

Intended for
Hydro Aluminium Kurri Kurri Pty Ltd

Document type
Site Validation Report

Date
January 2017

SITE VALIDATION REPORT

12 HORTON ROAD LOXFORD, NSW

Revision **Final**
Date **11/01/2017**
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Checked by **Fiona Robinson**
Approved by **Fiona Robinson**
Description **Ramboll Environ has supervised remediation and validation works associated with an underground storage tank at 12 Horton Road, Loxford. An outline of the remedial works and validation results are presented in this Site Validation Report.**

Ref AS130492
AS130492_Horton Rd_Validation_Report_V1.docxVersion Final

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ACRONYMS AND ABBREVIATIONS

ACM	Asbestos Containing Materials
AEC	Area of Environmental Concern
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ASET	Australian Safer Environment and Technology Pty Ltd. (Laboratory)
ANZECC	Australian and New Zealand Environment and Conservation Council
B(a)P	Benzo(a)pyrene
BGS	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes (Monocyclic aromatic Hydrocarbons)
CN	Cyanide (total or free)
CT	Certificate of Title
DP	Deposited Plan
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
Ha	Hectare
km	Kilometres
LOR	Limit of Reporting
m	Metres
MAH	Monocyclic Aromatic Hydrocarbons
Mercury	Inorganic mercury unless noted otherwise
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Fe: Iron, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
m BGL	Metres below ground level
mg/L	Micrograms per Litre
MW	Monitoring well
NATA	National Association of Testing Authorities
NC	Not Calculated
ND	Not Detected
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
OCPs	Organochlorine Pesticides
OH&S	Occupational Health & Safety
OPPs	Organophosphorus Pesticides
PAEC	Potential Area of Environmental Concern
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PQL	Practical Quantitation Limit
pH	a measure of acidity, hydrogen ion activity
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
SILs	Soil Investigation Levels
SVOCs	Semi Volatile Organic Compounds
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
µg/L	Micrograms per Litre
-	On tables is "not calculated", "no criteria" or "not applicable"

EXECUTIVE SUMMARY

Ramboll Environ has been commissioned by Hydro Aluminium Kurri Kurri Pty Limited to complete validation works associated with the decommissioning and remediation of an underground petroleum storage system (UPSS) at 12 Horton Road, Loxford, New South Wales, 2320. The remediation and validation works required were described in Ramboll Environ (August 2016) Remedial Action Work Plan, 12 Horton Road, Loxford, NSW.

An underground storage tank was identified at 12 Horton Road, Loxford during the demolition of buildings at the Site in August 2016. Information provided by the Hydro Environment Manager indicated that the underground storage tank was likely installed by a tenant in the late 1970s to early 1980s who used the Site as a truck depot. This tenant left the Site in the early 1980s and it is likely that the underground storage tank has not been used since this time.

The underground storage tank was identified by its vent pipe. No surface infrastructure relating to the UPSS remained on site. The bowser had been removed. Approximately 1000L of watery sludge was identified in the tank following its discovery.

The UPSS was decommissioned and remediation and validation works were completed on 8 September 2016, including the following works:

- Removal of liquid waste from the base of the underground storage tank.
- Excavation of the underground storage tank from the ground and off-site disposal to a metal recycling facility following certified degassing.
- Excavation of the packing sands around the underground storage tank and collection of validation samples.
- Collection of validation soil samples from the walls and base of the underground storage tank excavation.
- Collection of a validation soil samples from coal washery reject subbase identified during the works.
- Backfilling of the underground storage tank excavation with the packing sands.

The underground storage tank was observed to be in good condition, with no rust or corrosion evident. There was no odour evident during the excavation of the tank. The tank was measured following excavation and found to be 7.5m in length and 2.15m in diameter.

Packing sands were observed to be free of staining and odour. The walls and base of the underground storage tank excavation, which were in natural clayey sand, were observed to be free of staining and odour.

Excavation of soils beneath the location of the former bowser uncovered black fill material, which was identified as coal washery reject that had been used as the hardstand subbase. This material was not odorous.

Validation soil samples were analysed for contaminants of concern associated with fuel storage, including total recoverable hydrocarbons (TRH), benzene, toluene, ethyl benzene and xylenes (BTEX) and lead. The coal washery reject sample was analysed for heavy metals, TRH, BTEX and PAHs. All analytical results were below the site criteria.

Based on observations made of the underground storage tank and the packing sands during the excavation works and the validation analytical results, it is considered that the UPSS has been satisfactorily decommissioned.

1. INTRODUCTION

This Validation Report has been prepared to provide independent verification that the former Underground Petroleum Storage System (UPSS) located at 12 Horton Road, Loxford, is free of unacceptable levels of contamination, all necessary remediation works have been successfully carried out, and the site is suitable for an ongoing or future use. The UPSS subject of this report is located at 12 Horton Road, Loxford, within the buffer zone of the former Hydro Kurri Kurri Aluminium Smelter in New South Wales.

1.1 Site Characterisation and Validation

Hydro Aluminium Kurri Kurri Pty Limited (Hydro) is evaluating options for redevelopment and possible divestment of land parcels following closure of the Hydro Aluminium Kurri Kurri Smelter (the Smelter) in May 2014. A Rezoning Masterplan was developed that identified land proposed for a range of uses. The Rezoning Masterplan identified the Site for proposed General Industrial (IN1) use.

During demolition works to remove site structures at 12 Horton Road, Loxford (the Site), including a residence and sheds, an underground storage tank (UST) was identified by its vent pipe following the demolition of an overlying concrete slab. Former fuel lines and bowser were not found however the bowser location was identified by the Hydro Environment Manager based on his memory of the site in the 1980s. The UST and the location of the bowser are referred to as the UPSS in this report. The UST requires remediation and validation for the Site to be made suitable for the current and proposed landuses.

A Phase 1 Environmental Site Assessment (previously prepared for all Hydro owned lands) had evaluated the potential for contamination at the Smelter Site and within the surrounding Buffer Zone. A Phase 2 Environmental Site Assessment, which included intrusive investigations at the Site, was completed in 2015. The intrusive investigations did not identify soil contamination at the Site, aside from the identification of Asbestos Containing Materials (ACM) fragments on the surface of the Site.

Requirements for remediation of asbestos within the buffer zone, including at the Site, was outlined in 'Remedial Action Work Plan, Buffer Zone Asbestos, Kurri Kurri NSW', dated May 2016 by Ramboll Environ. Remedial works to remove ACM fragments from the surface of the Site were completed in August 2016 and a Clearance Certificate was provided.

Following the identification of the UPSS at the Site, a RAWP dated August 2016 was developed by Ramboll Environ to outline requirements for remediation and validation of the UST removal, in accordance with the requirements of NSW DECCW (2010) *UPSS Technical Note: Decommissioning, Abandonment and Removal of UPSS* and NSW DECCW (2010) *UPSS Technical Note: Site Validation Reporting*.

1.2 Objective

The objective of the works is to remove the UPSS and to remediate associated contaminated soils (if any) to a level suitable for the proposed General Industrial (IN1) land use. This Site Validation Report forms part of those works and provides a description of the impacted area requiring remediation, the methodology to remediate that area and validation of that area in order to meet the project objective.

1.3 Scope of Work

To meet the objective, Ramboll Environ has completed the following scope of work:

- Review previous reports prepared for the Smelter Site including:
 - ENVIRON (October 2013) Phase 1 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter; and
 - ENVIRON (April 2015) Phase 2 Environmental Site Assessment, Parcel 4;

- Identify and evaluate possible remedial options for the UPSS including consultation with Hydro personnel in order to determine the most appropriate remedial option;
- Consultation with regulatory guidelines;
- Develop RAWP including establishment of Data Quality Objectives (DQOs) for the validation plan;
- Develop a validation plan to validate completion of the site remediation and confirm the suitability of the Site for the proposed use;
- Supervise contractors to conduct the site remediation works in accordance with the RAWP;
and
- Complete a site validation report.

2. SITE INFORMATION AND IDENTIFICATION

The Site at 12 Horton Road, Loxford is located approximately 30km west of the city of Newcastle and 150km north of Sydney in NSW, Australia. The site is located within the following boundaries:

- East: Horton Road then rural properties within the Buffer Zone owned by Hydro;
- North: Buffer Zone properties owned by Hydro; and
- West and South: Hunter Expressway then Buffer Zone properties owned by Hydro.

Table 2.1 presents site identification and location details. The location of the Site is shown on **Figure 1**.

Table 2.1: Site Identification

Site Owner	Hydro Aluminium Kurri Kurri Pty Limited (subject to Deed of Company Arrangement)
Street Address	12 Horton Road, Loxford, New South Wales, Australia , 2327
Local Government Area	Cessnock City Council
Parish	Heddon
County	Northumberland
Distance from Nearest CBD	Approximately 3.5km north-west of Kurri Kurri, and 30km north-west of Newcastle
Geographical Coordinates	Latitude 32°47.936' S, Longitude 151°28.822' E
Lot and DP Numbers	Lot 16 in DP1082569
Site Area	1.2 Ha
Zoning (current)	RU2 – Rural Landscape
Zoning (future)	IN1 – General Industrial
Site Elevation	Approximately 17m AHD
Site Map	Figure 1

3. COMPANY INFORMATION

The Site is owned by Hydro Aluminium Kurri Kurri Pty Limited. The site is located within the Buffer Zone of the former aluminium smelter and was previously leased for commercial uses, including a truck depot and a landscaping business.

Table 3.1: Company Information

Company	Hydro Aluminium Kurri Kurri Pty Limited
ABN	55 093 266 221
Contact Person	Andrew Solomou
Dates Onsite	The remediation and validation works were completed on Wednesday 7 and Thursday 8 September 2016.
Phone Number	+61 2 49 37 15 55
Postal Address	PO Box 1, Kurri Kurri NSW 2327
Trading Name	Hydro Aluminium Kurri Kurri Pty Limited
Company Description	<p>The primary metal plant in Kurri Kurri began operations in 1969. Hydro, a member of Hydro Aluminium Group based in Norway, became owner of the plant through its 2002 acquisition of VAW aluminium AG.</p> <p>In the 1980s, the site was leased by Hydro to a local company who used the site as a truck depot.</p>
Current Site Use	<p>The site forms part of the Hydro owned land and is currently vacant.</p> <p>Hydro is evaluating options for redevelopment and possible divestment of the site following closure of the Hydro Aluminium Kurri Kurri Smelter (the Smelter) in May 2014.</p>
Reason for Removal /Decommissioning	<p>The UPSS is no longer required.</p> <p>A Rezoning Masterplan was developed that identified land proposed for general industrial (IN1) use which includes the Site.</p>

4. CONTRACTOR INFORMATION

Hydro commissioned Spero Demolition Pty Limited to undertake the demolition and removal of structures from the Site. Hydro retained Spero Demolition to complete the tank pull and remedial civil works. Spero Demolition hold an Unrestricted Demolition (DE2) Licence, which is required for the removal of USTs.

Table 4.1 presents relevant company information.

Table 4.1: Contractor Information

Company	Spero Demolition Pty Limited
ABN	69 159 577 894
Contact Person	Michael Owen
Phone Number	02 4967 2725
Postal Address	Unit 5, 11 Kinta Drive, Beresfield, NSW 2322

5. SITE BACKGROUND

5.1 Site History

A site history review was completed as part of the Phase 2 Environmental Site Assessment for Parcel 4, a larger land parcel within the Hydro Buffer Zone which includes the Site. This review identified the following relevant to the Site:

- Earliest records (aerial photographs in 1951) show Parcel 4 predominantly comprises bushland with some open areas.
- Lot 16 was developed for residential landuse with a dwelling between the 1950s and 1970s.
- At the time of the site walkover, the site comprised a residence located in the front of the property (on Horton Road) and the remainder of the site was occupied by an operating landscaping business.
- The landscaping business included:
 - A large two-storey metal shed located on the south-western corner of the site used for storage of plant and equipment;
 - A smaller storage shed/ informal workshop located on the north-eastern side of the site;
 - A small portable demountable building located immediately behind the large shed. At the time of the site walkover, the building had over 100 empty 20L plastic pesticide containers ("Round-Up") stacked inside and outside;
 - A number of empty 20L and 200L drums of lubricating oil in between the sheds and the demountable building;
 - A number of vehicles (trucks/ trailers/ tractors) were parked along the mid-north-eastern boundary;
 - Two to three pallets of unused refractory bricks were stored mid-way along the south-western boundary;
 - A large stack of broken wooden pallets, stockpiled mulch and green waste in the centre of the site.

Following the identification of the UST on 10 August 2016 during demolition works, the following information was provided by Mr Kerry McNaughton, the Hydro Environment Manager:

- In the 1970s, the site was used as a truck depot and it is likely that the diesel UST was installed at this time for truck refuelling.
- Use of the site as a truck depot ceased in the 1980s. There were a number of different tenants in the 1980s and 1990s. The most recent tenant, a landscaping business, had leased the site for approximately the past 10 years.
- Mr McNaughton recalls seeing a bowser at the location of the UST in the early 1980s.
- The UST was identified below a concrete slab that was a shed floor. It is likely that the slab was poured over the top of the UST pipework.
- The UST was dipped at the time it was found and there was a small amount of watery sludge identified. It is likely the UST has been unused since the early 1980s.

5.2 Tank testing

No information is available regarding historical tank testing.

Following its identification, the UST was exposed and the fill point was dipped to check its contents. A small amount of watery sludge was identified. A photoionisation detector (PID) was used to assess the potential for volatile vapours within the tank. The maximum reading of the PID was 160ppm on 5 September 2016. This concentration is well below the diesel Lower Explosive Limit (LEL) of 6000ppm.

5.3 Neighbouring Sites

The Site is within the Buffer Zone on Hydro owned land. The identification and uses of adjacent properties are outlined in **Table 5.1**.

Direction	Lot/ DP	Zoning	Use	Potential for Off-Site Effects
North	Lot 1 DP589169	RU2 Rural Landscape	Residential	Unlikely – this property is considered cross-gradient
South	Lot 17 DP1082569	RU2 Rural Landscape	Bushland	Unlikely – this property is considered cross-gradient
East	Lot 14 DP1082569	RU2 Rural Landscape	Bushland	Potential – this property is considered down-gradient
West	Lot 429 DP758231	RU2 Rural Landscape	Cleared land, filled with spoil from Hunter Expressway development	Unlikely – this property is considered up-gradient

5.4 Groundwater Monitoring and Use

There is no beneficial use of groundwater at the Site and no groundwater monitoring has been undertaken. The depth to groundwater is likely to be >4m below ground level within natural sands, based on drilling completed at other Buffer Zone properties to the south of the Smelter Site. Groundwater is likely to follow topography and flow to the east, towards the nearest surface water receptor of Swamp Creek. Swamp Creek is located approximately 200m east of the Site and flows in a northerly direction discharging into Wentworth Swamp, which in turn discharges to the Hunter River.

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).

Potential beneficial uses of groundwater down gradient of the site include:

- Discharge to Swamp Creek, which supports aquatic ecosystems and flows to Wentworth Swamp, which flows to the Hunter River; and
- Extraction of water from Swamp Creek may also be used for stock watering and/ or irrigation.

It is noted that drinking water has not been included as a potential beneficial use of water from Swamp Creek, for the following reasons:

- Drinking water supply to the local communities is reticulated and originates from Chichester Dam located on the Chichester River; and
- The Kurri Waste Water Treatment Works is located up-gradient of the Site. The Works has a licensed discharge point into Swamp Creek.

6. SITE CHARACTERISATION AND OBSERVATION

6.1 Topography

The site is located in an area of low lying flat land at approximately 17m AHD. The majority of the site is level, with a slope towards the north-western boundary.

Topography around the site is generally level, with the Hunter Expressway located within a section of cut to the south of the site. The drop in elevation from the site to the Hunter Expressway roadway is approximately 5m.

6.2 Regional Geology

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

The Sydney Basin is a sedimentary basin consisting of Permian and Triassic sedimentary rocks, which extends from Newcastle in the north to Batemans Bay in the south and to Lithgow, just west of the Blue Mountains. The basin overlies older basement rocks of the Lachlan Fold Belt. The sedimentary rocks of the basin generally consist of near horizontal sandstones and shales, with some recent igneous dykes. Only minor folding and faulting has occurred since these sedimentary rock sequences first formed. The Dalwood Group is stratigraphically located near the base of the Sydney Basin below the Greta Coal Measures and Newcastle Coal Measures and was deposited in a marine environment.

Undifferentiated Quaternary alluvium occurs to the northeast of the Site associated with surface water bodies. Quaternary sediments which are associated with Swamp Creek (located approximately 200m east of the Site), Wentworth Swamp and the Hunter River consist of gravel, sand, silt and clay.

6.3 Regional Hydrogeology

Regional groundwater is expected to follow topography and flow northeast towards surface water bodies that feed into the Hunter River. Locally, groundwater beneath the site is expected to flow to Swamp Creek located approximately 200m east of the site. There are dams located on the adjacent properties immediately north-west and south-west of the site. One of the dams was constructed for stormwater collection during construction of the Hunter Expressway in 2014.

6.4 Site Sensitivity

The Site's sensitivity with respect to surface water and groundwater is considered to be moderate based on the following:

- Surface water and groundwater discharge into Swamp Creek, which is located 3.5km from Wentworth Swamp and 15km from the Hunter River within the Fishery Creek Catchment.
- 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 the site has been impacted by historical coal mining.
- The Hunter River GMU is used for irrigation, urban supply, drought supply, stock, domestic and commercial/ industrial use but it is not the main drinking water supply in the region.

6.5 Assessment of Contamination

Ramboll Environ conducted a Phase 2 Environmental Site Assessment at Parcel 4, which includes the site, in April 2015 to assess the potential for soil and groundwater contamination (ENVIRON 2015). The UST was not identified at the time of this investigation. The investigation comprised:

- A site history review, as summarised in **Section 5.1**.
- A detailed walkover of Parcel 4, which included the site, which was observed to be leased to an operating landscaping business.

- Intrusive investigations at the site to target fill identified during the site walkover, which comprised the excavation of seven test pits, the collection of one surface sample for fluoride analysis and a detailed asbestos walkover at two locations.
- Analysis of soil samples for heavy metals, TRH, BTEX, Polycyclic Aromatic Hydrocarbons (PAHs), Organochlorine Pesticides (OCPs) and Organophosphorus Pesticides (OPPs).

The site subsurface profile generally comprised disturbed natural material underlain by sand. A generalised site lithology is presented in **Table 6.1**.

Table 6.1: Generalised Site Lithology

Depth (mbgs)	Soil Description
0.0 – 0.85	FILL: Disturbed natural silty sandy soils, containing vegetative matter and minor glass, plastic and timber. No ACM observed.
0.25 - >1	Silty SAND, grey and brown, with some clay, red-brown and grey in the north-eastern area of the site.

A summary of the soil results is presented in **Table 6.2**.

Table 6.2: Summary of Soil Results

Analyte	No. of Samples	Maximum Concentration (mg/kg)	No. exceeding Site Criteria	Criteria Exceeded (mg/kg)
Asbestos	9	Asbestos identified in two fragments	2	No asbestos in surface soils
Arsenic	7	16	0	-
Cadmium	7	<1	0	-
Chromium	7	24	0	-
Copper	7	47	0	-
Lead	7	46	0	-
Nickel	7	28	0	-
Zinc	7	322	0	-
Mercury	7	<0.1	0	-
Soluble Fluoride	1	5	0	-
Naphthalene	7	<0.5	0	-
Benzo(a)pyrene*	7	1.6	0	-
BaP TEQ	7	2.2	0	-
Total PAHs	7	27.8	0	-
F1 C6- C10	7	<10	0	-
F2 >C10-C16	7	<50	0	-
F3 >C16-C34	7	<100	0	-
F4 >C34-C40	7	<100	0	-
OCPs	7	<LOR	0	-
OPPs	7	<LOR	0	-

* Ramboll Environ has elected to use the revised Environment Canada soil quality guideline of 72mg/kg, for commercial/ industrial land use, as the most relevant ecological investigation level for benzo(a)pyrene at the site as this guideline has been derived from a larger and more up-to-date toxicity database than the NEPM (2013) low reliability criterion.

Results for heavy metals, TPH, PAHs, OCPs, OPPs and soluble fluoride were below the site criteria. ACM fragments were identified on the surface of the site and laboratory testing confirmed the presence of amosite, crocidolite and chrysotile asbestos within the fragments. No asbestos fines or fibres were detected in the soil samples.

The Phase 2 ESA recommended that the ACM fragments on the surface of the Site be appropriately managed or disposed of. A Remedial Action Work Plan was prepared to outline the requirements for remediation of asbestos at the Site and other properties within the Buffer Zone, as reported in:

- 'Remedial Action Work Plan, Buffer Zone Asbestos, Kurri Kurri NSW', draft dated April 2016 by Ramboll Environ.

No further soil or groundwater contamination was identified at the Site following these investigations and remedial actions.

6.6 Conceptual Site Model

A conceptual site model (CSM) is a representation of the source, pathway and receptor linkages at a site. The CSM is provided in **Table 6.3**.

Table 6.3: Conceptual Site Model

Element of CSM	12 Horton Road, Loxford
Contaminant source and mechanism	<p>Ramboll Environ completed a Phase 2 Environmental Site Assessment at the site in 2014 and intrusive investigations indicated that potential contaminant sources identified, such as storage of materials associated with the landscaping business, had not impacted soils at the Site. ACM fragments were identified on the surface of the site, likely associated with demolition of a former building.</p> <p>During the demolition of site structures in August 2016, a UPSS was identified beneath a concrete slab. The UST is considered to be a potential contaminant source. The mechanism for contamination is the leaking of fuel from the UST or the spillage of diesel fuel during filling of the tank or filling of vehicles adjacent to the tank.</p>
Affected media	Potential affected media is on-site soils and groundwater beneath the Site.
Receptor identification	Potential receptors include future commercial/ industrial workers and Swamp Creek, the closest surface water body located approximately 200m east of the site.
Exposure pathways	<p>Potential exposure pathways include:</p> <ul style="list-style-type: none"> • Future commercial/ industrial workers: vapour inhalation; and • Ecosystem of Swamp Creek: direct contact and ingestion.
Presence of preferential pathways for contaminant movement	Based on the former site layout of buildings and sheds, it is considered that the only potential preferential pathway for contaminant movement is movement within the packing sands around the UST, which are of a lower permeability than the surrounding natural silty, clayey sands.
Evaluation of data gaps	The UST was uncovered unexpectedly during the demolition of the site. The extent of potentially contaminated soils associated with the UST and the potential impact to groundwater are data gaps that are addressed in this RAWP.

6.7 Statement of Suitability for Existing and Proposed Site Use

The proposed future development of the site for commercial/ industrial land use will alter the exposure scenarios. The UPSS is unused and is legally required to be decommissioned. The presence of the UPSS may represent a human and ecological health risk.

7. REMEDIAL ACTION PLAN

Ramboll Environ completed a Remedial Action and Work Plan (RAWP) prior to undertaking the remediation of the UPSS:

- 'Remedial Action and Work Plan, 12 Horton Road, Loxford, NSW', dated 16 August 2016 by Ramboll Environ

A summary of the RAWP is provided below.

7.1 Summary of RAWP

7.1.1 Remediation Goal

The goal of this remediation project is to render the site suitable for commercial/ industrial (IN1) landuse by:

- Decommissioning the diesel UST;
- Completion of remediation and validation of associated contaminated soil (if any);
- Assessing potential for groundwater contamination (if contaminated soil is identified).

7.1.2 Extent of Remediation Required

The location of the diesel UST and likely extent of the packing sands is shown in **Figure 2**. The diesel UST is approximately 8m long by 3m diameter and the top of the tank is located approximately 1m below the ground surface. To remove the tank from the ground will likely require an excavation that is approximately 10m long by 5m wide by approximately 4m depth.

The contaminant profile identified comprises packing sands to a depth of approximately 4m bgl surrounded by natural clayey sands.

7.1.3 Remediation Options and Selected Option

Three remediation options were assessed in the RAWP, as follows:

- Decommissioning of UST by removal to appropriate disposal facility. Landfarming of contaminated packing sands (if required) and reuse this material to backfill excavation.
- Decommissioning of UST by removal to appropriate disposal facility. Off-site disposal of contaminated packing sands (if any) to appropriately licensed waste facility.
- Decommissioning of UST by removal to appropriate disposal facility. Encapsulation of contaminated packing sands (if any) with smelter-derived wastes at another location within Hydro owned land.

Remediation options were considered in terms of cost, risk of failure, long term legacy and onsite management, corporate responsibility and sustainability. In terms of these evaluators Option 1 was preferred.

7.1.4 Contingency if the Remediation Strategy Fails

Table 7.2 outlines the potential failure scenarios that could occur and the contingency mechanisms that will be implemented to achieve the overall remediation objective.

Table 7.2: Remediation Contingency Planning

Failure Scenario	Contingency Response
Contaminated packing sands cannot be excavated due to safety or other risks	While all efforts will be undertaken to remove contaminated packing sands, if a situation arises where it becomes impractical to completely remove them to meet the remediation objectives, (e.g. physical constraints, safety etc.), alternative strategies may be employed to justify leaving contamination in place (e.g. specific risk assessment). Such alternatives will not proceed without consultation and full written approval of the Principal, in this instance Hydro.
Unexpected materials are encountered such as asbestos-containing materials.	The Principal will be advised and consideration will be given to completing the works in accordance with 'Remedial Action Work Plan, Buffer Zone Asbestos, Kurri Kurri NSW', dated May 2016 by Ramboll Environ.
Landfarming of the packing sands is not completed within the required timeframe.	Consider options for disposal of packing sands such as within the whole-of-site strategy for the smelter or off-site disposal to an appropriately licensed landfill.
A whole-of-site strategy is not approved that incorporates the Horton Road wastes.	Consider the hierarchy of other preferred options being off-site.

7.2 Summary of Remedial Activities Undertaken

Remedial activities were completed on Wednesday 7 and Thursday 8 September 2016 and included the following:

- Wednesday 7 September 2016
- Excavation of packing sands around the UST and manoeuvre of the UST so that liquid within the UST would drain to one end in preparation for removal.
- Excavation of black material beneath location of former bowser and relocation to the Smelter Site. This material was later assessed to be coal washery reject used as a subgrade to the hardstand area.
 - Thursday 8 September 2016
- Removal of sludge from within the UST by a liquid waste contractor. Approximately 1000L of sludge was removed.
- Removal of the UST from the excavation. The UST was lifted on to the surface of the site and remained there until it was picked up for off-site disposal. The UST was observed to be intact, with no corrosion.
- Excavation of packing sands to observe potential for contamination. No odour or staining was observed. Validation samples were collected from the walls and base of the tank pit excavation.
- Chasing out of pipework to the south of the UST. The pipework was removed and stockpiled on the surface of the site.
- Collection of validation samples from the stockpiles of packing sands around the tank pit excavation.
- Backfilling of the tank pit excavation with packing sands.

8. SAMPLING AND ANALYSIS PLAN AND SAMPLING METHODOLOGY

The following is the validation sampling, analysis and quality plan (SAQP) that was implemented to validate the remedial objective has been achieved for the Site.

8.1 Validation Sampling and Analysis

Validation sampling of soil will be required to demonstrate that, following excavation of all contaminated soils, remaining soils are within the adopted guidelines for the Site.

Validation will involve:

- Visual assessment and documentation of remaining soils for absence of staining or odours associated with petroleum hydrocarbons;
- Sampling soil across the excavation on an approximate 10m grid (based on the NSW EPA Sampling Design Guidelines, assuming an area of approximately 1ha); and
- Analysis of soil validation samples for the contaminants of concern: TRH and BTEX.

All sampling and analysis will comply with the specific data quality objectives outlined in the next Sections.

8.2 Validation Data Quality Objectives

In order to achieve the objectives and purpose of the validation program, both the field and laboratory programs must be representative of the actual extent of contamination in soil. As such, specific Data Quality Objectives (DQOs) have been developed for the validation of field and analytical data obtained during the remediation. The DQO process is a systemic, seven step process that defines the criteria that the validation sampling should satisfy in accordance with the requirements of DEC (2006) *Guidelines for the NSW Site Auditor Scheme* (2nd Edition). The DQOs are as follows:

8.2.1 Step 1: State the Problem

It its current state, the Site is not considered suitable for the proposed commercial/ industrial (IN1) landuse and remediation is required. Remediation of the following contaminants is required:

- Decommissioning of the diesel UST;
- Soil contamination: excavation of stained or odourous packing sands around the UST; and
- Potential groundwater contamination: assess the potential for groundwater contamination if soil contamination is identified within the tank pit excavation.

The remedial works require validation to confirm that the objective of the remediation has been achieved.

8.2.2 Step 2: Identify the Decisions

The validation SAQP is to ensure that all relevant contamination has been identified associated with the UST and that remediation has been carried out successfully. To validate the effectiveness of the remediation strategy, validation sampling and analysis of soil is required. The Site will be considered remediated when the remediation and validation program has been carried out successfully. Remediation is deemed to be successful when:

- The diesel UST has been decommissioned and recycled at an appropriately licensed facility;
- All contaminated packing sands associated with the UST have been excavated from the tank pit excavation;
- Validation sampling has found that concentrations in soil for TRH and BTEX are below remediation acceptance criteria;
- The tank pit excavation has been reinstated to its former landform.

8.2.3 Identify Inputs to the Decision

For the diesel UST, the following inputs into the decision making process are required:

- An evaluation of soil contaminant concentrations for TRH and BTEX is required following remediation. Validation soil samples are to be collected from the walls and base of the tank pit excavation and from the packing sands.
- Documented decommissioning of the UST, including receipt of a tank destruction certificate from the licensed disposal facility.
- Reinstatement of the tank pit excavation to achieve the objectives of the final landform.

8.2.4 Step 4: Define the Study Boundary

The Site boundaries have been outlined and defined within this RAWP and are presented in **Figure 2**. Remediation applies to the diesel UST and associated impacted soils at the Site. The temporal boundary is limited to the day of tank removal and sample collection.

8.2.5 Step 5: Development of Decision Rules

The types of data quality required, appropriate field methods (including sampling procedure and preservation of samples) and the quality of analytical data undertaken by the commercial laboratories are summarised in the following.

- All sample analyses are to be conducted using National Association of Testing Authorities (NATA) registered methods in accordance with ANZECC (1996) and NEPC (2013) guidelines.
- All samples are to be extracted within the laboratory specified acceptable sample holding time.
- Samples are to be appropriately preserved and handled in accordance with the sampling methodology outlined in Step 7.
- PQLs are to be less than the adopted assessment criteria.
- Duplicates, spikes, blanks, and control samples are to meet the DQIs presented in Step 6.

8.2.6 Step 6: Specific Limits of Decision Error

Acceptable limits and the manner of addressing possible decision errors are outlined in the sections below:

Accuracy: Accuracy is defined as the nearness of a result to the true value, where all random errors have been statistically removed. Internal accuracy is measured using percent recovery '%R' and external accuracy is measured using the Relative Percent Difference '%RPD'.

Internal accuracy will be tested utilising:

Surrogates	Surrogates are QC monitoring spikes, which are added to all field and QA/QC samples at the beginning of the sample extraction process in the laboratory, where applicable. Surrogates are closely related to the organic target analytes being measured, are to be spiked at similar concentrations, and are not normally found in the natural environment;
Laboratory control samples	An externally prepared and supplied reference material containing representative analytes under investigation. These will be undertaken at a frequency of one per analytical batch;
Matrix spikes	Field samples which are injected with a known concentration of contaminant and then tested to determine the potential for adsorption onto the matrix. These will be undertaken at a frequency of 5%.

Recovery data shall be categorised into one of the following control limits:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances;
- 69%-20%R indicates discussion required. May be considered acceptable data, or may be regarded with uncertainty;
- 10-19 %R indicating that the data should be treated as an estimate result;
- <10 %R indicating that the data should be rejected.

External accuracy will be determined by the submission of inter-laboratory duplicates at a frequency of 5%. Data will be analysed in accordance with the following control limits:

- 60% RPD at concentration levels greater than ten times the PQL.
- 85% RPD at concentrations between five to ten times the PQL.
- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the AD <2.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Precision: The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors. Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'.

Internal precision will be determined by the undertaking of laboratory duplicates, where two sub samples from a submitted sample are analysed. These will be undertaken at a frequency of 10%. A RPD analysis is calculated and results compared to:

- 50% RPD at concentration levels greater than ten times the PQL.
- 75% RPD at concentrations between five to ten times the PQL.
- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the: AD <2.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

External precision will be determined by the submission of intra-laboratory duplicates at a frequency of 5%. The external duplicate samples are to be obtained by mixing and then splitting the primary sample to create two identical sub samples. Field duplicate samples are to be labelled with a unique identification that does not reveal the association between the primary and duplicate samples e.g. QA1.

It must be noted that significant variation in duplicate results is often observed (particularly for solid matrix samples) due to sample heterogeneity or concentrations reported near the Practical Quantification Limit (PQL).

Data will be analysed in accordance with the following control limits:

- 50% RPD at concentration levels greater than ten times the PQL.
- 75% RPD at concentrations between five to ten times the PQL.
- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the: $AD < 2.5 \text{ times the PQL}$.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Blank samples will be submitted with the analytical samples and analysed for the contaminants of concern: Field Blank One per matrix type each batch samples/each day.

The laboratory will additionally undertake a method blank with each analytical batch of samples. Laboratory method blank analyses are to be below the PQLs. Results shall be examined and any positive results shall be examined. Positive blank results may not be subtracted from sample results.

Positive results may be acceptable if sample analyte concentrations are significantly greater than the amount reported in the blank (ten times for laboratory reagents such as methylene chloride, chloroform, and acetone etc., and five times for all other analytes). Alternatively, the laboratory PQL may be raised to accommodate blank anomalies provided that regulatory guidelines are not compromised by any adjustment made to the PQL.

Completeness: The completeness of the data set shall be judged as:

- The percentage of data retrieved from the field compared to the proposed scope of works. The acceptance criterion is 95%;
- The percentage of data regarded as acceptable based on the above data quality objectives. 95% of the retrieved data must be reliable.
- The reliability of data based on cumulative sub-standard performance of data quality objectives.

Where two or more data quality objectives indicate less reliability than what the acceptance criteria dictates, the data will be considered with uncertainty.

Representativeness: Sufficient samples must have been collected from the soil present at the Site. This will be calculated for soil samples by Procedure B, NSW EPA Sampling Design Guidelines, 1995.

Samples must be collected and preserved in accordance with the sampling methodology proposed in Step 7 to ensure that the sample is representative of the assessed stratum.

Comparability: The data must show little to no inconsistencies with results and field observations and include likely associates e.g. TPH C6-C10 and BTEX.

Decision Error Protocol

If the data received is not in accordance with the defined acceptable limits outlined in Steps 5 and 6, it may be considered to be an estimate or be rejected. Determination of whether this data may be used or if re-sampling is required will be based on the following considerations:

- Closeness of the result to the guideline concentrations.
- Specific contaminant of concern (e.g. response to carcinogens may be more conservative).
- The area of site and the potential lateral and vertical extent of questionable information.
- Whether the uncertainty can be effectively incorporated into site management controls.

Rectifying Non-conformances

If any of the validation procedures or criteria identified are not followed or met, this will constitute a non-conformance. The significance of the non-conformance will determine if rectification is required after discussion with the Site auditor. In order to address any non-conformances, the

Contractor's Environmental Consultant must assess the significance of each non-conformance and put their conclusion and recommendation to the auditor for approval.

8.2.7 Step 7: Optimise the Design for Obtaining Data – Soil and Groundwater Validation

All validation samples are to be collected in accordance with the DQOs outlined in this Section.

The sampling methodology for the Site remediation work is outlined below.

The objective of the sampling pattern is to demonstrate that the adopted sample density and total number of samples collected is suitable for the proposed General Industrial (IN1) landuse. The excavations will be validated following removal of associated contaminated packing sands.

Validation samples, frequency of collection, the analysis required, and justification is presented in **Table 8.1**.

Table 8.1: Validation Sampling Program

Validation Method	Validation Requirements	Chemical Analysis
Visual validation of the removal of contaminated packing sands	Excavations are to be photographed and a photographic log maintained and included in the Validation Report.	NA
Base of Excavation	Sampling and analysis to demonstrate the removal of petroleum hydrocarbon contaminated soils. The base of the excavation shall be sampled as follows: Excavated Base: Sampling across each area is to be undertaken on 10m grid spacing. This sampling program is in accordance with NSW EPA (1995) Sampling Design Guidelines.	TRH, BTEX, Lead
Walls of Excavation	Sampling and analysis to demonstrate the removal of petroleum hydrocarbon contaminated soils. The walls of the excavation shall be sampled as follows: Excavation Walls: One sample for each soil type present within the face of the excavation per 10 lineal metres. This sampling density is considered sufficient to confirm the absence of a contaminant hot spot greater than 5m in diameter.	TRH, BTEX, Lead
Stockpiled Spoil	Sampling and analysis to demonstrate that the excavated packing sands are suitable for reuse as backfill within the tank pit excavation. The stockpiled spoil shall be sampled as follows: Each stockpile: One sample per 25m ³ . This sampling program is in accordance with NSW EPA (1994) Service Station Guidelines.	TRH, BTEX, Lead
Coal Washery Reject used as subbase	Sampling and analysis to demonstrate that coal washery reject is suitable to remain on-site as subbase to hardstand area.	TRH, BTEX, Heavy Metals, PAHs

8.3 Validation Sampling Methods and Field Screening Protocols

Field screening was undertaken during the remedial works, as follows:

- A PID was used to assess volatile vapours within the UST prior to its removal.
- The PID was used to assess volatile vapours in soil validation samples collected from the tank pit excavation and from the packing sands stockpiles.

The following sampling methods were employed during the sampling program:

- The sampling density was dependent on the homogeneity of the soil material sampled. All surfaces were inspected visually before sampling and a determination of variability of the media was made.
- Discrete sampling was undertaken by collecting samples from the tank pit excavation from the centre of the excavator bucket and from stockpiles directly from the stockpile by hand.
- Discrete samples were spaced in a 10m grid formation across the base of the tank pit excavation to ensure that an even coverage of the excavation base is achieved.
- Decontamination of sampling equipment was not required due to the nature of the sampling.
- Dedicated disposable gloves were worn for all sample collection.
- All samples were given a unique identifier and marked on a plan.

9. QUALITY ASSURANCE AND QUALITY CONTROL

A QA/QC assessment is presented in **Tables 9.1, 9.2 and 9.3** below. An assessment was made of data completeness, comparability, representativeness, precision and accuracy based on field and laboratory considerations, as outlined in NSW DECC (2006) and NSW EPA (2007) guidelines. These Data Quality Indicators (DQIs) are outlined in **Section 8.2.6**.

Table 9.1: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling Methodology	Ramboll Environ Assessment
Sampling Pattern and Locations	The sampling pattern adopted comprised grid-based sampling of the tank pit excavation walls and base. Validation samples were collected at a rate of 1 sample per 10 lineal meters on the walls and 1 sample per 10m ² on the excavation base. Different strata were targeted. Validation samples were also collected from the stockpile packing sands at a rate of 1 sample per 25m ³ . One sample was collected from the base of the former bowser location.
Sampling Density	The tank pit excavation was 10m long by 4m wide by 4.5m deep in the centre. One validation sample was collected from each wall of the tank pit excavation and one validation sample was collected from the base. A total of 3 validation samples were collected from approximately 70m ³ of stockpiled packing sands on the western side of the excavation and 2 validation samples were collected from 27m ³ of stockpiled packing sands on the eastern side of the excavation.
Sample depths	Validation samples from the walls of the excavation were targeted at a depth equal or below the location of the former UST between 3m and 3.5m below ground level. Strata with in the tank excavation was consistent throughout the depth. Coal washery reject was identified to form the base of the former bowser. One sample was collected from this material. Validation samples from the stockpiled packing sands were collected from below the surface of each stockpile.
Sample Collection Method	Soil samples from the tank pit excavation were collected from the centre of the excavator bucket. Soil samples from the stockpiled packing sands and coal washery reject were collected by hand. Sample jars were filled using a new pair of dedicated disposable gloves for each sample.
Decontamination Procedures	Decontamination was not required as soil samples were collected directly from the centre of the excavator bucket or by hand.
Sample handling and containers	All soil samples were placed into laboratory-supplied, acid-rinsed glass jars. Soil samples were placed on ice following collection and during transportation to the laboratory.
Chain of Custody	Samples were transported to the laboratory under chain of custody conditions. The chain of custody forms were signed by the laboratory on receipt of the samples.
Detailed description of field screening protocols	Field screening for volatiles was completed using a PID. The maximum reading from the PID was 0.2ppm.

Table 9.1: QA/QC – Sampling and Analysis Methodology Assessment	
Sampling Methodology	Ramboll Environ Assessment
Calibration of field equipment	The PID was calibrated by the hire company, Thermo Fisher, prior to delivery to site.
Sampling Logs	The lithology of validation soil samples was documented during sampling.

Table 9.2: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	Ramboll Environ Comments
Field quality control samples	<p>Two intra-laboratory duplicate samples were collected and analysed for 11 primary samples, exceeding the targeted rate of 10%.</p> <p>One inter-laboratory duplicate sample was collected and analysed for 11 primary samples, exceeding the targeted rate of 5%.</p> <p>One trip spike and one trip blank sample were collected for analysis for TRH and BTEX.</p> <p>A rinsate blank sample was not collected as no reusable sampling equipment was used.</p>
Field quality control results	<p>RPD results for soil were within acceptable limits, aside from some RPD results for the inter-laboratory duplicate pair, with all concentrations less than the laboratory detection limits. Duplicate soil results are included in Table LR2.</p> <p>Concentrations of TRH and BTEX in the trip blank were less than the laboratory detection limits. Concentrations of TRH and BTEX in the trip spike were close to the spike concentrations.</p>
NATA registered laboratory and NATA endorsed methods	Envirolab was used as the primary laboratory and ALS was used as the secondary laboratory. Envirolab and ALS laboratory certificates are NATA stamped and both laboratories are accredited for the analyses performed for this assessment.
Analytical methods	A summary of analytical methods were included in the laboratory test certificates.
Holding times	Review of the COCs and laboratory certificates indicate that holding times were met.
Practical Quantitation Limits (PQLs)	PQLs for soil analytes were below the 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.

Assessment of the Data Quality Indicators of completeness, comparability, representativeness, precision and accuracy, which are outlined in Section 8.2.6, is made in Table 9.3.

Table 9.3: QA/QC – Assessment of DQIs	
DQI	Ramboll Environ Comments
Completeness	<p>Completeness is a measure of whether all the data necessary to meet the project objectives was collected.</p> <p>As noted in Table 9.1 above, validation soil samples were collected from the walls and base of the tank pit excavation and from the stockpiled packing sands at the nominated rate. Ramboll Environ considers the investigation to be complete.</p>
Comparability	<p>Comparability is a measure of confidence that the data may be considered to be equivalent for each sampling and analysis event.</p> <p>The field investigations were completed by experienced personnel from Ramboll Environ using standard operating procedures. The fieldwork was completed by Kirsty Greenfield who also completed other investigations at the Hydro Aluminium Smelter.</p> <p>The laboratory analysis was undertaken by NATA registered laboratories using accredited analytical methods.</p> <p>Ramboll Environ considers the soil data collected during this investigation to be comparable.</p>
Representativeness	<p>Representativeness is the confidence that the data is representative of each media present at the site.</p> <p>In the field, representativeness was achieved by completing an adequate number of validation sampling points to validate that the tank pit excavation was not contaminated.</p>
Precision	<p>Precision is a measure of the reproducibility of the data.</p> <p>In the field, Ramboll Environ achieved precision by using standard operating procedures for the collection of soil samples and by collecting duplicate and triplicate samples for analysis. As outlined in Table 9.2, RPD results for duplicate samples were acceptable.</p> <p>At the laboratory, precision is assessed using blind replicate samples and split samples. As outlined in Table 9.2, all results for laboratory soil duplicates were acceptable and no detections were made in blank samples.</p>
Accuracy	<p>Accuracy is a measure of the closeness of a measurement to the true parameter value.</p> <p>In the field, Ramboll Environ achieved accuracy by using standard operating procedures for the collection of soil samples.</p> <p>At the laboratory, precision is assessed using blind replicate samples and split samples. As outlined in Table 9.2, all results for laboratory control samples, matrix spikes and surrogates were acceptable and no detections were made in blank samples.</p>

Overall, the Data Quality Indicators of completeness, comparability, representativeness, precision and accuracy have been met. It is considered that the data is of suitable quality to meet the project objectives.

10. BASIS FOR ASSESSMENT CRITERIA

10.1 Contaminants of Concern

Contaminants of concern associated with a diesel UST are:

- Total Petroleum Hydrocarbons (TRH); and
- Benzene, Toluene, Ethyl benzene, Xylene (BTEX).

The following potential contaminants of concern were also included for analysis:

- Lead to confirm that leaded petrol was not stored in the UST;
- Polycyclic Aromatic Hydrocarbons (PAHs) and heavy metals to assess the suitability of the coal washery reject subbase.

10.2 Soil

The guidelines proposed for the validation of soil contamination at the site were sourced from *National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPC 1999) (NEPM)*.

The variation to the NEPM was approved on 19 June 2013 by the NSW Environment Protection Authority (EPA) under the Contaminated Land Management Act 1997. The NEPM provides revised health-based soil investigation levels (HILs), health based screening levels (HSLs), ecological-based investigation levels (EILs) and ecological based screening levels (ESLs) for various land uses.

The future landuse of the site is for General Industrial (IN1). Under this landuse, it is anticipated the site will be used for light industrial activities such as warehousing, logistics, storage etc. The guidelines for commercial/ industrial landuse are therefore considered to be the most relevant.

The guidelines adopted for the site from the NEPM are as follows:

- HIL D – Health investigation level for commercial/ industrial landuse. 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 3m below the surface for industrial use.
- EIL for commercial/ industrial use – ecological investigations levels applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and generally apply to the top 2m of soil.
- ESLs for commercial/ industrial use – ecological screening levels 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 guidelines for TRH and BTEX in soil are presented in **Table 10.1** and **Table 10.2**.

Table 10.1: Soil Assessment Criteria for Vapour Intrusion - HSL D (mg/kg) - Sand

	0 to <1m	1m to <2m	2m to <4m	4m+
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	230	NL	NL	NL
Naphthalene	NL	NL	NL	NL
Benzene	3	3	3	3
F1	260	370	630	NL

	0 to <1m	1m to <2m	2m to <4m	4m+
F2	NL	NL	NL	NL

The soil saturation concentration (C_{sat}) 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 C_{sat}, 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'.

(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.

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

Table 10.2: ESLs and Management Limits for Total Petroleum Hydrocarbons in Soil

TPH fraction	Soil texture	ESLs (mg/kg dry soil)	
		Commercial and Industrial	Management Limits ¹ (mg/kg dry soil) Commercial and Industrial
F1 C6- C10	Coarse	215*	700
F2 >C10-C16	Coarse	170*	1000
F3 >C16-C34	Coarse	1700	3500
F4 >C34-C40	Coarse	2500	10 000
Benzene	Coarse	75	-
Toluene	Coarse	135	-
Ethylbenzene	Coarse	165	-
Xylenes	Coarse	180	-

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

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

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

The applicable assessment criteria for lead and PAHs in soil are presented in **Table 10.3**.

Table 10.3: HILs and EILs for Lead and PAHs in Soil

	HIL D	EIL
Heavy Metals		
Lead	1500	1800
Polycyclic Aromatic Hydrocarbons		
Carcinogenic PAHs (as BaP TEQ)	40	-
Total PAHs	4000	-
Benzo(a)pyrene	-	72 ²
Naphthalene	-	370

¹ EILs were calculated using the average CEC (7.26meq/100g), soil pH (5.5) and total organic carbon (1.3%) values from eight soil samples collected in the Buffer Zone during previous investigations (ENVIRON (May 2015) Phase 2 Environmental Site Assessment, Smelter Site, Additional Investigations). The NEPM (2013) EIL calculator spreadsheet was used to generate the numbers and a site-specific ambient background concentration (ABC) was not included (rather a default ABC was used as calculated in the EIL calculator).

² Benzo(a)pyrene ESL criteria from Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects) Scientific Criteria Document (revised).

11. RESULTS

11.1 Visual and Olfactory Observations

A Ramboll Environ environmental scientist was on-site during the excavation and removal of the UST. The UST was observed to be in good condition, with no corrosion evident and the UST appeared intact. There was no odour evident during the excavation of the UST. The UST was measured following excavation and found to be 7.5m long by 2.15m in diameter.

The packing sands were observed to be free of staining and odour. The walls and base of the UST excavation, which were in natural clayey sand, were observed to be free of staining and odour.

Excavation of soils beneath the location of the former bowser uncovered black fill material, which was identified as coal washery reject that had been used as the hardstand subbase. This material was not odorous.

Photographs of the UST, the tank pit excavation, stockpiled packing sands and coal washery reject hardstand subbase are included in **Appendix 1**.

11.2 Validation Sampling Results

Five validation soil samples (V1 to V5) were collected from the walls and base of the tank pit excavation. One validation soil sample (V6) was collected from the coal washery reject subbase material. Three validation soil samples (SP1 to SP3) were collected from stockpiled packing sands on the western side of the UST excavation and two validation soil samples (SP4 and SP5) were collected from the stockpiled packing sands on the eastern side of the UST excavation. All validation soil samples were analysed for TRH, BTEX and lead. Validation soil sample, V6, from the coal washery reject subbase was analysed for heavy metals and PAHs.

Concentrations of TRH and BTEX were below the laboratory limits of detection in all soil validation samples from the tank pit excavation and from the stockpiled packing sands. Concentrations of lead were less than 16mg/kg, indicating background soil concentrations.

Low concentrations of TRH, PAHs and heavy metals were detected in the coal washery reject subbase material, below the site criteria.

Based on the validation sampling results, the stockpiled packing sands were reused to backfill the UST excavation.

Validation sampling results are tabulated in **Appendix 2**. A site plan showing validation sampling locations included in **Figure 2**. Laboratory analytical reports are included in **Appendix 3**.

12. VALIDATION

12.1 Waste and UST Disposal

Approximately 1000L of watery sludge was removed from the UST by Worth Recycling.

The UST was disposed of at Sims Metals Recycling, Cormorant Road, Kooragang Island.

Dockets for the liquid waste removal and disposal of the UST are included in **Appendix 4**.

12.2 Soil

It is considered that the tank pit excavation and stockpiled packing sands have been validated as free from petroleum hydrocarbon contamination, based on the following:

- Visual and olfactory observations made during the excavation of the UST indicated low potential for soil contamination i.e. no odour and no staining.
- PID results also indicated a low potential for soil contamination, with a maximum concentration of 0.2ppm.
- Concentrations of TRH and BTEX in soil validation samples are below the laboratory limits of reporting and are below the site criteria.

Concentrations of lead in validation soil samples ranged between 2mg/kg and 16mg/kg, which are indicative of background concentrations.

Minor concentrations of TRH and PAHs were detected in the soil sample collected from the coal washery reject subbase. These concentrations are expected based on the material type and were below the site criteria, indicating the coal washery reject is suitable to remain on site.

12.3 Groundwater

It is considered that there is a low risk of groundwater contamination, based on the following lines of evidence:

- Based on information from Hydro's Environmental Manager, the UST was likely in use in the late 1970s/ early 1980s. The UST was abandoned in the early 1980s and was drained of fuel at this time.
- The UST was observed to be in good condition, with no corrosion and the tank appeared intact. The UST was holding approximately 1000L of sludge, indicated its condition had not deteriorated over time.
- There was no odour or staining of the packing sands or underlying natural soils.
- Concentrations of TRH and BTEX in the soil validation samples from the tank pit excavation and from the stockpiled packing sands were all below the laboratory limit of reporting, indicating there is no evidence of contamination in soil.
- Groundwater was not encountered during the excavation works. The depth to groundwater at the Site is likely to be around 4m below ground level.

Based on the low risk of groundwater contamination, it is considered that groundwater investigations are not required.

13. ONGOING SITE MONITORING

Based on the results of the validation soil sampling, there are no ongoing site monitoring requirements.

14. CONCLUSIONS AND RECOMMENDATIONS

14.1 Summary of Findings

A UST was identified at 12 Horton Road, Loxford during the demolition of buildings at the site. A Remedial Action Work Plan was prepared by Ramboll Environ for the remediation and validation of the UST. Remediation and validation works were completed on 8 September 2016, including the following works:

- Removal of liquid waste from the base of the UST.
- Excavation of the UST from the ground and off-site disposal to a metal recycling facility.
- Excavation of the packing sands around the UST to check for evidence of soil contamination.
- Collection of validation soil samples from the walls and base of the UST excavation.
- Collection of validation soil samples from the packing sands stockpiles.
- Collection of a validation soil sample from coal washery reject subbase identified during the works.
- Backfilling of the UST excavation with the packing sands.

Validation soil samples were analysed for contaminants of concern associated with diesel storage, including TRH, BTEX and lead. The coal washery reject sample was analysed for heavy metals, TRH, BTEX and PAHs. All analytical results were below the site criteria.

Multiple lines of evidence were provided to justify that there is a low risk of groundwater contamination and that groundwater investigations are not required.

14.2 Assumptions used in Reaching Conclusions

Upon identification of the UST, an interview was undertaken with Hydro's Environment Manager who provided information relating to the past uses of the site. Hydro's Environment Manager was unaware of the presence of the UST but did recall the presence of a bowser at the site in the early 1980s. Based on this recollection, it was assumed that the UST was installed by a tenant who leased the property as a truck depot in the late 1970s and early 1980s. It was assumed that the UST was used to store diesel for truck refuelling. It was also assumed that since the bowser had not been located at the site since the early 1980s, that the UST was abandoned at the time that a new tenant took on the lease of the site.

14.3 Extent of Uncertainties

The UST and pipework associated with the UST have been removed from site. Based on visual observations of the condition of the UST, visual and olfactory observations of the packing sands and underlying natural soils and the validation analytical results, there is little uncertainty in the conclusion that soil contamination from leaking or use of the UST has not occurred.

Based on the multiple lines of evidence provided to estimate the risks to groundwater, there is little uncertainty in the conclusion that there is a low risk of groundwater contamination relating to the UST at the site.

14.4 Activities and Physical Changes to the Site

At the time the UST was identified, demolition works were in progress to remove structures at the site including a dwelling and two sheds. A summary of activities undertaken at the site relating to the removal of the UST are outlined in **Section 14.1**. There are no identifiable physical changes at the site relating to the UST removal, aside from evidence of the excavation works over the area that was recently backfilled.

14.5 Statement of Validation

Based on observations made of the UST and the packing sands during the excavation works and the validation analytical results, it is considered that the site is suitable for the proposed commercial/ industrial use.

14.6 Site Limitations and Constraints

The site was assessed for contamination as part of the Buffer Zone investigations completed in 2015, as reported in:

- 'Phase 2 Environmental Site Assessment, Parcel 4', dated April 2015 by ENVIRON.

This report identified bonded ACM fragments on the surface of 12 Horton Road (Lot 16) at three locations and recommendations were made for the ACM fragments to be appropriately managed or disposed of. A Remedial Action Work Plan was prepared to outline the requirements for remediation of asbestos at the Site and other properties within the Buffer Zone, as reported in:

- 'Remedial Action Work Plan, Buffer Zone Asbestos, Kurri Kurri NSW', draft dated April 2016 by Ramboll Environ.

Buildings at the Site were demolished in August 2016 and the UST was identified at this time. It is noted that the shed beneath which the UST was identified did not contain asbestos building materials and ACM fragments were not observed in this portion of the Site. Remediation and validation works associated with the UST are described in this report. Clearance of asbestos identified on the surface of the Site at three locations during the Phase 2 ESA and clearance of asbestos building materials associated with the demolition of the house in the north-east corner of the Site have been reported separately. There are no site limitations or constraints on the use of the Site for IN1 General Industrial use.

14.7 Recommendations

The UST was successfully remediated and validated. No further works are recommended in relation to the UST.

15. REFERENCES

ENVIRON Australia Pty Ltd (ENVIRON 2015) Phase 2 Environmental Site Assessment, Parcel 4.

ENVIRON Australia Pty Ltd (ENVIRON 2013b) Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter, 22 October 2013;

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

NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Amendment Measure (NEPM) 2013;

New South Wales Department of Environment and Conservation (NSW DEC 2006) Guidelines for the NSW Site Auditor Scheme (Second Edition);

New South Wales Department of Environment and Conservation (NSW DEC 2007) Guidelines for the Assessment and Management of Groundwater Contamination;

NSW DECC&W (2010) UPSS Technical Note: Decommissioning, Abandonment and Removal of UPSS;

NSW DECC&W (2010) UPSS Technical Note: Site Validation Reporting;

Ramboll Environ (Ramboll Environ 2016) Remedial Action Work Plan, Buffer Zone Asbestos, Kurri Kurri NSW.

16. LIMITATIONS

Ramboll Environ Australia Pty Ltd prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Pty Ltd and in accordance with our understanding and interpretation of current regulatory standards.

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

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

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

Ramboll Environ did not independently verify all of the written or oral information provided to Ramboll Environ during the course of this investigation. While Ramboll 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 Ramboll Environ was itself complete and accurate.

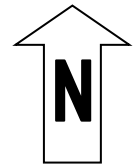
This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

16.1 User Reliance

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



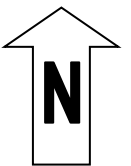
- Approximate Location of land owned by Hydro
 - Approximate Location of Buffer Zone
- Approximate Scale 1cm:220m





- Boundary of 12 Horton Road, Loxford
- Approximate Location of UST Excavation
- ▲ Validation Samples from UST Excavation
- ▲ Validation Samples from Stockpiles

Approximate Scale 1cm: 3m



APPENDIX 1
SITE PHOTOGRAPHS



Photo 1: Photograph of the shed beneath which the UST was identified during demolition of the shed, facing north.



Photo 2: Flag showing location of the UST following demolition of the shed, facing east.

Title:	UST Remediation and Validation	Approved: KG	Project-Nr.: AS130492	Date: 5/10/16
Site:	12 Horton Road, Loxford			
Client:	Hydro Aluminium Kurri Kurri			



Photo 3: Photograph of the dip pipe, indicating the presence of the UST.



Photo 4: Photograph of the uncovered UST, facing north.

Title:	UST Remediation and Validation	Approved: KG	Project-Nr.: AS130492	Date: 5/10/16
Site:	12 Horton Road, Loxford			
Client:	Hydro Aluminium Kurri Kurri			



Photo 5: Photograph of the removal of liquid sludge from the UST, facing south.



Photo 6: Photograph of the UST being removed from the ground, facing south.

Title:	UST Remediation and Validation	Approved: KG	Project-Nr.: AS130492	Date: 5/10/16
Site:	12 Horton Road, Loxford			
Client:	Hydro Aluminium Kurri Kurri			



Photo 7: Photograph of the UST showing size and condition, facing south.



Photo 8: Photograph of the UST showing size and condition, facing north west.

Title:	UST Remediation and Validation	Approved: KG	Project-Nr.: AS130492	Date: 5/10/16
Site:	12 Horton Road, Loxford			
Client:	Hydro Aluminium Kurri Kurri			



Photo 9: Photograph showing the excavation of packing sands, facing west.



Photo 10: Photograph of pipework to chase out and black coal washery reject subbase.

Title:	UST Remediation and Validation	Approved: KG	Project-Nr.: AS130492	Date: 5/10/16
Site:	12 Horton Road, Loxford			
Client:	Hydro Aluminium Kurri Kurri			



Photo 11: Photograph of black coal washery reject subbase stockpile.



Photo 12: Photograph of backfilled and track rolled UST excavation, facing north.

Title:	UST Remediation and Validation	Approved: KG	Project-Nr.: AS130492	Date: 5/10/16
Site:	12 Horton Road, Loxford			
Client:	Hydro Aluminium Kurri Kurri			

APPENDIX 2
VALIDATION ANALYTICAL RESULTS

Client sample ID (1st):	Sample date:	Depth (m):	Laboratory Report Number:	NEPM HIL D Commercial / Industrial	NEPM HSL D Commercial / Industrial				NEPM Commercial / Industrial Management Limits	NEPM Commercial / Industrial Ecological Screening Levels	NEPM Commercial / Industrial Ecological Investigation	8/09/2016	8/09/2016	8/09/2016	8/09/2016	8/09/2016	8/09/2016	8/09/2016	8/09/2016	8/09/2016	8/09/2016		
					Industrial							V1	V2	V3	V4	V5	V6	SP1	SP2	SP3	SP4	SP5	Under Bowser
					0 m to <1 m	1 m to <2 m	2 m to <4 m	4 m+				4.5	3.5	3.5	3	3	0.3	NA	NA	NA	NA	NA	NA
Lead	mg/kg	5	1,500							1800	5	3	4	4	6	3	2	5	16	5	5	13	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions																							
C6 - C10 Fraction	mg/kg	10									<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10		260	370	630				700	215												
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50								1000	170											98	
>C16 - C34 Fraction	mg/kg	100								3500	1700											530	
>C34 - C40 Fraction	mg/kg	100								10,000	3300											<100	
EP080: BTEXN																							
Benzene	mg/kg	0.2		3	3	3	3			75												<0.2	
Toluene	mg/kg	0.5								135												<0.5	
Ethylbenzene	mg/kg	0.5								165												<1	
meta- & para-Xylene	mg/kg	0.5																				<2	
ortho-Xylene	mg/kg	0.5																				<1	
Total Xylenes	mg/kg	0.5		230						180												<1	
Naphthalene	mg/kg	1																				<1	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons																							
Naphthalene	mg/kg	0.5																				<0.1	
Acenaphthylene	mg/kg	0.5																				<0.1	
Acenaphthene	mg/kg	0.5																				<0.1	
Fluorene	mg/kg	0.5																				<0.1	
Phenanthrene	mg/kg	0.5																				0.8	
Anthracene	mg/kg	0.5																				<0.1	
Fluoranthene	mg/kg	0.5																				0.3	
Pyrene	mg/kg	0.5																				0.3	
Benz(a)anthracene	mg/kg	0.5																				0.2	
Chrysene	mg/kg	0.5																				0.2	
Benzo(b+g)fluoranthene	mg/kg	0.5																				<0.2	
Benzo(a)pyrene	mg/kg	0.5								72*												0.09	
Indeno(1,2,3-cd)pyrene	mg/kg	0.5																				<0.1	
Dibenz(a,h)anthracene	mg/kg	0.5																				<0.1	
Benzo(g,h,i)perylene	mg/kg	0.5																				<0.1	
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5	4,000																			1.89	
Benzo(a)pyrene TEQ (zero)	mg/kg	0.5																				<0.5	
Benzo(a)pyrene TEQ (half LOR)	mg/kg	0.5																				<0.5	
Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5	40							40												<0.5	

Bold - Detection
 Shaded results exceeds adopted site criteria, or most sensitive adopted site criteria if multiple criteria exceeded
 LOR = Limit of Reporting
 <value = Less than the laboratory Limit of Reporting (LOR)
 BTEX = benzene, toluene, ethylbenzene, xylene. MAH = monocyclic aromatic hydrocarbons. TPH / TRH = total petroleum / recoverable hydrocarbons. PAH = Polynuclear Aromatic Hydrocarbons.
 NEPM (2013) Management Limits for TPH Fractions F1 to F4 in coarse grained soil for Commercial and Industrial sites
 Blank cell indicates no criterion available
 **Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets
 *ESL from Canadian Council of Ministers of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and Other PAHs (Environmental and Human Health Effects) Scientific Criteria Document (revised)

			Client sample ID:									
			V3	DUP 1	RPD	V6	DUP 2	RPD	V6	DUP 2A	RPD	
			3.5			0.3			0.3			
			153235	153235		153235	153235		153235	ES1620299		
Sample Description	Units	LOR			%			%			%	
Metals												
Lead	mg/kg	5	4	4	0.00	3	2	40.00	3	<5	0.00	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions												
C6 - C10 Fraction	mg/kg	10	<25	<25	0.00	<25	<25	0.00	<25	<10	0.00	
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10	<25	<25	0.00	<25	<25	0.00	<25	<10	0.00	
>C10 - C16 Fraction	mg/kg	50	<50	<50	0.00	<50	<50	0.00	<50	<50	0.00	
>C16 - C34 Fraction	mg/kg	100	<100	<100	0.00	<100	<100	0.00	<100	<100	0.00	
>C10 - C40 Fraction (sum)	mg/kg	50	<100	<100	0.00	<100	<100	0.00	<100	<100	0.00	
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	<50	<50	0.00	<50	<50	0.00	<50	<50	0.00	
EP080: BTEXN												
Benzene	mg/kg	0.2	<0.2	<0.2	0.00	<0.2	<0.2	0.00	<0.2	<0.2	0.00	
Toluene	mg/kg	0.5	<0.5	<0.5	0.00	<0.5	<0.5	0.00	<0.5	<0.5	0.00	
Ethylbenzene	mg/kg	0.5	<1	<1	0.00	<1	<1	0.00	<1	<0.5	0.00	
meta- & para-Xylene	mg/kg	0.5	<2	<2	0.00	<2	<2	0.00	<2	<0.5	0.00	
ortho-Xylene	mg/kg	0.5	<1	<1	0.00	<1	<1	0.00	<1	<0.5	0.00	
Total Xylenes	mg/kg	0.5	<1	<1	0.00	<1	<1	0.00	<1	<0.5	0.00	
Naphthalene	mg/kg	1	<1	<1	0.00	<1	<1	0.00	<1	<1	0.00	

APPENDIX 3
ANALYTICAL REPORTS

CHAIN OF CUSTODY - Client



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ENVIROLAB GROUP

Client: Ramboll Environ
Contact person: Kirsty Greenfield
Project Mgr: Fiona Robinson
Sampler: Kirsty Greenfield
Address: Level 2 Suite 19B, 50 Glebe Road,
 The Junction
Phone: (02) 49625444 **Mob:** 0407 149 176
Fax:
Email: kgreenfield@environcorp.com

Client Project Name / Number / Site etc (ie report title):
 AS130442
PO No.:
Envirolab Quote No.:
Date results required:

Or choose: (standard) same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharge applies
Lab comments:

Envirolab Services
 12 Ashley St, Chatswood, NSW 2067
 Phone: 02 9910 6200 Fax: 02 9910 6201
 E-mail: ahie@envirolabservices.com.au
 Contact: Aileen Hie
Envirolab Services WA t/a MPL
 16-18 Hayden Crt, Myaree WA 6154
 Phone: 08 9317 2505 Fax: 08 9317 4163
 E-mail: lab@mpl.com.au
 Contact: Joshua Lim

Sample information			Tests Required										Comments		
Envirolab Sample ID	Client Sample ID or information	Type of sample	Depth	Date sampled	Soils	Water	Metals	Asbestos	PCBs	PAHs	Hydrocarbons	Other		Other	Other
1	V1	SOIL	4.5	9/11/16	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
2	V2	SOIL	3.5		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
3	V3	SOIL	3.5		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
4	V4	SOIL	3		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
5	V5	SOIL	3		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
6	V6	SOIL	0.3		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
7	SP1														
8	SP2														
9	SP3														
10	SP4														
11	SP5														
12	DUP1		3.5		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
13	DUP2		0.3		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

Received by (company): RIA
Print Name: Kirsty Greenfield
Date & Time: 9/11/16 10:30
Signature: [Signature]

Relinquished by (company): Ramboll Environ
Print Name: KIRSTY GREENFIELD
Date & Time: 12pm 9/18/16
Signature: [Signature]

Lab use only:
 Samples Received: Cool or Ambient (circle one)
 Temperature Received at: (if applicable)
 Transported by: Hand delivered / courier

White - Lab copy / Blue - Client copy / Pink - Retain in Book
 Page No: of

* Dates on soil jars should be 8/9/16, not 9/8/16.

CHAIN OF CUSTODY - Client



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ENVIROLAB GROUP

Client: Ramboll Environ
 Contact person: Kirsty Greenfield
 Project Mgr: Fiona Robinson
 Sampler: Kirsty Greenfield
 Address: Level 2 Suite 19B, 50 Glebe Road,
 The Junction
 Phone: (02) 49625444 Mob: 0407 149 176
 Fax:
 Email: kgreenfield@environcorp.com

Client Project Name / Number / Site etc (ie report title):
 PO No.:
 Envirolab Quote No.:
 Date results required:
 Or choose: Standard / same day / 1 day / 2 day / 3 day
 Note: Inform lab in advance if urgent turnaround is required - surcharge applies
 Lab comments:

Envirolab Services
 12 Ashley St, Chatswood, NSW 2067
 Phone: 02 9910 6200 Fax :02 9910 6201
 E-mail: ahie@envirolabservices.com.au
 Contact: Aileen Hie

Envirolab Services WA t/a MPL
 16-18 Hayden Crt, Myaree WA 6154
 Phone: 08 9317 2505 Fax :08 9317 4163
 E-mail: lab@mpl.com.au
 Contact: Joshua Lim

Sample information				Tests Required						Comments												
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soil	Water	Other	Other	Other													
14	Under Bowser DUP 2A	0.3	7/9/16	SOIL	X															Provide as much information about the sample as you can		
15	TRIP SPIKE	0.3	7/9/16	SOIL	X																	
16	TRIP BLANK	-	7/9/16	WATER	X	X																

Relinquished by (company): Ramboll Environ
 Print Name: KIRSTY GREENFIELD
 Date & Time: 9/8/16 12PM
 Signature: KGreenfield

Received by (company): GUY
 Print Name: GUY
 Date & Time: 10/10/16 10:30
 Signature: Guy

Lab use only:
 Samples Received: Cool or Ambient (circle one)
 Temperature Received at: (if applicable)
 Transported by: Hand delivered / courier



CERTIFICATE OF ANALYSIS

153235

Client:

Ramboll Environ (Newcastle) Australia Pty Ltd

Suite 19B, Level 2

50 Glebe Rd

The Junction

NSW 2291

Attention: Klrsty Greenfield, Fiona Robinson

Sample log in details:

Your Reference:

AS130492

No. of samples:

14 soils 2 waters

Date samples received / completed instructions received

09/09/16

/ 09/09/16

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:

16/09/16

/ 13/09/16

Date of Preliminary Report:

Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing

Tests not covered by NATA are denoted with *.

Results Approved By:

David Springer
General Manager

vTRH(C6-C10)/BTEXN in Soil Our Reference: Your Reference	UNITS ----- -	153235-1 V1	153235-2 V2	153235-3 V3	153235-4 V4	153235-5 V5
Depth	-----	4.5	3.5	3.5	3	3
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016	13/09/2016
TRHC ₆ - C ₉	mg/kg	<25	<25	<25	<25	<25
TRHC ₆ - C ₁₀	mg/kg	<25	<25	<25	<25	<25
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	97	97	94	98	93

vTRH(C6-C10)/BTEXN in Soil Our Reference: Your Reference	UNITS ----- -	153235-6 V6	153235-7 SP1	153235-8 SP2	153235-9 SP3	153235-10 SP4
Depth	-----	0.3	-	-	-	-
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016	13/09/2016
TRHC ₆ - C ₉	mg/kg	<25	<25	<25	<25	<25
TRHC ₆ - C ₁₀	mg/kg	<25	<25	<25	<25	<25
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	96	97	99	94	100

vTRH(C6-C10)/BTEX in Soil	UNITS	153235-11	153235-12	153235-13	153235-14
Our Reference:	-----	SP5	DUP1	DUP2	Under Bowser
Your Reference	-				
Depth	-----	-	3.5	0.3	0.3
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil
Date extracted	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016
TRHC ₆ - C ₉	mg/kg	<25	<25	<25	<25
TRHC ₆ - C ₁₀	mg/kg	<25	<25	<25	<25
vTPHC ₆ - C ₁₀ less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	98	95	97	96

svTRH (C10-C40) in Soil Our Reference: Your Reference	UNITS ----- -	153235-1 V1	153235-2 V2	153235-3 V3	153235-4 V4	153235-5 V5
Depth	-----	4.5	3.5	3.5	3	3
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	12/09/2016	12/09/2016	13/09/2016	13/09/2016	13/09/2016
TRHC ₁₀ - C ₁₄	mg/kg	<50	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	mg/kg	<100	<100	<100	<100	<100
TRHC ₂₉ - C ₃₆	mg/kg	<100	<100	<100	<100	<100
TRH>C ₁₀ -C ₁₆	mg/kg	<50	<50	<50	<50	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH>C ₁₆ -C ₃₄	mg/kg	<100	<100	<100	<100	<100
TRH>C ₃₄ -C ₄₀	mg/kg	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	95	97	94	95	95

svTRH (C10-C40) in Soil Our Reference: Your Reference	UNITS ----- -	153235-6 V6	153235-7 SP1	153235-8 SP2	153235-9 SP3	153235-10 SP4
Depth	-----	0.3	-	-	-	-
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016	13/09/2016
TRHC ₁₀ - C ₁₄	mg/kg	<50	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	mg/kg	<100	<100	<100	<100	<100
TRHC ₂₉ - C ₃₆	mg/kg	<100	<100	<100	<100	<100
TRH>C ₁₀ -C ₁₆	mg/kg	<50	<50	<50	<50	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH>C ₁₆ -C ₃₄	mg/kg	<100	<100	<100	<100	<100
TRH>C ₃₄ -C ₄₀	mg/kg	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	94	94	94	93	97

svTRH (C10-C40) in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ----- - -----	153235-11 SP5 - 9/09/2016 soil	153235-12 DUP1 3.5 9/09/2016 soil	153235-13 DUP2 0.3 9/09/2016 soil	153235-14 Under Bowser 0.3 9/09/2016 soil
Date extracted	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016
TRHC ₁₀ - C ₁₄	mg/kg	<50	<50	<50	58
TRHC ₁₅ - C ₂₈	mg/kg	<100	<100	<100	430
TRHC ₂₉ - C ₃₆	mg/kg	<100	<100	<100	170
TRH>C ₁₀ -C ₁₆	mg/kg	<50	<50	<50	98
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	mg/kg	<50	<50	<50	98
TRH>C ₁₆ -C ₃₄	mg/kg	<100	<100	<100	530
TRH>C ₃₄ -C ₄₀	mg/kg	<100	<100	<100	<100
Surrogate o-Terphenyl	%	94	94	93	131

PAHs in Soil Our Reference: Your Reference	UNITS ----- -	153235-14 Under Bowser
Depth Date Sampled Type of sample	----- ----- -----	0.3 9/09/2016 soil
Date extracted	-	12/09/2016
Date analysed	-	12/09/2016
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	0.8
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	0.3
Pyrene	mg/kg	0.3
Benzo(a)anthracene	mg/kg	0.2
Chrysene	mg/kg	0.2
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	0.09
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Total Positive PAHs	mg/kg	1.9
Surrogate <i>p</i> -Terphenyl-d14	%	93

Acid Extractable metals in soil						
Our Reference:	UNITS	153235-1	153235-2	153235-3	153235-4	153235-5
Your Reference	-----	V1	V2	V3	V4	V5
	-					
Depth	-----	4.5	3.5	3.5	3	3
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Lead	mg/kg	5	3	4	4	6

Acid Extractable metals in soil						
Our Reference:	UNITS	153235-6	153235-7	153235-8	153235-9	153235-10
Your Reference	-----	V6	SP1	SP2	SP3	SP4
	-					
Depth	-----	0.3	-	-	-	-
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Lead	mg/kg	3	2	5	16	5

Acid Extractable metals in soil					
Our Reference:	UNITS	153235-11	153235-12	153235-13	153235-14
Your Reference	-----	SP5	DUP1	DUP2	Under Bowser
	-				
Depth	-----	-	3.5	0.3	0.3
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil
Date prepared	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Arsenic	mg/kg	[NA]	[NA]	[NA]	11
Cadmium	mg/kg	[NA]	[NA]	[NA]	<0.4
Chromium	mg/kg	[NA]	[NA]	[NA]	1
Copper	mg/kg	[NA]	[NA]	[NA]	48
Lead	mg/kg	5	4	2	13
Mercury	mg/kg	[NA]	[NA]	[NA]	<0.1
Nickel	mg/kg	[NA]	[NA]	[NA]	6
Zinc	mg/kg	[NA]	[NA]	[NA]	46

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Moisture						
Our Reference:	UNITS	153235-1	153235-2	153235-3	153235-4	153235-5
Your Reference	-----	V1	V2	V3	V4	V5
	-					
Depth	-----	4.5	3.5	3.5	3	3
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016	13/09/2016
Moisture	%	8.7	4.0	9.3	7.7	7.7

Moisture						
Our Reference:	UNITS	153235-6	153235-7	153235-8	153235-9	153235-10
Your Reference	-----	V6	SP1	SP2	SP3	SP4
	-					
Depth	-----	0.3	-	-	-	-
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016	13/09/2016
Moisture	%	7.5	7.1	8.3	9.5	9.6

Moisture					
Our Reference:	UNITS	153235-11	153235-12	153235-13	153235-14
Your Reference	-----	SP5	DUP1	DUP2	Under Bowser
	-				
Depth	-----	-	3.5	0.3	0.3
Date Sampled		9/09/2016	9/09/2016	9/09/2016	9/09/2016
Type of sample		soil	soil	soil	soil
Date prepared	-	12/09/2016	12/09/2016	12/09/2016	12/09/2016
Date analysed	-	13/09/2016	13/09/2016	13/09/2016	13/09/2016
Moisture	%	5.8	9.0	7.4	9.2

BTEX in Water Our Reference: Your Reference	UNITS ----- -	153235-15 Trip Spike	153235-16 Trip Blank
Depth Date Sampled Type of sample	----- - -	- 9/09/2016 water	- 9/09/2016 water
Date extracted	-	12/09/2016	12/09/2016
Date analysed	-	12/09/2016	12/09/2016
Benzene	µg/L	101%	<1
Toluene	µg/L	99%	<1
Ethylbenzene	µg/L	96%	<1
m+p-xylene	µg/L	100%	<2
o-xylene	µg/L	103%	<1
Surrogate Dibromofluoromethane	%	99	102
Surrogate toluene-d8	%	101	101
Surrogate 4-BFB	%	102	106

MethodID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore " Total +ve PAHs" is simply a sum of the positive individual PAHs.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
vTRH(C6-C10)/BTEXN in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/09/2016	153235-3	12/09/2016 12/09/2016	LCS-2	12/09/2016
Date analysed	-			12/09/2016	153235-3	13/09/2016 13/09/2016	LCS-2	12/09/2016
TRHC ₆ - C ₉	mg/kg	25	Org-016	<25	153235-3	<25 <25	LCS-2	96%
TRHC ₆ - C ₁₀	mg/kg	25	Org-016	<25	153235-3	<25 <25	LCS-2	96%
Benzene	mg/kg	0.2	Org-016	<0.2	153235-3	<0.2 <0.2	LCS-2	97%
Toluene	mg/kg	0.5	Org-016	<0.5	153235-3	<0.5 <0.5	LCS-2	96%
Ethylbenzene	mg/kg	1	Org-016	<1	153235-3	<1 <1	LCS-2	93%
m+p-xylene	mg/kg	2	Org-016	<2	153235-3	<2 <2	LCS-2	96%
o-Xylene	mg/kg	1	Org-016	<1	153235-3	<1 <1	LCS-2	98%
naphthalene	mg/kg	1	Org-014	<1	153235-3	<1 <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	99	153235-3	94 98 RPD: 4	LCS-2	99%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
svTRH(C10-C40) in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/09/2016	153235-3	12/09/2016 12/09/2016	LCS-2	12/09/2016
Date analysed	-			12/09/2016	153235-3	13/09/2016 13/09/2016	LCS-2	12/09/2016
TRHC ₁₀ - C ₁₄	mg/kg	50	Org-003	<50	153235-3	<50 <50	LCS-2	115%
TRHC ₁₅ - C ₂₈	mg/kg	100	Org-003	<100	153235-3	<100 <100	LCS-2	110%
TRHC ₂₈ - C ₃₆	mg/kg	100	Org-003	<100	153235-3	<100 <100	LCS-2	110%
TRH>C ₁₀ -C ₁₆	mg/kg	50	Org-003	<50	153235-3	<50 <50	LCS-2	115%
TRH>C ₁₆ -C ₃₄	mg/kg	100	Org-003	<100	153235-3	<100 <100	LCS-2	110%
TRH>C ₃₄ -C ₄₀	mg/kg	100	Org-003	<100	153235-3	<100 <100	LCS-2	110%
Surrogate o-Terphenyl	%		Org-003	102	153235-3	94 96 RPD: 2	LCS-2	80%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results		
PAHs in Soil						Base II Duplicate II %RPD		
Date extracted	-			12/09/2016	[NT]	[NT]		
Date analysed	-			12/09/2016	[NT]	[NT]		
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]		

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Soil						Base II Duplicate II %RPD		
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]		
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]		
Surrogate p-Terphenyl-d14	%		Org-012	97	[NT]	[NT]		
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Acid Extractable metals in soil						Base II Duplicate II %RPD		
Date prepared	-			12/09/2016	153235-3	12/09/2016 12/09/2016	LCS-2	12/09/2016
Date analysed	-			12/09/2016	153235-3	12/09/2016 12/09/2016	LCS-2	12/09/2016
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	LCS-2	106%
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	LCS-2	93%
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	LCS-2	103%
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	LCS-2	104%
Lead	mg/kg	1	Metals-020	<1	153235-3	4 6 RPD: 40	LCS-2	100%
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	LCS-2	95%
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	LCS-2	97%
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	LCS-2	99%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
BTEX in Water						Base II Duplicate II %RPD		
Date extracted	-			12/09/2016	[NT]	[NT]	LCS-W1	12/09/2016
Date analysed	-			12/09/2016	[NT]	[NT]	LCS-W1	12/09/2016
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	97%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	96%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	93%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	96%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	98%
Surrogate Dibromofluoromethane	%		Org-016	103	[NT]	[NT]	LCS-W1	100%
Surrogate toluene-d8	%		Org-016	102	[NT]	[NT]	LCS-W1	102%
Surrogate 4-BFB	%		Org-016	105	[NT]	[NT]	LCS-W1	98%
QUALITYCONTROL	UNITS	Dup. Sm#		Duplicate		Spike Sm#	Spike % Recovery	
vTRH(C6-C10)/BTEXN in Soil				Base + Duplicate + %RPD				
Date extracted	-	153235-13		12/09/2016 12/09/2016		153235-4	12/09/2016	
Date analysed	-	153235-13		13/09/2016 13/09/2016		153235-4	13/09/2016	
TRHC6 - C9	mg/kg	153235-13		<25 <25		153235-4	92%	
TRHC6 - C10	mg/kg	153235-13		<25 <25		153235-4	92%	
Benzene	mg/kg	153235-13		<0.2 <0.2		153235-4	94%	
Toluene	mg/kg	153235-13		<0.5 <0.5		153235-4	90%	

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QUALITYCONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Ethylbenzene	mg/kg	153235-13	<1 <1	153235-4	91%
m+p-xylene	mg/kg	153235-13	<2 <2	153235-4	93%
o-Xylene	mg/kg	153235-13	<1 <1	153235-4	90%
naphthalene	mg/kg	153235-13	<1 <1	[NR]	[NR]
Surrogate aaa- Trifluorotoluene	%	153235-13	97 96 RPD: 1	153235-4	94%
QUALITYCONTROL svTRH (C10-C40) in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	153235-13	12/09/2016 12/09/2016	153235-4	12/09/2016
Date analysed	-	153235-13	13/09/2016 13/09/2016	153235-4	13/09/2016
TRHC ₁₀ - C ₁₄	mg/kg	153235-13	<50 <50	153235-4	99%
TRHC ₁₅ - C ₂₈	mg/kg	153235-13	<100 <100	153235-4	93%
TRHC ₂₉ - C ₃₆	mg/kg	153235-13	<100 <100	153235-4	86%
TRH>C ₁₀ -C ₁₆	mg/kg	153235-13	<50 <50	153235-4	99%
TRH>C ₁₆ -C ₃₄	mg/kg	153235-13	<100 <100	153235-4	93%
TRH>C ₃₄ -C ₄₀	mg/kg	153235-13	<100 <100	153235-4	86%
Surrogate o-Terphenyl	%	153235-13	93 94 RPD: 1	153235-4	95%
QUALITYCONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD		
Date extracted	-	[NT]	[NT]		
Date analysed	-	[NT]	[NT]		
Naphthalene	mg/kg	[NT]	[NT]		
Acenaphthylene	mg/kg	[NT]	[NT]		
Acenaphthene	mg/kg	[NT]	[NT]		
Fluorene	mg/kg	[NT]	[NT]		
Phenanthrene	mg/kg	[NT]	[NT]		
Anthracene	mg/kg	[NT]	[NT]		
Fluoranthene	mg/kg	[NT]	[NT]		
Pyrene	mg/kg	[NT]	[NT]		
Benzo(a)anthracene	mg/kg	[NT]	[NT]		
Chrysene	mg/kg	[NT]	[NT]		
Benzo(b,j+k)fluoranthene	mg/kg	[NT]	[NT]		
Benzo(a)pyrene	mg/kg	[NT]	[NT]		
Indeno(1,2,3-c,d)pyrene	mg/kg	[NT]	[NT]		
Dibenzo(a,h)anthracene	mg/kg	[NT]	[NT]		
Benzo(g,h,i)perylene	mg/kg	[NT]	[NT]		
Surrogate p-Terphenyl-d14	%	[NT]	[NT]		

Client Reference: AS130492

QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	153235-13	12/09/2016 12/09/2016	153235-4	12/09/2016
Date analysed	-	153235-13	12/09/2016 12/09/2016	153235-4	12/09/2016
Arsenic	mg/kg	[NT]	[NT]	[NR]	[NR]
Cadmium	mg/kg	[NT]	[NT]	[NR]	[NR]
Chromium	mg/kg	[NT]	[NT]	[NR]	[NR]
Copper	mg/kg	[NT]	[NT]	[NR]	[NR]
Lead	mg/kg	153235-13	2 2 RPD: 0	153235-4	95%
Mercury	mg/kg	[NT]	[NT]	[NR]	[NR]
Nickel	mg/kg	[NT]	[NT]	[NR]	[NR]
Zinc	mg/kg	[NT]	[NT]	[NR]	[NR]
QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	LCS-1	12/09/2016
Date analysed	-	[NT]	[NT]	LCS-1	12/09/2016
Naphthalene	mg/kg	[NT]	[NT]	LCS-1	85%
Acenaphthylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	[NT]	[NT]	LCS-1	90%
Phenanthrene	mg/kg	[NT]	[NT]	LCS-1	93%
Anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	[NT]	[NT]	LCS-1	85%
Pyrene	mg/kg	[NT]	[NT]	LCS-1	87%
Benzo(a)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(b,j+k)fluoranthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	[NT]	[NT]	LCS-1	84%
Indeno(1,2,3-c,d)pyrene	mg/kg	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%	[NT]	[NT]	LCS-1	134%

Client Reference: AS130492

QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	LCS-1	12/09/2016
Date analysed	-	[NT]	[NT]	LCS-1	12/09/2016
Arsenic	mg/kg	[NT]	[NT]	LCS-1	108%
Cadmium	mg/kg	[NT]	[NT]	LCS-1	96%
Chromium	mg/kg	[NT]	[NT]	LCS-1	104%
Copper	mg/kg	[NT]	[NT]	LCS-1	106%
Lead	mg/kg	[NT]	[NT]	LCS-1	101%
Mercury	mg/kg	[NT]	[NT]	LCS-1	97%
Nickel	mg/kg	[NT]	[NT]	LCS-1	99%
Zinc	mg/kg	[NT]	[NT]	LCS-1	101%

Report Comments:

Asbestos ID was analysed by Approved Identifier: Not applicable for this job
Asbestos ID was authorised by Approved Signatory: Not applicable for this job

INS: Insufficient sample for this test
NR: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

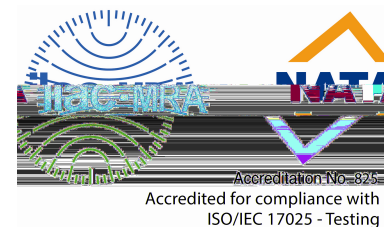
Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

CERTIFICATE OF ANALYSIS

Work Order : **ES1620299**
Client : **RAMBOLL ENVIRON**
Contact : FIONA ROBINSON(ramboll)
Address : Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435
 THE JUNCTION NSW 2291
Telephone : +61 02 4962 5444
Project : ----
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : ----
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 4
Laboratory : Environmental Division Sydney
Contact :
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 12-Sep-2016 16:30
Date Analysis Commenced : 14-Sep-2016
Issue Date : 16-Sep-2016 13:12



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Pabi Subba	Senior Organic Chemist	Sydney Organics, Smithfield, NSW
RICHARD TEA	Lab technician	Sydney Inorganics, Smithfield, NSW



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
∅ = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID			DUP2A	----	----	----	----
		Client sampling date / time			0.3	----	----	----	----
		[09-Sep-2016]			ES1620299-001	-----	-----	-----	-----
Compound	CAS Number	LOR	Unit	Result	----	----	----	----	
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%	7.8	----	----	----	----	----
EG005T: Total Metals by ICP-AES									
Lead	7439-92-1	5	mg/kg	<5	----	----	----	----	----
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 Fractions									
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	----	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	----	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%	94.4	----	----	----	----	----
Toluene-D8	2037-26-5	0.2	%	97.6	----	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%	82.5	----	----	----	----	----

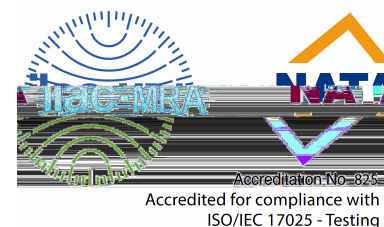


Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

QUALITY CONTROL REPORT

Work Order	: ES1620299	Page	: 1 of 5
Client	: RAMBOLL ENVIRON	Laboratory	: Environmental Division Sydney
Contact	: FIONA ROBINSON(ramboll)	Contact	:
Address	: Eastpoint Complex Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 4962 5444	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 12-Sep-2016
Order number	: ----	Date Analysis Commenced	: 14-Sep-2016
C-O-C number	: ----	Issue Date	: 16-Sep-2016
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Pabi Subba	Senior Organic Chemist	Sydney Organics, Smithfield, NSW
RICHARD TEA	Lab technician	Sydney Inorganics, Smithfield, NSW



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 583816)									
ES1620284-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	33.6	33.4	0.679	0% - 20%
ES1620291-011	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	3.8	3.7	2.80	No Limit
EG005T: Total Metals by ICP-AES (QC Lot: 583921)									
ES1620298-022	Anonymous	EG005T: Lead	7439-92-1	5	mg/kg	10	10	0.00	No Limit
ES1620477-004	Anonymous	EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 581171)									
ES1620204-005	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
ES1620291-002	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 581972)									
ES1620291-006	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
ES1620272-003	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 581171)									
ES1620204-005	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
ES1620291-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 581972)									
ES1620291-006	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
ES1620272-003	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit

Page : 3 of 5
 Work Order : ES1620299
 Client : RAMBOLL ENVIRON
 Project : ----



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 Fractions (QC Lot: 581972) - continued									
ES1620272-003	Anonymous	EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080: BTEXN (QC Lot: 581171)									
ES1620204-005	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
ES1620291-002	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
EG005T: Total Metals by ICP-AES (QCLot: 583921)								
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	98.2	80	114
EP080/071: Total Petroleum Hydrocarbons (QCLot: 581171)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	77.1	68	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 581972)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	105	75	129
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	100	77	131
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	108	71	129
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 581171)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	76.4	68	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 581972)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	250 mg/kg	98.8	77	125
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	115	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	150 mg/kg	90.6	63	131
EP080: BTEXN (QCLot: 581171)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	101	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	109	67	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	106	65	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	82.5	66	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	105	68	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	86.3	63	119

Matrix Spike (MS) Report

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

Sub-Matrix: SOIL

				Matrix Spike (MS) Report				
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%) Low High		
EG005T: Total Metals by ICP-AES (QCLot: 583921)								
ES1620298-022	Anonymous	EG005T: Lead	7439-92-1	250 mg/kg	96.0	70	130	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 581171)								
ES1620204-005	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	74.0	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	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 581972)								
ES1620272-003	Anonymous	EP071: C10 - C14 Fraction	----	523 mg/kg	82.4	73	137	
		EP071: C15 - C28 Fraction	----	2319 mg/kg	89.8	53	131	
		EP071: C29 - C36 Fraction	----	1714 mg/kg	113	52	132	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 581171)								
ES1620204-005	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	72.2	70	130	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 581972)								
ES1620272-003	Anonymous	EP071: >C10 - C16 Fraction	----	860 mg/kg	93.1	73	137	
		EP071: >C16 - C34 Fraction	----	3223 mg/kg	114	53	131	
		EP071: >C34 - C40 Fraction	----	1058 mg/kg	119	52	132	
EP080: BTEXN (QCLot: 581171)								
ES1620204-005	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	76.3	70	130	
		EP080: Toluene	108-88-3	2.5 mg/kg	78.5	70	130	
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	76.9	70	130	
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	77.8	70	130	
			106-42-3					
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	77.1	70	130	
	91-20-3	2.5 mg/kg	77.3	70	130			

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES1620299	Page	: 1 of 4
Client	: RAMBOLL ENVIRON	Laboratory	: Environmental Division Sydney
Contact	: FIONA ROBINSON(ramboll)	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 12-Sep-2016
Site	: ----	Issue Date	: 16-Sep-2016
Sampler	: ----	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

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

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103) DUP2A - 0.3	09-Sep-2016	----	----	----	14-Sep-2016	23-Sep-2016	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) DUP2A - 0.3	09-Sep-2016	14-Sep-2016	08-Mar-2017	✓	15-Sep-2016	08-Mar-2017	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080) DUP2A - 0.3	09-Sep-2016	15-Sep-2016	23-Sep-2016	✓	15-Sep-2016	23-Sep-2016	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080) DUP2A - 0.3	09-Sep-2016	15-Sep-2016	23-Sep-2016	✓	15-Sep-2016	23-Sep-2016	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) DUP2A - 0.3	09-Sep-2016	15-Sep-2016	23-Sep-2016	✓	15-Sep-2016	23-Sep-2016	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: * = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	In house: 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).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015A Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40.
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to 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.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	In house: Referenced to 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	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

**APPENDIX 4
DOCKETS**

WASTE DATA FORM

NEW SOUTH WALES

BEFORE COMPLETING AND SIGNING THIS FORM,
READ THE BACK OF THIS FORM FOR IMPORTANT INFORMATION ON HOW TO FILL IN THIS FORM
AND FOR THE INFORMATION ABOUT OBLIGATIONS AND OFFENCES

77171

Dangerous Goods

Complete this part if waste is a dangerous good

Proper Shipping Name
Dangerous Goods Class Subsidiary Risk/s (if any) UN Number Packing Group No.
Type of Packaging Number of Packages Aggregate Nett Quantity

Load Identification

Consignment Authorisation Number 222016 9999 4602 Load Number
This consignment authorisation is valid From 1/7/16 To 30/6/17 (DD/MM/YY)

Waste Consignor (Activity)

Licensed Non-Licensed License No.

Company Name Spero Demolition Address of waste source
Company Address (if not the same as
..... company address)

Contact Phone
Name of Consignor (print) A Sbrna (On behalf Spero Demo.) Signature of Consignor [Signature] Date

Waste Description

List Contaminants

Waste Origin Code (ANZSIC) Waste Code 5120 Amount of Waste 1 tonnes litres

Physical nature of waste (Solid, Liquid, Sludge etc.) LIQUID

Waste Type (Hazardous, Industrial, Group A) GROUP A

Proposed treatment at destination (Landfill, Incineration, Immobilisation, Storage, Treatment etc.) REPROCESSING

Dates of Waste Movements

Date of dispatch 8.9.16 Expected date of delivery to destination 8.9.16

Transporter

Licensed Non-Licensed License No. 6351

Company Name WORTH RECYCLING P/L
Company Address 1ST FLOOR 458 ROCKY POINT RD SANS SOUCI RTA Registration No. of Vehicle BWSK GF
Type of Transport (Road, Rail, Road Rail) ROAD

Contact Phone 8558 5100
*Name of Driver (print) S. Davenport *Signature of Driver [Signature] *Date 8.9.16

Waste Consignee (Destination)

Company Name WORTH RECYCLING P/L License No. 4602

Company Address *Quantity Received

..... *Treatment given to waste at destination REPROCESSING

Contact Phone 8558 5100 *Date Received

*Name of Representative (print) *Signature of Representative

Collection Details

Litres/Tonnes 1 Arrive Site 7:15 Leave Site 8:15 Travel

Comment PUMP OUT UNDERGROUND TANK

Order No Con No

EMERGENCY CONTACT NUMBER (24 HOURS)

0419 619 931



CUSTOMER DETAILS		ON-SITE	
Request Date:	<i>Spero Demolition</i>	Start Time:	<i>0715</i>
Customer:	<i>9.8.10</i>	Finish Time:	<i>0815</i>
Address:	<i>12 Hoxton Rd Kororo Kororo</i>	Customer P/O:	
Ordered By:		Customer Signature:	
Contact Ph:			
Truck Rego:	<i>BW 5A GF</i>		
Work Order:	<i>P1525929</i>		

SERVICE TYPE					
Tender <input type="checkbox"/>	Quoted <input type="checkbox"/>	Hrly Hire <input type="checkbox"/>	Waste Type:	Liquid QTY:	Sludge QTY:
			<i>3120</i>	<i>1+</i>	

PLANNING		
<input type="checkbox"/> Spout Vac	<input type="checkbox"/> Waste Doc No	<input type="checkbox"/> Hire Equipment
<input type="checkbox"/> Hot Wash	<input type="checkbox"/> TC No	PO Number:
<input type="checkbox"/> HPW 7500 psi		On Hired: Date:
<input type="checkbox"/> Vac Bins		Off Hired: Date:
<input type="checkbox"/> PPE		Shift Used: QTY:
<input type="checkbox"/> Other _____		

<input type="checkbox"/> Sub Contract Hire	Start:	Finish:
Comment: <i>Pump out fuel tank.</i>		

RESOURCES - LABOUR/EQUIPMENT DETAILS											
CHARGED AS PER BELOW DEPOT TO DEPOT											
Employee Surname	Depart Depot	Arrive Site	Depart Site	Arrive Disposal	Depart Disposal	Depot Return	HOURS			OFFICE USE ONLY	
							Ordinary	Penalty	Travel	Rate	Value
<i>S J...</i>	<i>0700</i>	<i>0715</i>	<i>0815</i>			<i>0830</i>					
										Sub Total (A)	



Ticket # TYL003

PURCHASE TICKET

SIMSMETAL LIMITED
NEWCASTLE DIVISION
KOORAGANG ISLAND
NSW, 2304
ABN 37 008 634 526

Ticket # TYL003
Vehicle ID: CJ95AE

Date: 09/09/16
Ship Date: 09/09/16

Vehicle # CJ95AE

Purchased From: MES001 ABN # 69159577894
SPERO (EFT ACC - MES DEMO)
5/11 KINTA DRIVE
BERESFIELD, NSW 2322

Item	Shpmt	Material	Kilograms			
			Gross	Tare	Net	Adj Pd Wt
1.	TYL003	O/SIZE SHEAR DEL NEWC H-OS1N	24780a	22080a	2700	0 2700
Totals					2700	0 2700

Gross Wght Date/Time 09/09/16 07:11
Tare Wght Date/Time 09/09/16 07:28
KILOGRAMS 2700

Ticket Comment: 2582- KURRI KURRI

Weighmaster Signature
(ALANAH HOOKER)

Principal/Agent Signature _____

(All weights are reported in Kilograms)
(a=W/Bge 1 b=W/Bge 2 c=W/Bge 3 d=W/Bge 4 m=Manual Wgt entry)
("a" to "d" above indicates automatic weight capture)
(All Adj (Adjustments) weights are manually entered)

For Purchase Terms & Conditions-please visit
<http://www.scrapmetal.com.au/terms>

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