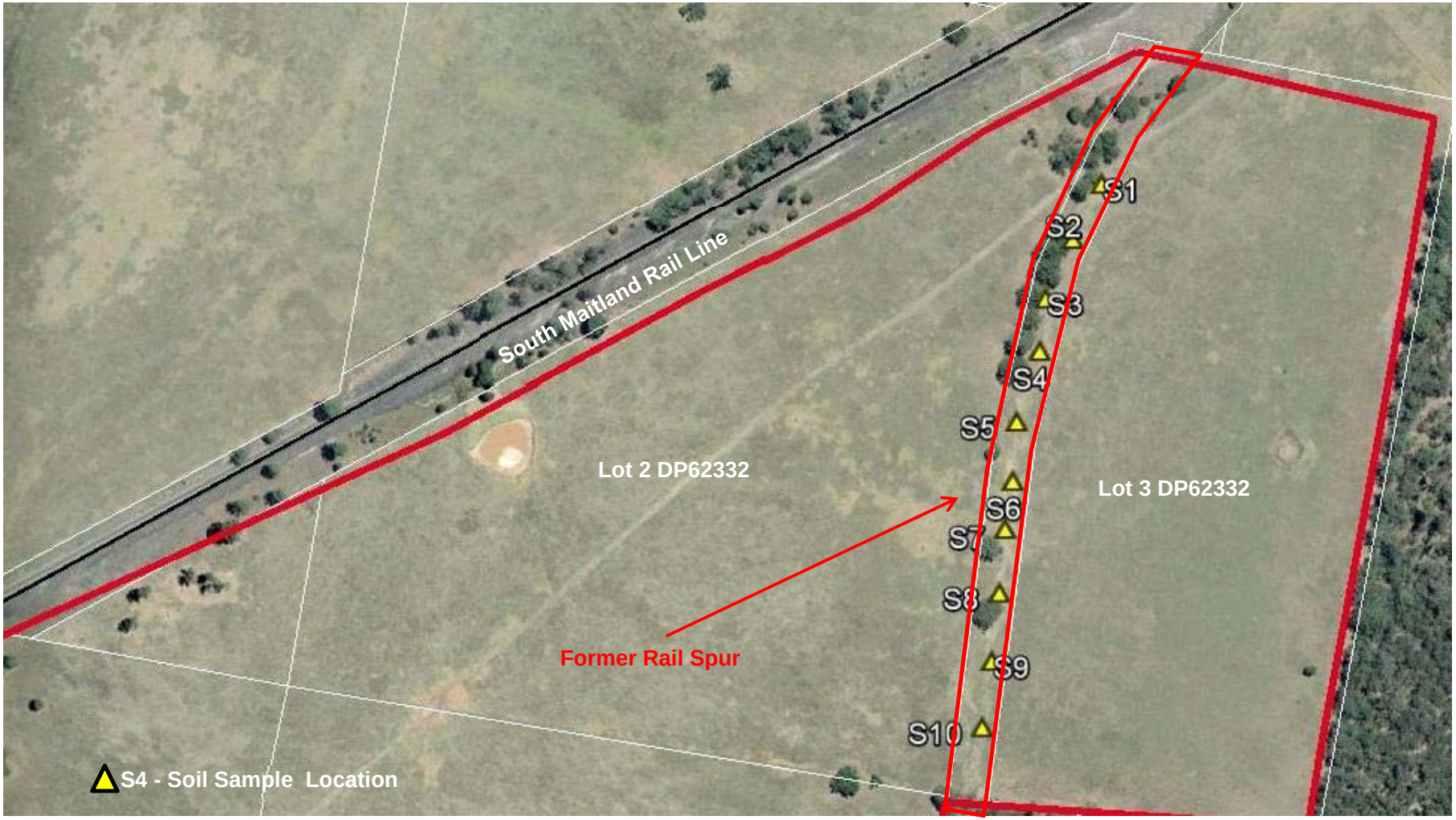


Hydro Aluminium Kurri Kurri

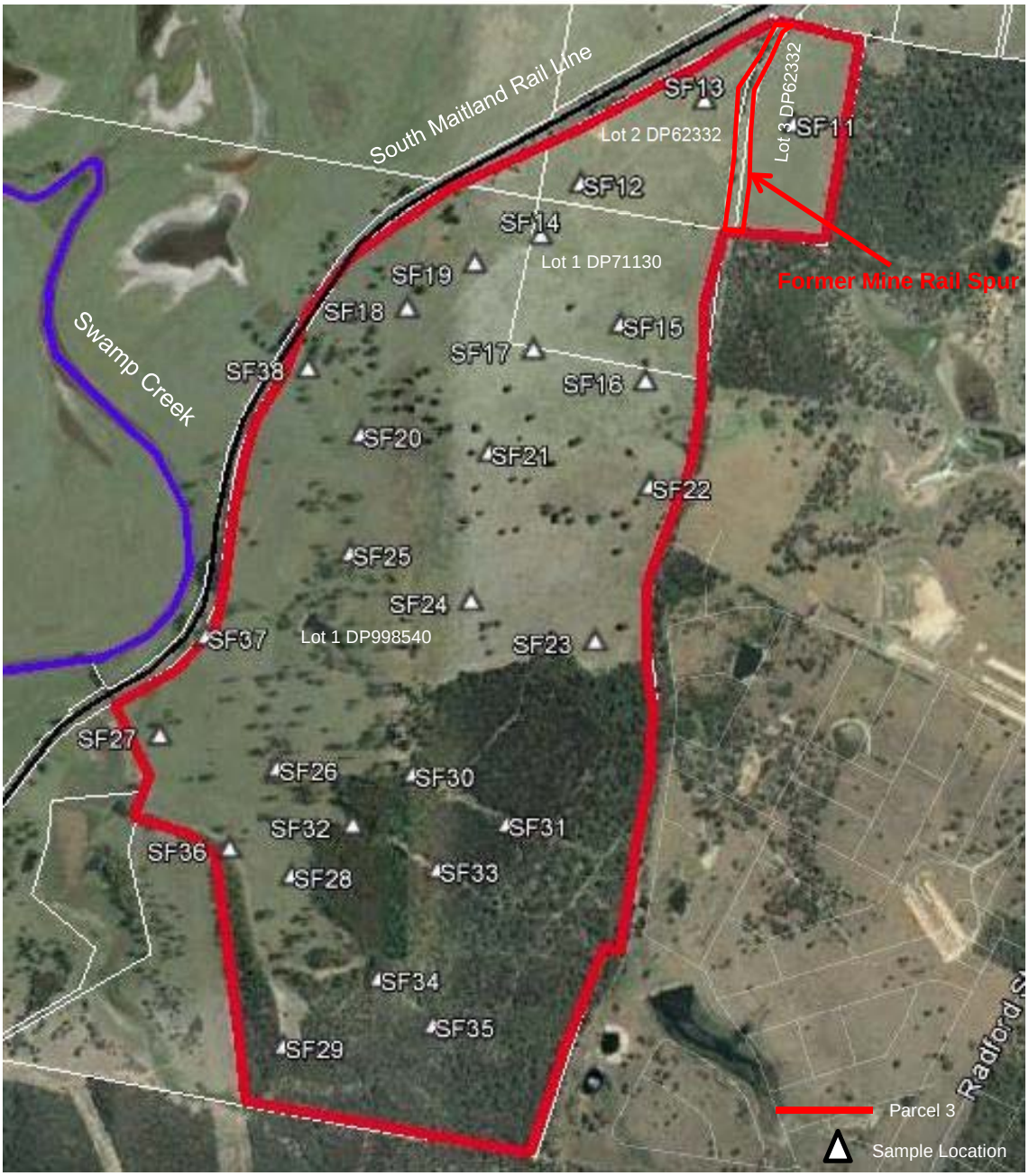
Buffer Zone Investigations: Parcel 3

Parcel 3 Layout

ENVIRON JOB NO:AS130348 DATE: February 2014 FIGURE 4



Hydro Aluminium Kurri Kurri – Buffer Zone Investigations: Parcel 3		PARCEL 3, Sampling Locations – Former Rail Spur
ENVIRON	JOB NO: AS130348	DATE: February 2014	FIGURE 5



N

Hydro Aluminium Kurri Kurri Buffer Zone Investigations Parcel 3	**PARCEL 3** **Fluoride Sampling Locations**

ENVIRON JOB NO:AS130348 DATE: February 2014 FIGURE 6

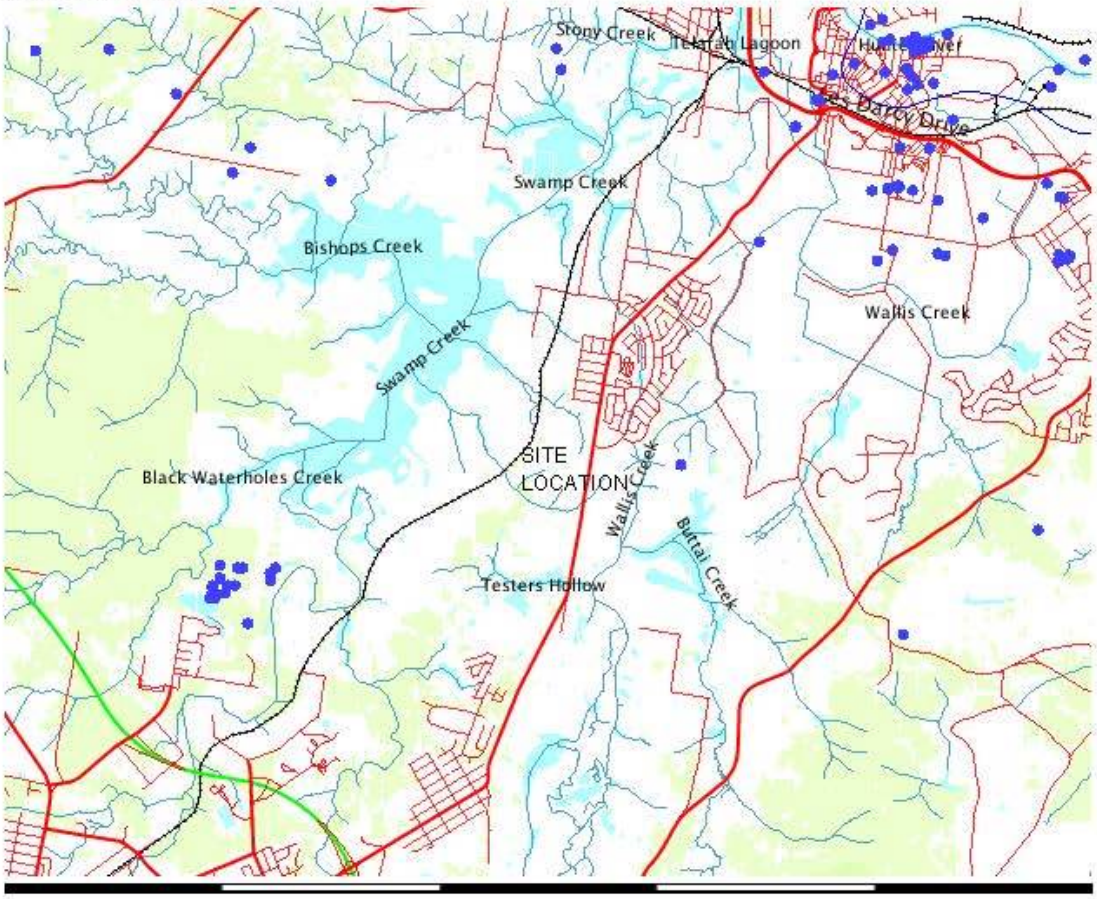
Appendix A

Surrounding Groundwater Bores

Groundwater Bores near Parcel 3

Map created with NSW Natural Resource Atlas - http://www.nratlas.nsw.gov.au
Monday, January 13, 2014

Map created with NSW Natural Resource Atlas - http://www.nratlas.nsw.gov.au
Monday, September 02, 2013



Legend

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

Topographic base map

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, September 2, 2013

Print Report

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

Work Requested -- GW201877

Works Details (top)

GROUNDWATER NUMBER	GW201877
LIC-NUM	20WA212098
AUTHORISED-PURPOSES	STOCK
INTENDED-PURPOSES	STOCK
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1990-07-01
FINAL-DEPTH (metres)	26.00
DRILLED-DEPTH (metres)	26.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	210 - HUNTER RIVER
AREA-DISTRICT	
CMA-MAP	9232-4S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6375745.00
EASTING	363670.00
LATITUDE	32 44' 52"
LONGITUDE	151 32' 41"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	781//997350

Licensed (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	781 997350

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, September 2, 2013

Print Report

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

Work Requested -- GW201357

Works Details (top)

GROUNDWATER NUMBER	GW201357
LIC-NUM	20BL172373
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2009-12-03
FINAL-DEPTH (metres)	6.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	NA
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	210 - HUNTER RIVER
AREA-DISTRICT	
CMA-MAP	9232-4S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6377825.00
EASTING	361590.00
LATITUDE	32 43' 43"
LONGITUDE	151 31' 23"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	NORTHUMBERLAND
PARISH	GOSFORTH
PORTION-LOT-DP	2//1049391

Licensed (top)

COUNTY	NORTHUMBERLAND
PARISH	GOSFORTH
PORTION-LOT-DP	2 1049391

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	150			Auger - So Flight
1	1	Casing	PVC Class 18	0.00	6.00	50	44		Screwed; Seated on Bottom; En cap
1	1	Opening	Slots - Horizontal	4.50	6.00	50			PVC Class 18; Mechanica Slotted; SL 45mm; A: 6mm; Screwed
1		Annulus	Cement	0.00	0.50	150	50		
1		Annulus	Bentonite	0.50	4.00	150	50		
1		Annulus	Waterworn/Rounded	4.00	6.00	150	50		Graded; GS 2-5mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
3.00	6.00	3.00							

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	Clayey Sand, brown, fine-medium		

0.20	6.00	5.80	Sandy Clay, light brown-light grey, fine-medium

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, September 2, 2013

Print Report

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

Work Requested -- GW201106

Works Details (top)

GROUNDWATER NUMBER	GW201106
LIC-NUM	20BL171421
AUTHORISED-PURPOSES	RECREATION (GROUNDWATER)
INTENDED-PURPOSES	RECREATION (GROUNDWATER)
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Auger - Hollow Flight
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-09-27
FINAL-DEPTH (metres)	14.50
DRILLED-DEPTH (metres)	14.50
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MAITLAND CROQUET CLUB
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	7.20
SALINITY	
YIELD	2.00

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	210 - HUNTER RIVER
AREA-DISTRICT	
CMA-MAP	9232-4S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6376386.00
EASTING	364823.00
LATITUDE	32 44' 31"
LONGITUDE	151 33' 26"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	GPS - Global Positioning System
REMARK	

Form-A (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	1//503194

Licensed (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	1 503194

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	14.50	180			Auger - Hollow Flight
1	1	Casing	PVC Class 9	-0.10	14.50	80	68.8		Glued; Seated on Bottom; End cap
1	1	Opening	Slots - Vertical	13.00	14.50	80			PVC Class 9; Casing - Drilled Holes; SL: 1.5mm; A: .8mm; Glued

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
7.20	14.50	7.30		7.20	7.50	2.00		1.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.60	1.60	Silty Sandy Clay, brown		
1.60	5.00	3.40	Sandy Clay; brown/grey		
5.00	7.90	2.90	Silt, grey, with coarse Sand		

7.90	14.50	6.60	Gravel; medium to very large

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, September 2, 2013

Print Report

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

Work Requested -- GW079091

Works Details (top)

GROUNDWATER NUMBER	GW079091
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	6371369.00
EASTING	358209.00
LATITUDE	32 47' 11"
LONGITUDE	151 29' 9"
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, September 2, 2013

Print Report

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

Work Requested -- GW066948

Works Details (top)

GROUNDWATER NUMBER	GW066948
LIC-NUM	20BL144247
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	14.00
DRILLED-DEPTH (metres)	14.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	7.50
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	210 - HUNTER RIVER
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	Est. Contour 8-15M.
NORTHING	6375529.00
EASTING	364891.00
LATITUDE	32 44' 59"
LONGITUDE	151 33' 28"
GS-MAP	0053C4

AMG-ZONE	56
COORD-SOURCE	GD.,ACC.MAP
REMARK	

Form-A (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	209

Licensed (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	B 162784

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	P.V.C.	0.00	14.00	100			Seated on Bottom
1	1	Opening	Slots - Horizontal	8.00	14.00	100		1	SL: 0mm; A: 0mm
1	1	Annulus	Waterworn/Rounded	6.00	14.00	200			Graded; GS: 1.5-3mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
7.50	14.00	6.50	Unconsolidated	7.50					

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, September 2, 2013

Print Report

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

Work Requested -- GW051647

Works Details (top)

GROUNDWATER NUMBER	GW051647
LIC-NUM	20BL112319
AUTHORISED-PURPOSES	STOCK
INTENDED-PURPOSES	STOCK
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Rotary
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1980-09-01
FINAL-DEPTH (metres)	12.00
DRILLED-DEPTH (metres)	12.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	KARINYA
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	210 - HUNTER RIVER
AREA-DISTRICT	
CMA-MAP	9232-3N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6373006.00
EASTING	362896.00
LATITUDE	32 46' 20"
LONGITUDE	151 32' 10"
GS-MAP	0053C4

AMG-ZONE	56
COORD-SOURCE	GD.,ACC.MAP
REMARK	

Form-A (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	L9 (1)

Licensed (top)

COUNTY	NORTHUMBERLAND
PARISH	MAITLAND
PORTION-LOT-DP	L9 (P+ Port 1)

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.15	0.15	Topsoil		
0.15	3.00	2.85	Clay		
3.00	3.81	0.81	Sand Yellow		
3.81	4.57	0.76	Sand White		
4.57	6.10	1.53	Clay Sand		
6.10	12.00	5.90	Sandstone Hard		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, September 2, 2013

Print Report

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

Work Requested -- GW029088

Works Details (top)

GROUNDWATER NUMBER	GW029088
LIC-NUM	20BL021619
AUTHORISED-PURPOSES	IRRIGATION STOCK
INTENDED-PURPOSES	NOT KNOWN
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Rotary Mud
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	39.00
DRILLED-DEPTH (metres)	39.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	603 - SYDNEY BASIN
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	20 - HUNTER
RIVER-BASIN	210 - HUNTER RIVER
AREA-DISTRICT	
CMA-MAP	9132-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6376436.00
EASTING	359230.00
LATITUDE	32 44' 27"
LONGITUDE	151 29' 51"
GS-MAP	0053B3

AMG-ZONE	56
COORD-SOURCE	GD.,ACC.MAP
REMARK	

Form-A (top)

COUNTY	NORTHUMBERLAND
PARISH	GOSFORTH
PORTION-LOT-DP	77

Licensed (top)

COUNTY	NORTHUMBERLAND
PARISH	GOSFORTH
PORTION-LOT-DP	70 1104158

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	P.V.C.	-0.20	0.40	127			Driven into Hole

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
11.60	11.60	0.00	Fractured	3.00		0.13			(Unknown)

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	6.10	6.10	Clay Sand		
6.10	24.38	18.28	Shale Water Supply		
24.38	39.01	14.63	Sandstone		

Appendix B

Site Photographs

Photo 1: Farm Dam, Lot 2 DP62332, Looking west.

Photo 2: Remnant Rail Embankment, Lot 3, DP62332, Looking west

Photo 3: Lot 3, looking North-east and east..

Photo 4: Lot 1 DP71130. Looking north-east - east

Photo 5: Lot 1 DP998540, North-east Area, looking east.

Appendix C

Field Information Sheets

Site Walkover Checklist

Project No.: AS130348	**Date and Time:** 22/10/13
Land Parcel: RES3	**Weather:** Fine / Hot.
Lot and DP: Lot 1, DP 71130.	**Environ Personnel:** SC

Site Description

Topography	Open. Flat. paddock. grassed.
Surface Geology	no outcrop - soil
Fill evident?	no
Hummocky ground?	no
Structures on site?	no
Location of structures	no
Building materials used in structures	no
Asbestos debris on site?	no
Location of asbestos debris?	no
Volume of asbestos debris?	no.

GPS location of interest

Point of Interest	Easting	Northing

Description of Photographs Taken

756 - 759. From NW corner

Miscellaneous Information

Open flat paddock - grass - covered.

Site Walkover Checklist

Project No.:	AS130346	**Date and Time:**	22/10/13 - 12:30.
Land Parcel:	RES 3	**Weather:**	Fine / Hot
Lot and DP:	LOT 2 DP62332	**Environ Personnel:**	SC.

Site Description

Topography	Flat open slope N→S ≤1° with slope down to Dam on W.
Surface Geology	No outcrop - Topsoil.
Fill evident?	no
Hummocky ground?	slightly (livestock)
Structures on site?	Dam. - mid west (near rail line).
Location of structures	-
Building materials used in structures	na
Asbestos debris on site?	na
Location of asbestos debris?	na
Volume of asbestos debris?	na.

GPS Location of Interest

Point of Interest	Easting	Northing
Dam	151.50847.	32.77716

Description of Photograph Taken

750-752 - From SW corner
753-755 Dam.

Miscellaneous Site Comments

Open field, dam in mid-west
NW border - railway.
S " - Lot 1
E - old rail spur / Lot 3.

Site Walkover Checklist

Project No.: AS130348	**Date and Time:** 22/10/13 11:45
Land Parcel: RES3	**Weather:** Fine / Hot
Lot and DP: Lot 3 DP62332	**Environ Personnel:** SC

Site Description

Topography	Slight slope N to S. 1-2°
Surface Geology	- no outcrop / surface topsoil.
Fill evident?	no - Remnant rail spur embankment on W margin
Hummocky ground?	no
Structures on site?	no
Location of structures	NA
Building materials used in structures	NA
Asbestos debris on site?	NA
Location of asbestos debris?	NA
Volume of asbestos debris?	NA.

GPS Locations of Interest

Point of Interest	Easting	Northing
Small Door bear mid-eastern fence.	151 51261	32 77696

Description of Photographs Taken

743 & 744 - N & S along rail line (old spur) from middle
745-748 - from NW corner
749 - Dam/King S.

Miscellaneous Field Comments

Open, grass-covered paddock bordered on S & E by bushland on W & rail embankment (defined by a line of trees).

Flouride Sample - (SF11).

Site Walkover Checklist

Project No.: AS1303468	**Date and Time:** 22/10/13
Land Parcel: RES 3	**Weather:** Fine / Hot
Lot and DP: Lot 1 DP998540	**Environ Personnel:** SC

Site Description

Topography	Generally flat with drainage lines.
Surface Geology	no outcrop seen
Fill evident?	none found - farm dams (pushed out from mob)
Hummocky ground?	no
Structures on site?	No
Location of structures	N/A
Building materials used in structures	N/A
Asbestos debris on site?	N/A
Location of asbestos debris?	N/A
Volume of asbestos debris?	N/A

GPS Locations of Interest

Point of Interest	Easting	Northing

Description of Photographs Taken

760 - N. Dam
761-763 W mid Dam
764-766 E " "
767-771 At S. end - S → N pan
772-776 - Mid W site S → N pan.
777 -786 = 360° pan N → N from N end, (150m SE of Dam).

Miscellaneous Observations

Very large open paddocks in N & SW area.
- approx 25-30% bush in SE area.
- Small dam in N
- Large dam in central west.

Bush area fenced - gates

Appendix D

Results Tables

TABLE A: Soil Analytical Results - Grid Sampling

Sample Depth: 0.01m - 0.02m

Sampling Date: 22/10/13

Laboratory PQL: 0.5 mg/kg

Site Specific HIL - Fluoride: 400mg/kg

Sample Identification	Soluble Fluoride mg/kg (1:5 soil:water)
SF11	2
SF12	2
SF13	4
SF14	2
SF15	2
SF16	2
SF17	2
SF18	1
SF19	2
SF20	2
SF21	2
SF22	2
SF23	1
SF24	2
SF25	2
SF26	2
SF27	2
SF28	3
SF29	<1
SF30	3
SF31	<1
SF32	1
SF33	1
SF34	<1
SF35	2
SF36	2
SF37	2
SF38	2

cell shaded grey where investigation criteria exceeded

TABLE B: Soil Analytical Results - Former Rail Embankment

Sample Identification	PQL	Guideline						S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Sample Depth (m)																	
Date		HIL 'A' [A]	HIL 'B' [B]	HSL 'A & B' [C] Sand 0m to 1m	EIL Urban Residential (lowest ACL)[D]	ESL Urban Residential (Coarse Soil)	Mgt Limits Residential	22/10/2013	22/10/2013	22/10/2013	22/10/2013	22/10/2013	22/10/2013	22/10/2013	22/10/2013	22/10/2013	22/10/2013
Sample Profile								FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	TOPSOIL
Sample collected by								SC	SC	SC	SC	SC	SC	SC	SC	SC	SC
Polycyclic Aromatic Hydrocarbons (PAH)																	
Naphthalene	0.5			3	170			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.6	<0.5	<0.5
Anthracene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1	0.6	<0.5	<0.5
Pyrene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5
Benz(a)anthracene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	0.5					0.7		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of polycyclic aromatic hydrocarbons	0.5	300	400					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.7	1.2	<0.5	<0.5
Benzo(a)pyrene TEQ (zero)	0.5	3	4					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Identification of Asbestos in bulk samples																	
Asbestos Detected	0.1							No	No	No	No	No	No	No	No	No	No
Asbestos Type	1							-	-	-	-	-	-	-	-	-	-
Sample weight (dry)	0.01							22.6	27.6	31.8	23.8	26.7	36.3	25.4	28.7	29.1	28.6
Asbestos Quantification																	
Weight Used for % Calculation (kg)	0.0001							0.0226	0.0276	0.0318	0.0238	0.0267	0.0363	0.0254	0.0287	0.0291	0.0286
Asbestos Containing Material (g)	0.1							<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fibrous Asbestos (g)	0.002							<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Asbestos Containing Material (as 15% Asbestos in ACM >7mm) - %	0.01							<0.07	<0.06	<0.05	<0.07	<0.06	<0.05	<0.06	<0.06	<0.06	<0.06
Asbestos Fines and Fibrous Asbestos (<7mm) - %	0.001	0.00%						<0.009	<0.008	<0.007	<0.009	<0.008	<0.006	<0.008	<0.007	<0.007	<0.007
Trace Asbestos Detected (fibres)	5							No	No	No	No	No	No	No	No	No	No
Total Recoverable Hydrocarbons (TRH) - NEPM (2013)																	
TRH C6 - C10	25							<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	25			45		180	800	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
TRH >C10-C16 minus napthalene (F2)	50			110		120	1000	100	<50	60	**160**	<50	**120**	<50	<50	80	**110**
TRH >C16-C34	100					1300	3500	760	**1390**	320	1150	<100	830	320	200	330	520
TRH >C34-C40	100					5600	10 000	350	660	<100	560	<100	500	110	<100	140	170
C10 - C36 Fraction (sum)								1210	2050	380	1870	<50	1450	430	200	550	800
BTEXN																	
Benzene	0.2		0.5			65		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.5		160			85		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5		55			70		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	0.5		40			45		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	0.5		40			45		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	0.2							<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylenes	0.5							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	1							<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

All results are in mg/kg unless otherwise indicated.

[A] HIL A - residential landuse with garden/accessible soil.

[B] HIL B - residential with minimal opportunities for soil access (highrise buildings/flats).

[C] HSL A & B are the same landuses as the HILs. The values for residential A and B are combined in the HSL tables as they represent vapour exposure risk and are based on the same amount of time spent indoors. The HSL for shallow sand was used and is therefore conservative.

[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.

* Site specific health investigation criteria for Hydro Aluminium Kurri Kurri for Fluoride.

** ESL for TRH >C16-C34 in fine soil is also provided for reference.

Results shaded grey are in excess of the investigation criteria.

HILs for cyanide are based on free cyanide.

HILs for chromium are based on Cr (VI).

The EIL for chromium are based on Cr (III).

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	S5	QA1	RPD %	SF17	QA2	RPD %	SF27	QA4	RPD %	SF36	QA3	RPD %
Sample Depth (m)	0.01-0.02			0.01-0.02			0.01-0.02			0.01-0.02		
Duplicate Type	Intralaboratory			Intralaboratory			Intralaboratory			Intralaboratory		
Sample Profile	Fill soil matrix			Topsoil			Topsoil			Topsoil		
Sample collected by	SC			SC			SC			SC		
Fluoride												
Soluble Fluoride	-	-	-	2	1	100.0	2	2	0.0	2	2	0.0
Polycyclic Aromatic Hydrocarbons (PAH)												
Naphthalene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Acenaphthylene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Acenaphthene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Fluorene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Phenanthrene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Anthracene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Fluoranthene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Pyrene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Chrysene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Benzo(a) pyrene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Total +ve	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene TEQ	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Total Recoverable Hydrocarbons (TRH)												
TRH C6-C9	<25	<25	0.0	-	-	-	-	-	-	-	-	-
TRH C10-C14	<50	<50	0.0	-	-	-	-	-	-	-	-	-
TRH C15-C28	<100	<100	0.0	-	-	-	-	-	-	-	-	-
TRH C29-C36	<100	<100	0.0	-	-	-	-	-	-	-	-	-
TRH C10-C36	<250	<250	0.0	-	-	-	-	-	-	-	-	-
Total Recoverable Hydrocarbons (TRH) - NEPM (2013)												
TRH C6 - C10	<25	<25	0.0	-	-	-	-	-	-	-	-	-
vTPH C6 - C10 less BTEX	<25	<25	0.0	-	-	-	-	-	-	-	-	-
TRH >C10-C16	<50	<50	0.0	-	-	-	-	-	-	-	-	-
TRH >C16-C34	<50	<50	0.0	-	-	-	-	-	-	-	-	-
TRH >C34-C40	<100	<100	0.0	-	-	-	-	-	-	-	-	-
BTEX												
Benzene	<0.2	<0.2	0.0	-	-	-	-	-	-	-	-	-
Toluene	<0.5	<0.5	0.0	-	-	-	-	-	-	-	-	-
Ethylbenzene	<1	<1	0.0	-	-	-	-	-	-	-	-	-
m+p-xylene	<2	<2	0.0	-	-	-	-	-	-	-	-	-
o-Xylene	<1	<1	0.0	-	-	-	-	-	-	-	-	-
Asbestos Quantification												
Asbestos Fines and Fibrous Asbestos (<7mm) - %	0.186	0.186	0.0	-	-	-	-	-	-	-	-	-

Note all units in mg/kg

BOLD identifies where RPD results

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

BOLD identified where blanks >0

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

Appendix E

Laboratory Reports

CERTIFICATE OF ANALYSIS

Work Order	: **EN1303916**	Page	: 1 of 18
Amendment	: **1**		
Client	: **ENVIRON**	Laboratory	: Environmental Division Newcastle
Contact	: MR STEVE CADMAN	Contact	: Peter Keyte
Address	: PO Box 435 THE JUNCTION NSW 2291	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: scadman@environcorp.com	E-mail	: peter.keyte@als.com.au
Telephone	: ----	Telephone	: 61-2-4968-9433
Facsimile	: ----	Facsimile	: +61-2-4968 0349
Project	: AS130348	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: 155061-64	Date Samples Received	: 24-OCT-2013
Sampler	: SC	Issue Date	: 19-FEB-2014
Site	: ----		
		No. of samples received	: 42
Quote number	: SY/433/13	No. of samples analysed	: 42

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

- **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.**
- **EA200Q: ALS laboratory procedures and methods used for the identification and quantitation of asbestos are consistent with AS4964-2004 and the requirements of the 2013 NEPM for Assessment of Site Contamination**
- **EA200Q: Asbestos weights and percentages are not covered under the Scope of NATA Accreditation.**
  Weights of Asbestos are based on extracted bulk asbestos, fibre bundles, and/or ACM and do not include respirable fibres (if present).
  Percentages for Asbestos content in ACM are based on the 2013 NEPM default values. All numerical results under this method are approximate and should be used as a guide only.
- **EP080: Poor surrogate recoveries due to matrix interferences.**
- **This report has been amended following minor LIMS report formatting corrections. All analysis results are as per the previous report**

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
Pabi Subba	Senior Organic Chemist	Sydney Organics
Sanjeshni Jyoti Mala	Senior Chemist Volatile	Sydney Organics
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	RES 3 - S2	RES 3 - S3	RES 3 - QA1	RES 3 - S4	RES 3 - S1
				Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
					EN1303916-001	EN1303916-002	EN1303916-003	EN1303916-004	EN1303916-005
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		**2.7**	**3.4**	**2.8**	**9.0**	**11.8**
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples									
Asbestos Detected	1332-21-4	0.1	g/kg		**No**	**No**	**No**	**No**	**No**
Asbestos Type	1332-21-4	1	--		**-**	**-**	**-**	**-**	**-**
Sample weight (dry)	----	0.01	g		**27.6**	**31.8**	**23.1**	**23.8**	**22.6**
APPROVED IDENTIFIER:	----	1	--		**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**
EA200Q: Asbestos Quantification (non-NATA)									
Weight Used for % Calculation	----	0.0001	kg		**0.0276**	**0.0318**	**0.0231**	**0.0238**	**0.0226**
Asbestos Containing Material	1332-21-4	0.1	g		<0.1	<0.1	<0.1	<0.1	<0.1
Fibrous Asbestos	----	0.002	g		<0.002	<0.002	<0.002	<0.002	<0.002
Asbestos Containing Material (as 15% Asbestos in ACM >7mm)	1332-21-4	0.01	%		<0.06	<0.05	<0.07	<0.07	<0.07
Asbestos Fines and Fibrous Asbestos (<7mm)	1332-21-4	0.001	%		<0.008	<0.007	<0.009	<0.009	<0.009
Trace Asbestos Detected	----	5	Fibres		**No**	**No**	**No**	**No**	**No**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<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	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<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	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<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	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<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	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<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	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client sample ID	RES 3 - S2	RES 3 - S3	RES 3 - QA1	RES 3 - S4	RES 3 - S1
				Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
					EN1303916-001	EN1303916-002	EN1303916-003	EN1303916-004	EN1303916-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	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	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	150	80
C15 - C28 Fraction	----	100	mg/kg		600	240	<100	670	450
C29 - C36 Fraction	----	100	mg/kg		1080	150	<100	780	520
^ C10 - C36 Fraction (sum)	----	50	mg/kg		1680	390	<50	1600	1050
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	60	<50	160	100
>C16 - C34 Fraction	----	100	mg/kg		1390	320	<100	1150	760
>C34 - C40 Fraction	----	100	mg/kg		660	<100	<100	560	350
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		2050	380	<50	1870	1210
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	60	<50	160	100
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<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	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<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	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		82.6	85.2	82.7	85.8	84.5
2-Chlorophenol-D4	93951-73-6	0.1	%		81.6	85.8	87.3	92.5	89.5
2.4.6-Tribromophenol	118-79-6	0.1	%		113	109	90.0	104	87.0
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		98.3	95.2	89.0	99.7	96.5
Anthracene-d10	1719-06-8	0.1	%		80.6	85.6	85.5	78.8	79.9

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	RES 3 - S2	RES 3 - S3	RES 3 - QA1	RES 3 - S4	RES 3 - S1
				Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit		EN1303916-001	EN1303916-002	EN1303916-003	EN1303916-004	EN1303916-005
EP075(SIM)T: PAH Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	0.1	%		98.3	97.8	86.1	81.8	86.1
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		120	105	104	106	105
Toluene-D8	2037-26-5	0.1	%		114	71.2	81.2	80.9	82.2
4-Bromofluorobenzene	460-00-4	0.1	%		111	89.8	92.9	96.0	100

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	RES 3 - S6	RES 3 - S7	RES 3 - S9	RES 3 - S8	RES 3 - S10
				Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
					EN1303916-006	EN1303916-007	EN1303916-008	EN1303916-009	EN1303916-010
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		**2.6**	**4.4**	**1.4**	**4.6**	**5.9**
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples									
Asbestos Detected	1332-21-4	0.1	g/kg		**No**	**No**	**No**	**No**	**No**
Asbestos Type	1332-21-4	1	--		**-**	**-**	**-**	**-**	**-**
Sample weight (dry)	----	0.01	g		**36.3**	**25.4**	**29.1**	**28.7**	**28.6**
APPROVED IDENTIFIER:	----	1	--		**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**
EA200Q: Asbestos Quantification (non-NATA)									
Weight Used for % Calculation	----	0.0001	kg		**0.0363**	**0.0254**	**0.0291**	**0.0287**	**0.0286**
Asbestos Containing Material	1332-21-4	0.1	g		<0.1	<0.1	<0.1	<0.1	<0.1
Fibrous Asbestos	----	0.002	g		<0.002	<0.002	<0.002	<0.002	<0.002
Asbestos Containing Material (as 15% Asbestos in ACM >7mm)	1332-21-4	0.01	%		<0.05	<0.06	<0.06	<0.06	<0.06
Asbestos Fines and Fibrous Asbestos (<7mm)	1332-21-4	0.001	%		<0.006	<0.008	<0.007	<0.007	<0.007
Trace Asbestos Detected	----	5	Fibres		**No**	**No**	**No**	**No**	**No**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	**0.8**	<0.5	**0.6**	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	**1.0**	<0.5	**0.6**	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	**0.9**	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<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	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<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	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<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	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg		<0.5	**2.7**	<0.5	**1.2**	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client sample ID	RES 3 - S6	RES 3 - S7	RES 3 - S9	RES 3 - S8	RES 3 - S10
				Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
					EN1303916-006	EN1303916-007	EN1303916-008	EN1303916-009	EN1303916-010
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	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	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		80	<50	50	<50	70
C15 - C28 Fraction	----	100	mg/kg		520	220	240	150	410
C29 - C36 Fraction	----	100	mg/kg		550	180	190	110	240
^ C10 - C36 Fraction (sum)	----	50	mg/kg		1150	400	480	260	720
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	>C10_C16	50	mg/kg		120	<50	80	<50	110
>C16 - C34 Fraction	----	100	mg/kg		830	320	330	200	520
>C34 - C40 Fraction	----	100	mg/kg		500	110	140	<100	170
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		1450	430	550	200	800
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		120	<50	80	<50	110
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<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	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<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	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		93.8	88.0	85.2	88.5	82.6
2-Chlorophenol-D4	93951-73-6	0.1	%		95.5	95.4	82.6	83.5	93.0
2.4.6-Tribromophenol	118-79-6	0.1	%		96.9	94.3	81.3	106	103
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		111	89.8	91.6	90.9	94.8
Anthracene-d10	1719-06-8	0.1	%		85.0	81.0	72.6	80.8	81.4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - S6	RES 3 - S7	RES 3 - S9	RES 3 - S8	RES 3 - S10
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	EN1303916-006	EN1303916-007	EN1303916-008	EN1303916-009	EN1303916-010
EP075(SIM)T: PAH Surrogates - Continued								
4-Terphenyl-d14	1718-51-0	0.1	%	79.8	94.4	84.6	81.7	85.1
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	109	96.6	108	96.8	80.5
Toluene-D8	2037-26-5	0.1	%	92.9	73.6	94.6	76.2	56.0
4-Bromofluorobenzene	460-00-4	0.1	%	102	82.5	110	91.8	74.0

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	RES 3 - S5	RES 3 - SF11	RES 3 - SF12	RES 3 - SF13	RES 3 - SF14
				Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
					EN1303916-011	EN1303916-012	EN1303916-013	EN1303916-014	EN1303916-015
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		**2.5**	**5.8**	**7.6**	**2.9**	**7.6**
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	1	--		**-**	----	----	----	----
Sample weight (dry)	----	0.01	g		**26.7**	----	----	----	----
APPROVED IDENTIFIER:	----	1	--		**C.OWLER**	----	----	----	----
EA200Q: Asbestos Quantification (non-NATA)									
Weight Used for % Calculation	----	0.0001	kg		**0.0267**	----	----	----	----
Asbestos Containing Material	1332-21-4	0.1	g		<0.1	----	----	----	----
Fibrous Asbestos	----	0.002	g		<0.002	----	----	----	----
Asbestos Containing Material (as 15% Asbestos in ACM >7mm)	1332-21-4	0.01	%		<0.06	----	----	----	----
Asbestos Fines and Fibrous Asbestos (<7mm)	1332-21-4	0.001	%		<0.008	----	----	----	----
Trace Asbestos Detected	----	5	Fibres		**No**	----	----	----	----
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		----	**2**	**2**	**4**	**2**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client sample ID	RES 3 - S5	RES 3 - SF11	RES 3 - SF12	RES 3 - SF13	RES 3 - SF14
				Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
					EN1303916-011	EN1303916-012	EN1303916-013	EN1303916-014	EN1303916-015
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	----	----	----	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg		<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**86.0**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**82.8**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**95.6**	----	----	----	----
EP075(SIM)T: PAH Surrogates									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - S5	RES 3 - SF11	RES 3 - SF12	RES 3 - SF13	RES 3 - SF14
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	EN1303916-011	EN1303916-012	EN1303916-013	EN1303916-014	EN1303916-015
EP075(SIM)T: PAH Surrogates - Continued								
2-Fluorobiphenyl	321-60-8	0.1	%	**95.0**	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%	**74.8**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	**90.1**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**110**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	**110**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**111**	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - SF15	RES 3 - SF16	RES 3 - SF17	RES 3 - SF18	RES 3 - SF19
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	EN1303916-016	EN1303916-017	EN1303916-018	EN1303916-019	EN1303916-020
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**5.4**	**9.5**	**9.9**	**7.9**	**6.3**
EK040S: Fluoride Soluble								
Fluoride	16984-48-8	1	mg/kg	**2**	**2**	**2**	**1**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - SF20	RES 3 - SF21	RES 3 - SF22	RES 3 - SF23	RES 3 - SF24
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	EN1303916-021	EN1303916-022	EN1303916-023	EN1303916-024	EN1303916-025
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**7.4**	**7.8**	**8.2**	**4.7**	**6.1**
EK040S: Fluoride Soluble								
Fluoride	16984-48-8	1	mg/kg	**2**	**2**	**2**	**1**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - SF25	RES 3 - SF26	RES 3 - SF27	RES 3 - SF28	RES 3 - SF29
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	EN1303916-026	EN1303916-027	EN1303916-028	EN1303916-029	EN1303916-030
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**5.8**	**1.8**	**15.4**	**2.8**	<1.0
EK040S: Fluoride Soluble								
Fluoride	16984-48-8	1	mg/kg	**2**	**2**	**2**	**3**	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - SF30	RES 3 - SF31	RES 3 - SF32	RES 3 - SF33	RES 3 - SF34
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	EN1303916-031	EN1303916-032	EN1303916-033	EN1303916-034	EN1303916-035
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**3.0**	**2.9**	**4.1**	**1.9**	**1.5**
EK040S: Fluoride Soluble								
Fluoride	16984-48-8	1	mg/kg	**3**	<1	**1**	**1**	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - SF35	RES 3 - SF36	RES 3 - SF37	RES 3 - SF38	RES 3 - QA2
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00	22-OCT-2013 15:00
Compound	CAS Number	LOR	Unit	EN1303916-036	EN1303916-037	EN1303916-038	EN1303916-039	EN1303916-040
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**1.3**	**3.3**	**6.0**	**9.6**	**7.4**
EK040S: Fluoride Soluble								
Fluoride	16984-48-8	1	mg/kg	**2**	**2**	**2**	**2**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RES 3 - QA3	RES 3 - QA4	----	----	----
			Client sampling date / time	22-OCT-2013 15:00	22-OCT-2013 15:00	----	----	----
Compound	CAS Number	LOR	Unit	EN1303916-041	EN1303916-042	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**3.9**	**14.4**	----	----	----
EK040S: Fluoride Soluble								
Fluoride	16984-48-8	1	mg/kg	**2**	**2**	----	----	----

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	RES 3 - S2 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.
EA200: Description	RES 3 - S3 - 22-OCT-2013 15:00	Dark grey - brown soil with plenty of slag and charcoal pieces plus plenty of vegetation.
EA200: Description	RES 3 - QA1 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.
EA200: Description	RES 3 - S4 - 22-OCT-2013 15:00	Dark grey - brown soil with plenty of slag and charcoal pieces plus plenty of vegetation.
EA200: Description	RES 3 - S1 - 22-OCT-2013 15:00	Dark grey - brown soil with plenty of slag and charcoal pieces plus plenty of vegetation.
EA200: Description	RES 3 - S6 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.
EA200: Description	RES 3 - S7 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.
EA200: Description	RES 3 - S9 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.
EA200: Description	RES 3 - S8 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.
EA200: Description	RES 3 - S10 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.
EA200: Description	RES 3 - S5 - 22-OCT-2013 15:00	Dark grey soil with dark grey rocks plus plenty of slag pieces and vegetation.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
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

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EN1303916**	Page	: 1 of 9
Amendment	: **1**		
Client	: **ENVIRON**	Laboratory	: Environmental Division Newcastle
Contact	: MR STEVE CADMAN	Contact	: Peter Keyte
Address	: PO Box 435 THE JUNCTION NSW 2291	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: scadman@environcorp.com	E-mail	: peter.keyte@als.com.au
Telephone	: ----	Telephone	: 61-2-4968-9433
Facsimile	: ----	Facsimile	: +61-2-4968 0349
Project	: AS130348	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: 155061-64	Date Samples Received	: 24-OCT-2013
Sampler	: SC	Issue Date	: 19-FEB-2014
Order number	: ----		
		No. of samples received	: 42
Quote number	: SY/433/13	No. of samples analysed	: 42

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
Christopher Owler	Team Leader - Asbestos	Newcastle - Asbestos
Pabi Subba	Senior Organic Chemist	Sydney Organics
Sanjeshni Jyoti Mala	Senior Chemist Volatile	Sydney Organics
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 (%)*
EA055: Moisture Content (QC Lot: 3128857)									
EN1303916-003	RES 3 - QA1	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	2.8	2.4	17.1	No Limit
ES1322916-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	68.6	69.6	1.4	0% - 20%
EA055: Moisture Content (QC Lot: 3149662)									
EB1327056-036	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	29.8	28.2	5.2	0% - 20%
EB1327056-054	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	35.2	37.2	5.7	0% - 20%
EA055: Moisture Content (QC Lot: 3149663)									
EN1303916-017	RES 3 - SF16	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	9.5	9.5	0.0	No Limit
EN1303916-028	RES 3 - SF27	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	15.4	17.2	11.3	0% - 50%
EA055: Moisture Content (QC Lot: 3149664)									
EN1303916-037	RES 3 - SF36	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	3.3	3.8	15.7	No Limit
ES1323865-006	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	5.6	4.8	14.6	No Limit
EK040S: Fluoride Soluble (QC Lot: 3148949)									
EN1303916-012	RES 3 - SF11	EK040S: Fluoride	16984-48-8	1	mg/kg	2	2	0.0	No Limit
EN1303916-021	RES 3 - SF20	EK040S: Fluoride	16984-48-8	1	mg/kg	2	2	0.0	No Limit
EK040S: Fluoride Soluble (QC Lot: 3148950)									
EN1303916-032	RES 3 - SF31	EK040S: Fluoride	16984-48-8	1	mg/kg	<1	<1	0.0	No Limit
EN1303916-041	RES 3 - QA3	EK040S: Fluoride	16984-48-8	1	mg/kg	2	2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3128346)									
EN1303916-001	RES 3 - S2	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3128346) - continued									
EN1303916-001	RES 3 - S2	EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EN1303916-011	RES 3 - S5	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3126366)									
EN1303916-001	RES 3 - S2	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EN1303916-011	RES 3 - S5	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3128345)									
EN1303916-001	RES 3 - S2	EP071: C15 - C28 Fraction	----	100	mg/kg	600	620	3.3	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	1080	1130	4.1	0% - 50%
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EN1303916-011	RES 3 - S5	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3126366)									
EN1303916-001	RES 3 - S2	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EN1303916-011	RES 3 - S5	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3128345)									
EN1303916-001	RES 3 - S2	EP071: >C16 - C34 Fraction	----	100	mg/kg	1390	1430	3.0	0% - 50%
		EP071: >C34 - C40 Fraction	----	100	mg/kg	660	630	4.2	0% - 20%
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	0.0	No Limit
EN1303916-011	RES 3 - S5	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3128345) - continued									
EN1303916-011	RES 3 - S5	EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 3126366)									
EN1303916-001	RES 3 - S2	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EN1303916-011	RES 3 - S5	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	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: 3148949)								
EK040S: Fluoride	16984-48-8	1.0	mg/kg	<1	25.0 mg/kg	116	69	117
EK040S: Fluoride Soluble (QCLot: 3148950)								
EK040S: Fluoride	16984-48-8	1.0	mg/kg	<1	25.0 mg/kg	116	69	117
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3128346)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	4 mg/kg	86.8	80	124
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	4 mg/kg	92.5	77	123
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	4 mg/kg	95.5	79	123
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	4 mg/kg	104	77	123
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	4 mg/kg	88.5	79	123
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	4 mg/kg	89.2	79	123
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	4 mg/kg	90.0	79	123
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	4 mg/kg	91.0	79	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	4 mg/kg	96.5	73	121
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	4 mg/kg	93.8	81	123
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	4 mg/kg	94.5	70	118
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	4 mg/kg	101	77	123
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	4 mg/kg	97.1	76	122
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	4 mg/kg	83.8	71	113
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	4 mg/kg	83.8	71.7	113
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	4 mg/kg	85.0	72.4	114
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3126366)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	84.2	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3128345)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	105	71	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	123	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	105	64	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3126366)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	81.3	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3128345)								
EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	250 mg/kg	114	70	130
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	126	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
		50	mg/kg	----	150 mg/kg	112	63	131
EP080: BTEXN (QCLot: 3126366)								

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
EP080: BTEXN (QCLot: 3126366) - continued								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	85.2	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	85.6	62	128
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	82.8	58	118
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	84.2	60	120
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	83.9	60	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	82.6	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
EK040S: Fluoride Soluble (QCLot: 3148949)							
EN1303916-012	RES 3 - SF11	EK040S: Fluoride	16984-48-8	25.0 mg/kg	120	70	130
EK040S: Fluoride Soluble (QCLot: 3148950)							
EN1303916-032	RES 3 - SF31	EK040S: Fluoride	16984-48-8	25.0 mg/kg	124	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3128346)							
EN1303916-001	RES 3 - S2	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	89.3	70	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	92.2	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3126366)							
EN1303916-001	RES 3 - S2	EP080: C6 - C9 Fraction	----	32.5 mg/kg	99.4	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3128345)							
EN1303916-001	RES 3 - S2	EP071: C10 - C14 Fraction	----	640 mg/kg	88.1	73	137
		EP071: C15 - C28 Fraction	----	3140 mg/kg	81.5	53	131
		EP071: C29 - C36 Fraction	----	2860 mg/kg	65.9	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3126366)							
EN1303916-001	RES 3 - S2	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	94.7	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3128345)							
EN1303916-001	RES 3 - S2	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	110	73	137
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	72.2	53	131
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	54.2	52	132
EP080: BTEXN (QCLot: 3126366)							
EN1303916-001	RES 3 - S2	EP080: Benzene	71-43-2	2.5 mg/kg	91.0	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	96.2	70	130

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
EP080: BTEXN (QCLot: 3126366) - continued							
EN1303916-001	RES 3 - S2	EP080: Ethylbenzene	100-41-4	2.5 mg/kg	95.4	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	95.0	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	99.3	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	85.5	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
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3126366)										
EN1303916-001	RES 3 - S2	EP080: C6 - C9 Fraction	----	32.5 mg/kg	99.4	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3126366)										
EN1303916-001	RES 3 - S2	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	94.7	----	70	130	----	----
EP080: BTEXN (QCLot: 3126366)										
EN1303916-001	RES 3 - S2	EP080: Benzene	71-43-2	2.5 mg/kg	91.0	----	70	130	----	----
		EP080: Toluene	108-88-3	2.5 mg/kg	96.2	----	70	130	----	----
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	95.4	----	70	130	----	----
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	95.0	----	70	130	----	----
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	99.3	----	70	130	----	----
		EP080: Naphthalene	91-20-3	2.5 mg/kg	85.5	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3128345)										
EN1303916-001	RES 3 - S2	EP071: C10 - C14 Fraction	----	640 mg/kg	88.1	----	73	137	----	----
		EP071: C15 - C28 Fraction	----	3140 mg/kg	81.5	----	53	131	----	----
		EP071: C29 - C36 Fraction	----	2860 mg/kg	65.9	----	52	132	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3128345)										
EN1303916-001	RES 3 - S2	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	110	----	73	137	----	----
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	72.2	----	53	131	----	----
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	54.2	----	52	132	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3128346)										
EN1303916-001	RES 3 - S2	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	89.3	----	70	130	----	----
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	92.2	----	70	130	----	----
EK040S: Fluoride Soluble (QCLot: 3148949)										
EN1303916-012	RES 3 - SF11	EK040S: Fluoride	16984-48-8	25.0 mg/kg	120	----	70	130	----	----

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: 3148950)										
EN1303916-032	RES 3 - SF31	EK040S: Fluoride	16984-48-8	25.0 mg/kg	124	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EN1303916**	Page	: 1 of 8
Amendment	: **1**		
Client	: ENVIRON	Laboratory	: Environmental Division Newcastle
Contact	: MR STEVE CADMAN	Contact	: Peter Keyte
Address	: PO Box 435 THE JUNCTION NSW 2291	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: scadman@environcorp.com	E-mail	: peter.keyte@als.com.au
Telephone	: ----	Telephone	: 61-2-4968-9433
Facsimile	: ----	Facsimile	: +61-2-4968 0349
Project	: AS130348	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: 155061-64	Date Samples Received	: 24-OCT-2013
Sampler	: SC	Issue Date	: 19-FEB-2014
Order number	: ----		
		No. of samples received	: 42
Quote number	: SY/433/13	No. of samples analysed	: 42

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							
Pulp Bag (EA055-103)							
RES 3 - SF11, RES 3 - SF12, RES 3 - SF13, RES 3 - SF14, RES 3 - SF15, RES 3 - SF16, RES 3 - SF17, RES 3 - SF18, RES 3 - SF19, RES 3 - SF20, RES 3 - SF21, RES 3 - SF22, RES 3 - SF23, RES 3 - SF24, RES 3 - SF25, RES 3 - SF26, RES 3 - SF27, RES 3 - SF28, RES 3 - SF29, RES 3 - SF30, RES 3 - SF31, RES 3 - SF32, RES 3 - SF33, RES 3 - SF34, RES 3 - SF35, RES 3 - SF36, RES 3 - SF37, RES 3 - SF38, RES 3 - QA2, RES 3 - QA3, RES 3 - QA4	**22-OCT-2013**	**----**	----	----	**08-NOV-2013**	05-NOV-2013	×
Soil Glass Jar - Unpreserved (EA055-103)							
RES 3 - S2, RES 3 - S3, RES 3 - QA1, RES 3 - S4, RES 3 - S1, RES 3 - S6, RES 3 - S7, RES 3 - S9, RES 3 - S8, RES 3 - S10, RES 3 - S5	**22-OCT-2013**	**----**	----	----	**28-OCT-2013**	05-NOV-2013	✓
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples							
Soil Glass Jar - Unpreserved (EA200)							
RES 3 - S2, RES 3 - S3, RES 3 - QA1, RES 3 - S4, RES 3 - S1, RES 3 - S6, RES 3 - S7, RES 3 - S9, RES 3 - S8, RES 3 - S10, RES 3 - S5	**22-OCT-2013**	**---**	20-APR-2014	----	**06-NOV-2013**	05-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
EK040S: Fluoride Soluble							
Pulp Bag (EK040S)							
RES 3 - SF11, RES 3 - SF12, RES 3 - SF13, RES 3 - SF14, RES 3 - SF15, RES 3 - SF16, RES 3 - SF17, RES 3 - SF18, RES 3 - SF19, RES 3 - SF20, RES 3 - SF21, RES 3 - SF22, RES 3 - SF23, RES 3 - SF24, RES 3 - SF25, RES 3 - SF26, RES 3 - SF27, RES 3 - SF28, RES 3 - SF29, RES 3 - SF30, RES 3 - SF31, RES 3 - SF32, RES 3 - SF33, RES 3 - SF34, RES 3 - SF35, RES 3 - SF36, RES 3 - SF37, RES 3 - SF38, RES 3 - QA2, RES 3 - QA3, RES 3 - QA4	**22-OCT-2013**	**11-NOV-2013**	29-OCT-2013	×	**11-NOV-2013**	09-DEC-2013	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved (EP071)							
RES 3 - S2, RES 3 - S3, RES 3 - QA1, RES 3 - S4, RES 3 - S1, RES 3 - S6, RES 3 - S7, RES 3 - S9, RES 3 - S8, RES 3 - S10, RES 3 - S5	**22-OCT-2013**	**29-OCT-2013**	05-NOV-2013	✓	**30-OCT-2013**	08-DEC-2013	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
RES 3 - S2, RES 3 - S3, RES 3 - QA1, RES 3 - S4, RES 3 - S1, RES 3 - S6, RES 3 - S7, RES 3 - S9, RES 3 - S8, RES 3 - S10, RES 3 - S5	**22-OCT-2013**	**29-OCT-2013**	05-NOV-2013	✓	**30-OCT-2013**	08-DEC-2013	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
RES 3 - S2, RES 3 - S3, RES 3 - QA1, RES 3 - S4, RES 3 - S1, RES 3 - S6, RES 3 - S7, RES 3 - S9, RES 3 - S8, RES 3 - S10, RES 3 - S5	**22-OCT-2013**	**28-OCT-2013**	05-NOV-2013	✓	**29-OCT-2013**	05-NOV-2013	✓

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 (EP080)							
RES 3 - S2, RES 3 - S3, RES 3 - QA1, RES 3 - S4, RES 3 - S1, RES 3 - S6, RES 3 - S7, RES 3 - S9, RES 3 - S8, RES 3 - S10, RES 3 - S5	**22-OCT-2013**	**28-OCT-2013**	05-NOV-2013	✓	**29-OCT-2013**	05-NOV-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	4	31	**12.9**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Moisture Content	EA055-103	8	80	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	15	**13.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Fluoride - Soluble	EK040S	2	31	**6.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	15	**6.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Fluoride - Soluble	EK040S	2	31	**6.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	15	**6.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Fluoride - Soluble	EK040S	2	31	**6.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	15	**6.7**	**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
Asbestos - Quantitative Analysis	* EA200Q	SOIL	Asbestos Materials Content with Confirmation of Identification by AS 4964 - 2004 Asbestos
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.
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
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.
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 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	EN1303916-007	RES 3 - S7	**Toluene-D8**	2037-26-5	73.6 %	73.9-132.1 %	**Recovery less than lower data quality objective**
EP080S: TPH(V)/BTEX Surrogates	EN1303916-002	RES 3 - S3	**Toluene-D8**	2037-26-5	71.2 %	73.9-132.1 %	**Recovery less than lower data quality objective**
EP080S: TPH(V)/BTEX Surrogates	EN1303916-010	RES 3 - S10	**Toluene-D8**	2037-26-5	56.0 %	73.9-132.1 %	**Recovery less than lower 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	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA055: Moisture Content						

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
EA055: Moisture Content - Analysis Holding Time Compliance						
Pulp Bag						
RES 3 - SF11, RES 3 - SF12, RES 3 - SF13, RES 3 - SF14, RES 3 - SF15, RES 3 - SF16, RES 3 - SF17, RES 3 - SF18, RES 3 - SF19, RES 3 - SF20, RES 3 - SF21, RES 3 - SF22, RES 3 - SF23, RES 3 - SF24, RES 3 - SF25, RES 3 - SF26, RES 3 - SF27, RES 3 - SF28, RES 3 - SF29, RES 3 - SF30, RES 3 - SF31, RES 3 - SF32, RES 3 - SF33, RES 3 - SF34, RES 3 - SF35, RES 3 - SF36, RES 3 - SF37, RES 3 - SF38, RES 3 - QA2, RES 3 - QA3, RES 3 - QA4	----	----	----	08-NOV-2013	05-NOV-2013	**3**
EK040S: Fluoride Soluble						
Pulp Bag						
RES 3 - SF11, RES 3 - SF12, RES 3 - SF13, RES 3 - SF14, RES 3 - SF15, RES 3 - SF16, RES 3 - SF17, RES 3 - SF18, RES 3 - SF19, RES 3 - SF20, RES 3 - SF21, RES 3 - SF22, RES 3 - SF23, RES 3 - SF24, RES 3 - SF25, RES 3 - SF26, RES 3 - SF27, RES 3 - SF28, RES 3 - SF29, RES 3 - SF30, RES 3 - SF31, RES 3 - SF32, RES 3 - SF33, RES 3 - SF34, RES 3 - SF35, RES 3 - SF36, RES 3 - SF37, RES 3 - SF38, RES 3 - QA2, RES 3 - QA3, RES 3 - QA4	11-NOV-2013	29-OCT-2013	**13**	----	----	----

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

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 3.

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 3 appear to be limited to farmland. This use of Parcel 3 requires confirmation via a site walkover. 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 3 consistent with site observations?
- Has Parcel 3 been impacted by fluoride from dust deposition from the Hydro smelter?
- Has Parcel 3 been impacted by other contaminants?
- Is Parcel 3 suitable for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use?

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 3, as shown on Figure 1.

Vertical boundaries – as areas of concern at Parcel 3 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.

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 3 for low rural residential (R2), environmental conservation (E2) and public recreation (RE1) landuse, then an assessment of the suitability of Parcel 3 for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use 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 3 for the purposes of low rural residential (R2), environmental conservation (E2) and public recreation (RE1) land use.

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 3.

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 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 B and C, 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 B: 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 the entire site to assess the impact of particulate fallout from Hydro Aluminium Smelter. Shallow soil samples were collected along the 300m alignment of the former rail line in northern area of Parcel 3.
Sampling Density	38 soil samples were collected from a grid across the entire site which is approximately 139 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. Fluoride soil sampling completed on a reduced density to identify if fluoride in surface soils is an issue. 10 soil samples were collected along the 300m alignment of the former rail line in northern area of Parcel 3. This was a targeted investigation and therefore the sampling density was considered appropriate to investigate impacts from former rail surface infrastructure.
Sample depths	One soil sample was collected from each location, from the ground surface.
Sample Collection Method	Surface soil samples across Parcel 3 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 3 were collected directly from the ground surface using using dedicated disposable gloves and a hand trowel. The hand trowel was brushed clean prior to sample collection.
Sample handling and containers	All soil samples were placed into laboratory-supplied, 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.

Table B: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling Methodology	**ENVIRON Assessment**
Detailed description of field screening protocols	Field screening for volatiles was not completed during soil sampling as volatile contaminants were not the main chemical of concern.
Calibration of field equipment	No field equipment requiring calibration was used in the field

Table B: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**ENVIRON Comments**
Field quality control samples	Intra-laboratory duplicate soil samples were analysed at a ratio of 1:9 for fluoride, TRH, BTEX and PAHs analysed for the rail spur samples. Intra-laboratory duplicate soil samples were analysed at a ratio of 1:9 for fluoride analysed for the grid samples across the entire site. No rinsate blank samples were collected.
Field quality control results	Intra- duplicate results are presented in Table C for soil. There were no RPD exceedences for the intra-laboratory duplicates collected for this assessment.
NATA registered laboratory and NATA endorsed methods	ALS was used as the primary laboratory. ALS laboratory certificates are NATA stamped and is accredited for the analyses performed for this assessment.
Analytical methods	A summary of analytical methods were included in the laboratory test certificates.
Holding times	Review of the COCs and laboratory certificates indicate that holding times were met.
Practical Quantitation Limits (PQLs)	PQLs for all soil analytes were below Parcel 3 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.