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APPENDIX G

Site Contamination Investigation

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DESIGN . PLAN . MANAGE

Site Contamination Investigation

Client: Narromine Shire Council

Site Address: 397 Craigie Lea Lane, Narromine, NSW 2821

16 June 2023

Our Reference: 40038-ER01_A

DISCLAIMER

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Project Name:	Preliminary Site Contamination Assessment – 397 Craigie Lea Lane, Narromine, NSW 2821
Client:	Narromine Shire Council
Project Number:	40038
Report Reference:	40038 ER01_A
Date:	16/06/2023

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	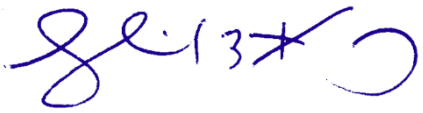
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Executive Summary

Barnson Pty Ltd was engaged by Narromine Shire Council (Rep. Phil Johnston) to undertake a preliminary contaminated site investigation over Part of 397 Craigie Lea Lane, Narromine, NSW 2821, hereafter referred to as the Subject Site.

The Preliminary Site Investigation (PSI) is in support of the potential future industrial development of the investigation area. The primary future land use proposed for the property is to be of a commercial/industrial nature and the focus of the preliminary site contamination assessment is to determine the suitability of the site for use as industrial land.

The investigation was based on a desktop review of information available for the property, as well as the findings of a site inspection and confirmatory sampling and analysis of surface soils collected at the site. A review of the available historical information indicated that agriculture (pastoral) pursuits were carried out on the site for many years.

Activities associated with the historical and current use of the Subject Site were identified as having a potential to contaminate surface soil at the site. The following potential sources of contamination were identified:

- Historical and current livestock farming and grazing activities;
- Historical and current feed-crop cultivation;
- Use, maintenance and storage of motorised vehicles and equipment, and
- Localised waste disposal

A site inspection, supplemented with confirmatory sampling and analysis, was undertaken to determine the presence and significance of potential contamination associated with the identified sources. This investigation did not find any evidence of contamination and concluded that the Investigation Area is suitable for the proposed development and use.

Contents

List of Figures

List of Tables

Appendices

1. INTRODUCTION

1.1. Background and Objectives

Barnson was engaged by Narromine Shire Council to undertake investigations in support of a feasibility study for future industrial related development of a site located at 397 Craigie Lea Lane, south-west of Narromine, NSW (the Subject Site).

The Subject Site is located approximately 7kms south of Narromine. Figure 1.1 presents a map indicating the location of the Subject Site. The site identified for the future development is an area of approximately 95ha located in the north-eastern half of Lot 21 DP 592824, hereafter referred to as the Investigation Area.

1.2. Objectives

The objectives of the Investigation are:

- Identify contamination that may affect the site's suitability for development, and
- Assess the need for possible further investigations, remediation or management of any contamination identified.

1.3. Scope of Work

To meet the stated objectives, Barnson completed the following scope of work:

- Site identification including a review of site history, site condition, surrounding environment, geology and, where information was available, hydrogeology.
- Desktop review of site history and assessment of potential sources of contamination.
- Development of a Conceptual Site Model (CSM) with information gathered from the data review and site inspection.
- Site inspection to assess site conditions.
- Collection of confirmatory soil samples and analysis to determine nature of possible contamination.
- Provide conclusions as to the suitability of the site for the intended future land use.
- Preparation of a report.

1.4. Purpose of this report

The purpose of this report is to document, with cognisance of the Guidelines for Consultants Reporting on Contaminated sites (NSW EPA, 2020), works undertaken, in accordance with the scope of works as described in Section 1.3, results of the desktop review and site inspection, and recommendations for further actions required to determine fitness of the site for the intended use.

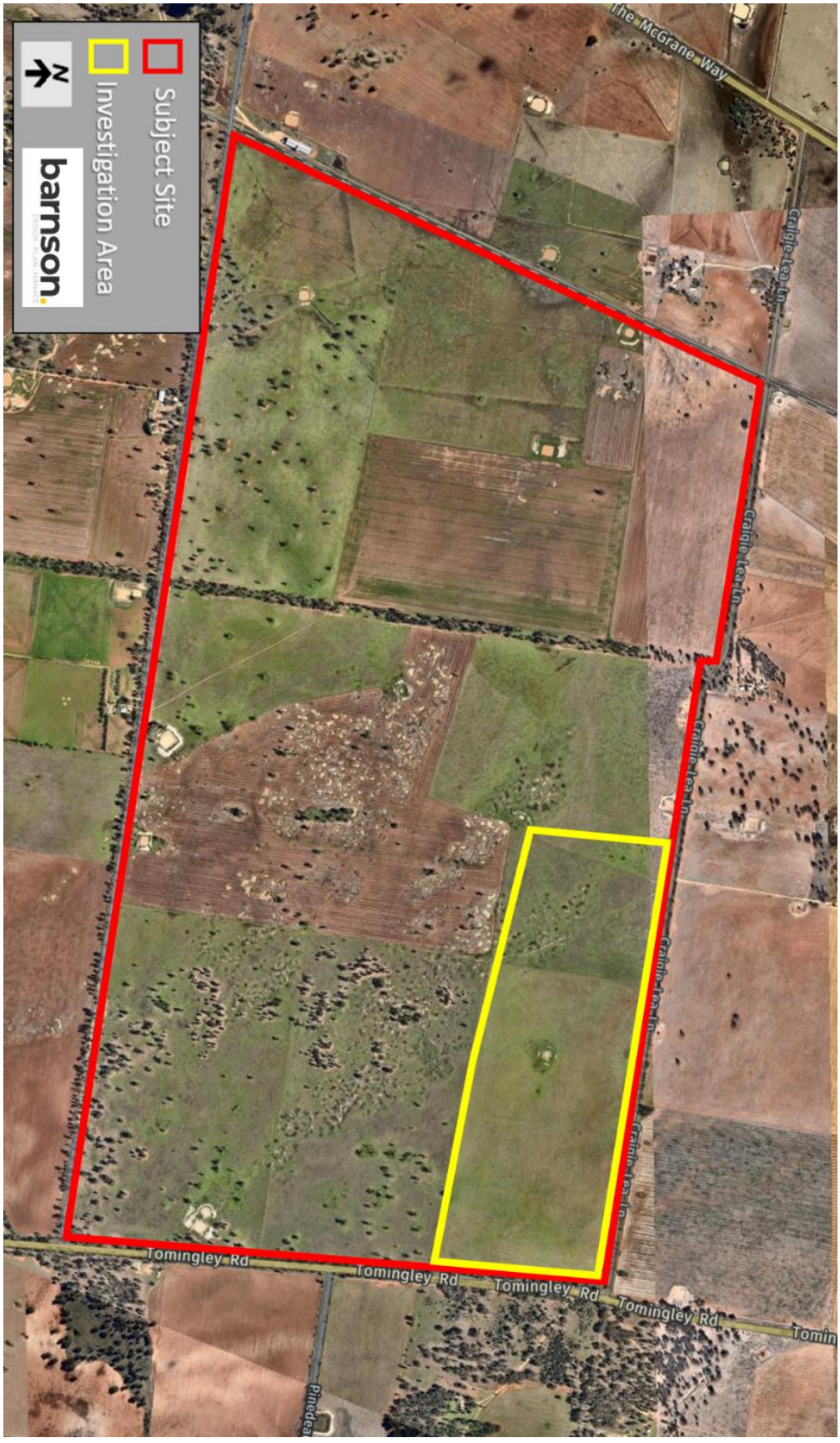

Figure 1.1: Location of the Subject Site and Investigation Area

1.5. Assumptions and Limitations

The following assumptions have been made in preparing this report:

- The future use of the site will be for commercial/industrial purposes. This assumption forms the basis for the conceptual site model (Section 4).
- All information pertaining to the contamination status of the site has been obtained through public record searches, a preliminary site inspection and analysis of confirmatory samples collected at the site. All documents and information in relation to the site, which were obtained from public records, are accepted to be correct and has not been independently verified or checked.

It should be recognised that even the most comprehensive site assessments may fail to detect all contamination on a site. This is because contaminants may be present in areas that were not previously surveyed or sampled or may migrate to areas that showed no signs of contamination when sampled. Investigative works undertaken at the Subject Site by Barnson identified actual conditions only at those locations in which sampling and analysis were performed. Opinions regarding the conditions of the site have been expressed based on historical information and analytical data obtained and interpreted from previous assessments of the site. Barnson does not take responsibility for any consequences as a result of variations in site conditions.

2. SITE DESCRIPTION

2.1. Site Identification

Table 2.1 presents a summary of the available information pertaining to the identification of the Subject Site.

Table 2.1: Summary of Subject Site

Information	Details
Site address	397 Craigie Lea Lane, Narromine, NSW 2821
Lot/Section and Deposited Plan No.	Lot 1 DP 1198931 Part Lot 16 DP 755131 Part Lot 17 DP 755131 Lot 232 DP 755131 Lot 233 DP 755131
Zoning	RU1 – Primary Production
County	Narromine
Parish	Wentworth
Local Government Area	Narromine Shire Council
Subject Site Area	Approx. 830ha
Investigation Area	Approx. 95ha

The entirety of the Subject Site is zoned RU1 – Primary Production and has an area of approximately 830ha. The site is surrounded by similar land zoning with Large Lot Residential (R5) approximately 1.5kms to the north-east.

2.2. Investigation Area

The Investigation Area is bounded to the north by Cragie Lea Lane and Tomingley Road to the east. To the south and west the Investigation Area adjoins the remainder of Lots 232 and 233 of DP 755131.

The Subject Site has historically been used for agricultural (pastoral) purposes and the Investigation Area is currently unoccupied and covered in vegetation (mainly tall pasture grass, see Figure 2.1). The Subject Site is sectioned into several paddocks with steel wire fencing and gates and include several earthen farm dams constructed to collect rain for stock water supply purposes (Figure 2.2).

Figure 2.1: Vegetation covering Investigation Area.

Figure 2.2: View of dam in centre of the Investigation Area.

A portion of the Investigation Area is covered in a series of small mounds and depressions known as gilgai. The depressions seasonally fill with water and retains this water as a result of underlaying expanding clay soils. The area of the Investigation Area where the gilgai is most well observed is outlined in Figure 2.3.

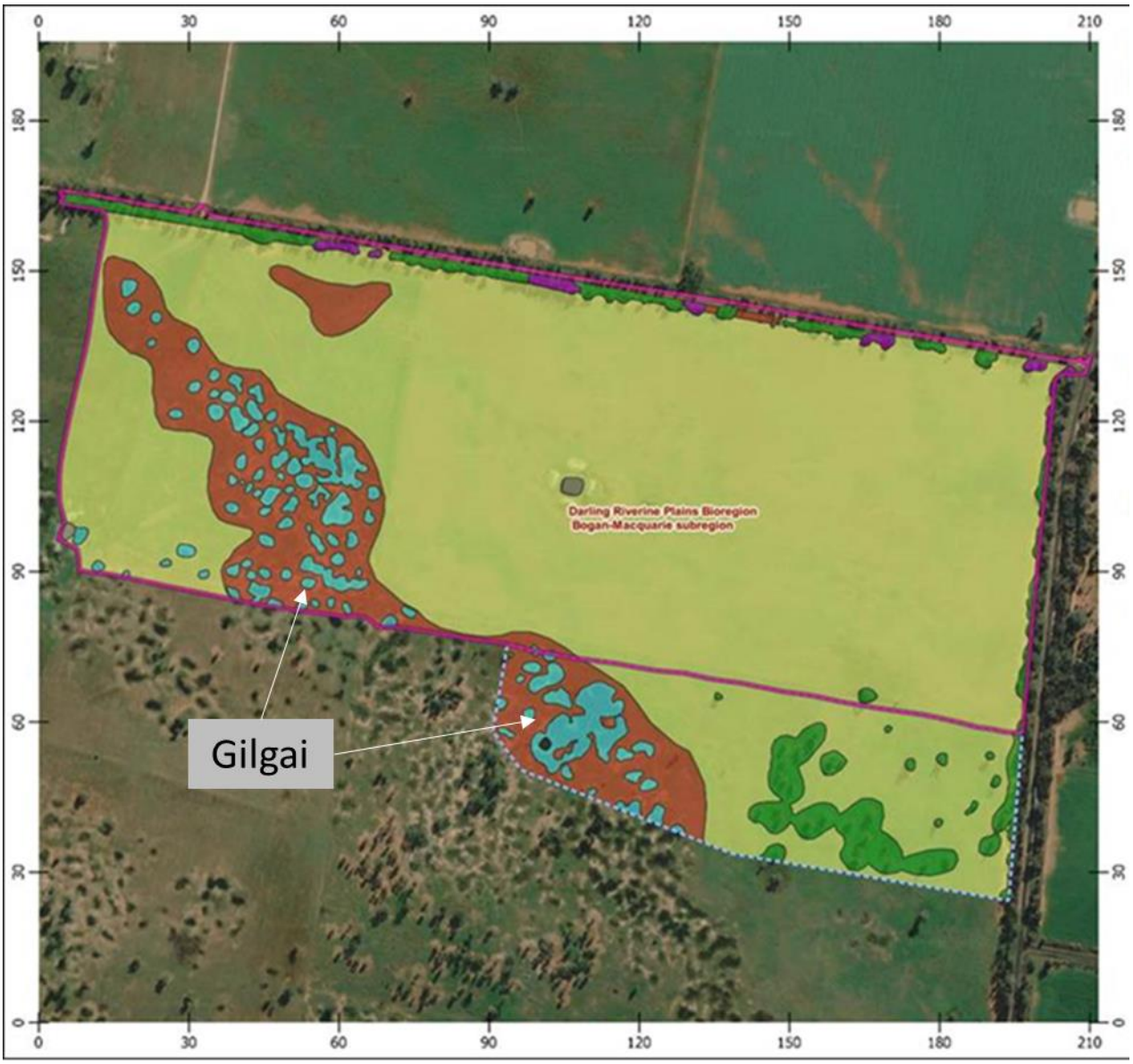

Figure 2.3: Aerial view of Investigation Area indicating location of gilgai.

The Investigation Area is proposed to be utilised for future industrial land uses. At this stage, the Preliminary Site Investigation is to be a part of a due diligence study to determine the potential opportunities and constraints of the Investigation Area for the proposed use/s.

2.3. Historical Record of Site Contamination

Datasets maintained by the Office of Environment and Heritage (OEH) including notices under CLM Act, POEO Environment Protection License Register, and environmental incidents were reviewed.

- List of NSW contaminated sites notified to EPA – The sites appearing on the OEH "List of NSW contaminated sites notified to the EPA" indicate that the notifiers consider that the sites are contaminated and warrant reporting to EPA. However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA needs to review information before it can make a determination as to whether the site warrants regulation. A search of the listing returned no record for the subject site.
- Contaminated Land Record of Notices – A site will be on the Contaminated Land Record of Notices only if the EPA has issued a regulatory notice in relation to the site under the *Contaminated Land Management Act 1997*. A search of the register in May 2023 returned no record for the subject site.

There is further no record of the Subject Site in any of the following databases:

- Former Gasworks Database
- EPA PFAS Investigation Program
- Defence PFAS Investigation & Management Program
- Air Services Australia National PFAS Management Program
- Defence 3 Year Regional Contamination Investigation Program.

2.4. Previous Site Investigations

Barnson previously conducted an assessment of potential contamination at the Subject Site. The preliminary site investigation report (Barnson, 2021) identified the following as potential sources of contamination:

- Historical livestock farming activities.
- Historical cropping activities
- Storage of demolition waste
- Vehicles and equipment

The report (Barnson, 2021) concluded that the site investigation conducted to determine the presence and significance of potential contamination associated with the identified sources, revealed that none of the potential sources identified are likely to have contributed significant quantities of contamination to the surface soils of the Subject Site..

3. SITE SETTING

3.1. Geology

Geologically, the main units underlaying the area south of Narromine include limestone quartzose greywacke, siltstone, chert, slate, quartzite, sandstone, phyllite, mica, paragneiss, shale, and schist. The area is shown with volcanic intrusions of the Cotton Formation, which are described as basalt intrusions separated by layers of clay and slate.

A review of the Narromine 1:250,000 Geology map (refer to Figure 3.1) shows the geology of the area where the Subject Site is situated as alluvium.

Figure 3.1: Narromine 1:25000 geology map showing the location of the Subject Site

Source: Google Earth, accessed 22/05/2023

Surface geology of the Subject Site is described as recent alluvium deposits derived from the underlaying geology, consisting mainly of red silt with pebbles and quartz grit.

The geological units underlaying the Subject Site area has low asbestos potential.

3.2. Soils

The subject site is mapped within three hydrogeological landscapes namely the 'Trangie, Terowie and Wyangal'. In these landscapes, soils are described as sandy silt (Eutrophic Red Sodosol and Solodic Soil) underlain with Endocalcareous Epipedal Brown Vertosol and Grey Clay, all of alluvial origin.

The soils are described as of moderate to low chemical fertility with known use for improved pastures and some dryland animal feed cropping. In general, top-soils are considered slightly erodible but sub-soil erodibility is low.

Surface soils are not saline but are susceptible to structure degradation leading to decreased permeability, water holding and drainage. Soils are not indicated as acid sulphate soils.

The Atlas of Australian Acid Sulfate Soil has the subject site in an area of 'very low' probability of occurrence. According to the National Assessment dataset for dryland salinity, the subject site does not fall in an area with current risk of soil salinity.

3.3. Topography and Drainage

Figure 3.2 presents topographical information overlain on a map of the Subject Site. The presented data shows that the site slopes gently from an elevated area near the south-eastern corner toward the west and north-west at less than 1°

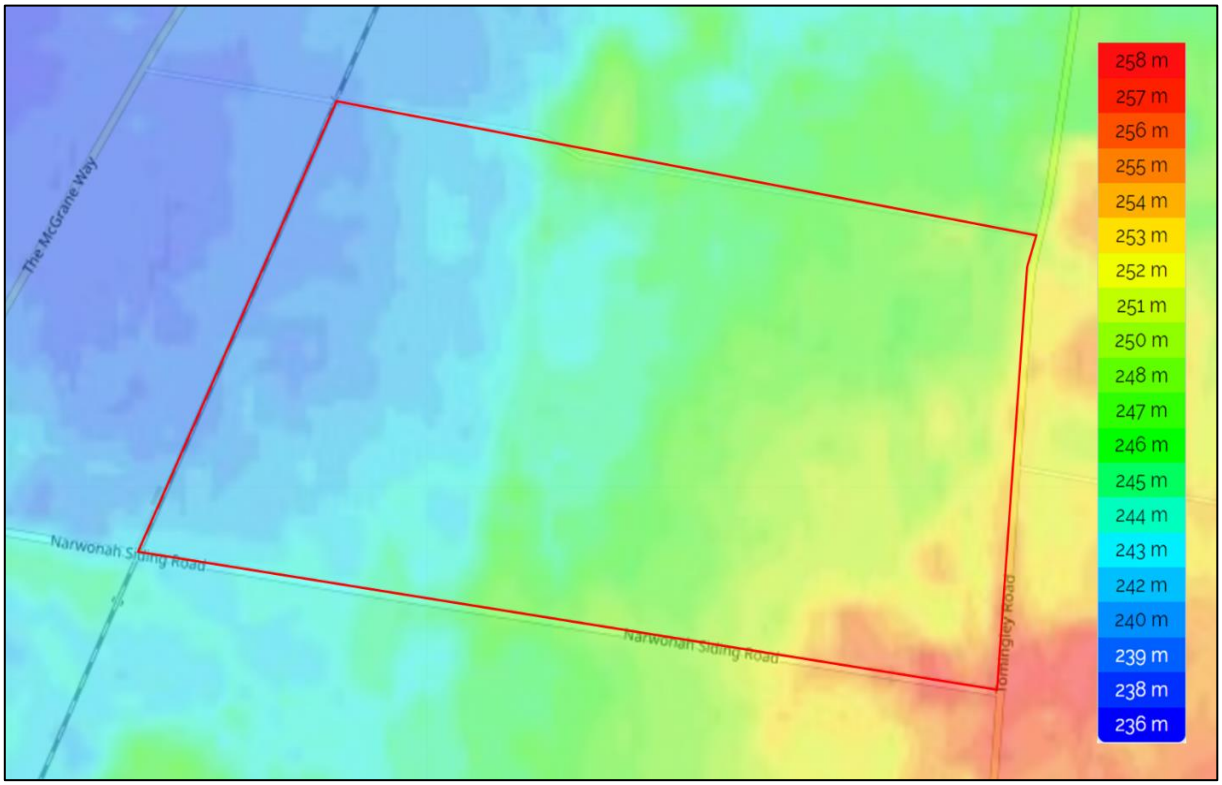

Figure 3.2: Subject Site topography.

Precipitation runoff at the site will most likely remain on site and either pool and evaporate or seep into surface soils.

The closest natural water body is the Yellow Creek, which represents the main drainage for the area, at its closest point it is located approximately 200m to the south from the south-western corner of the Subject Site.

3.4. Groundwater Resources

A review of existing groundwater bore records (WaterNSW, 2023) indicate 1 registered groundwater bore within the boundaries of the Subject Site (see Figure 3.3: Groundwater bores near the Subject Site.). The information recorded in the database for this bore (GW001565) and two more closest to the Subject Site (GW002441 and GW000306) indicate an average depth of between 89m and 112m deep. Only the on-site bore has data reported for depth of water bearing zones, indicating 50.3m, with standing water level of 42m and average yields 0.38L/s. According to the database all bores are used for stock.

The Subject Site falls outside the area mapped as groundwater vulnerable in the Narromine Local Environmental Plan (Narromine LEP, 2011). Based on the lithology of the area, aquifers are deep and unconfined with groundwater flow occurring vertically and laterally through fractures in bedrock. Most aquifers are isolated from surface by thick layers of clay with low hydraulic conductivity and transmissivity. High runoff rates occur on steeper slopes.

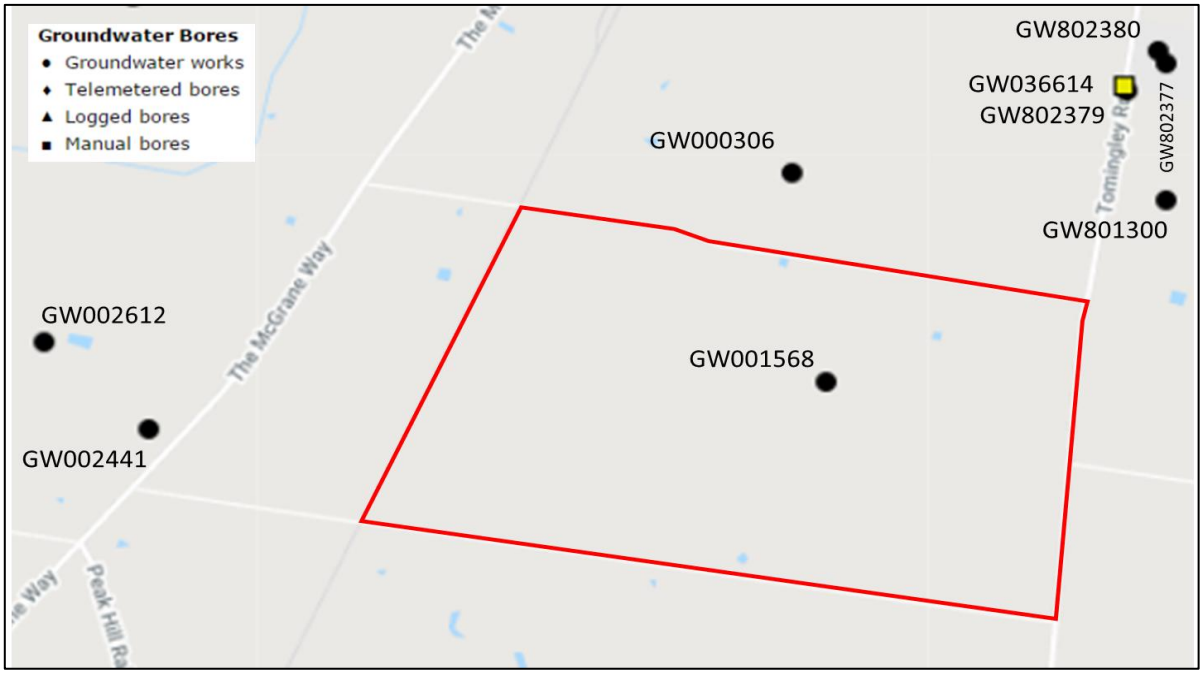

Figure 3.3: Groundwater bores near the Subject Site.

Source: WaterNSW All Goundwater Map, accessed 22/05/2023

The information recorded in the database for the groundwater bores indicates the depth of the bores reach final depths ranging from 61.0m to 85.0m. With a Standing Water Level (S.W.L) of 8m recorded for GW803397 and provided a Water Bearing Zone (W.B.Z) of 22.00m thick, starting at 9m. According to the database, the bores are utilised for domestic or stock watering purposes.

4. CONCEPTUAL SITE MODEL

4.1. General

The Conceptual Site Model (CSM) is intended to provide an understanding of the potential for contamination and exposure to contaminants within the investigation areas. The CSM draws together the available historical information for the site, with site specific geological, and hydrogeological information to identify potential contaminants, contamination sources, migration and exposure pathways and sensitive receptors.

4.2. Sources

The identification of sources presented here is based on the review of available historical information and photographs, as well as an understanding of current conditions at the Subject Site. The following is a summary of the potentially contaminated areas and sources of contamination identified:

- Historical farming activities.

Both the eastern and western portions of the Subject Site have historically been used in the operation of the livestock farming activities. Potential sources of contamination associated with these activities include the animal pens and yards, as well as the disposal of animal wastes. Activities associated with the management of animal health, including sheep dip or spraying for the control of parasites could further result in localised contamination. Potential contaminants include pesticides, hydrocarbons, heavy metals, and elevated nutrients.

- Cropping and feed production.

Historical photographs of the Subject Site indicate periodic crop farming activities in the western half of the Site. Crop farming in moderate to low fertility soils likely required the use of chemicals such as fertilisers and pesticides in the maintenance of the crops. Potential contaminants associated with these chemicals include heavy metals, organochlorine and organophosphate pesticides. Intensive use of fertiliser can also lead to the build-up of heavy metals in surface soil particularly zinc and cadmium, depending on the type and source of the fertiliser.

- Vehicles and equipment.

Operation of farm often involves the use of motorised vehicles and equipment used for a variety of applications such as transport, earth moving or pumping water. The use, storage, maintenance and refuelling of the equipment and vehicles has the potential to contribute to localised contamination of surface soils.

- Use of unclassified fill or uncontrolled disposal of waste.

There is no evidence to suggest that significant quantities of fill material have ever been imported to the Site for levelling or construction purposes. The Subject Site is further fenced and it is unlikely that large quantities of domestic or demolition waste would have been disposed of at the Site. However, foreign or potentially hazardous materials or wastes sporadically disposed of at the site could contribute a variety of contaminants to localised areas of the Site. Contaminants may include hydrocarbons and heavy metals.

4.3. Contaminants of Potential Concern

Considering the potential sources relevant to the Subject Site, a wide variety of contaminants may be present. With the historical agricultural activities considered the primary potential source of contamination, the residues of agricultural chemicals such as pesticides and fertilisers are accepted as the most likely contaminants. Of interest here are chlorinated organic compounds which historically have been widely used as insecticides, fungicides, herbicides and soil fumigants in agriculture and which are stable enough in the environment (persistent) to remain in soil for extended periods of time. Inorganic compounds that contain heavy metal including arsenic, copper, lead and mercury were also historically used as pesticides, particularly in the control of external parasites on sheep. The use of fertiliser, although not commonly considered a source of soil contamination, potentially could lead to a build-up of heavy metals such as cadmium in soils in areas where it has been extensively applied.

The potential presence of fuels and lubricants are further potentially relevant to the on-site storage, maintenance or movement of vehicles and equipment in the operation of the farm.

Based on this understanding of the site history and activities, the contaminants of potential concern identified for the investigation of the Subject Site include:

- pesticides (organochlorines, organophosphates);
- hydrocarbons (mainly fuel and lubricants); and
- heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)

4.4. Pathways

The primary pathways by which receptors could be exposed to the contaminants outlined above include:

- Inhalation of dust or vapours.
- Dermal contact with contaminated soils.
- Incidental ingestion of contaminated soils.
- Surface runoff, sediment transport and discharge to surface waters.
- Vertical and horizontal migration of contamination through the soils into the underlying groundwater.

Of the listed potential pathways, the contamination of water resources through infiltration is considered the most unlikely. The Subject Site is not indicated as a groundwater vulnerable zone (Narromine LEP, 2011) and the depth to groundwater at the site is estimated to be at least 40m. The slope of the site further would likely limit overland flow of water, in turn limiting the migration of any contaminants with overland flow.

4.5. Receptors

Potential receptors may include:

Human receptor populations

- Workers of the proposed manufacturing and warehousing facilities.
- Visitors to the site (e.g. workers conducting maintenance, contractors).
- Workers involved in the construction of facilities and rail infrastructure.

Environmental Receptors

- Local drainage channels and receiving surface water bodies (negligible likelihood of contamination expected).
- Groundwater resources beneath the site (negligible likelihood of contamination expected).

4.6. Potential for Contamination

The Subject Site is not listed in any of the contaminated land databases. Based on the results of the desktop assessment, the overall likelihood for *significant* chemical contamination to be present within the site is low.

Although agricultural activities at the Subject Site is reasoned to have a potential for contaminating surface soils at the site, the type and quantity of contaminants introduced through this land use is not expected to have led to significant contamination of the surface soils.

5. SITE INVESTIGATION

5.1. General

The objective of the investigation is to determine whether there are any environmental risks associated with the Investigation Area that could affect the proposed future development and would require further investigation or action to render the site suitable for its intended use.

The desktop evaluation of the site history and current use of the site did not identify any significant risks in this regard but did identify both historical and current land use activities that could contribute to contamination of the surface soils of the Subject Site.

Barnson conducted an inspection of the Investigation Area on 30 March 2023. The purpose of the site inspection was to verify the findings of the desktop assessment, as well as to collect confirmatory samples of soil from areas of the Subject Site where development is proposed, or contamination is suspected.

Based on the findings of the CSM the inspection and sampling were focussed on the surface soils (0-150mm).

During the site inspection the following observations were made:

- The Subject Site is fenced and access to the site is controlled. There are several informal vehicle paths traversing the site and there is at least two (2) access gates and paths from the Cragie Lea Lane frontage (see Figure 5.1).
- At the time Barnson conducted the site inspection, most of the Investigation Area was covered with tall pasture grass. All areas were attended by vehicle, where vehicle paths were available, and all visible open ground and prominent features were inspected. No visible discoloration or staining of open ground or soil, and no obvious discoloration or irregularities in the occurrence of vegetation was observed during the site inspection.
- Surface soils over most of the Investigation Area are soft red sands (Figure 5.2), however, in the areas where gilgai are present surface soils consist of grey sticky clay. Gilgai areas were wet at the time of the site inspection (Figure 5.3).
- The surface water observed on site were confined to a dams located on the property (See Figure 2.2).
- There was no evidence found to indicate that any part of the Investigation Area previously contained structures. No evidence of demolition waste or footings of any previous structures were observed during the site investigations.

Figure 5.1: Gate from Cragie Lea Lane.

Figure 5.2: Red surface soil encountered in majority of the Investigation Area.

Figure 5.3: Gilgai with green vegetation indicating wet area.

5.2. Confirmatory Sampling

The purpose of collecting confirmatory samples as part of the site inspection is to determine if any of the potential contaminants identified from the CSM are present. The samples are not intended for statistically valid characterisation or quantification of contamination levels.

Based on the findings of the CSM the inspection and sampling were focussed on the surface soils (0-150mm). Samples of soil were collected from the areas of the site where surface soils were accessible. The sample collection was coordinated with the geotechnical investigation of the site and while some locations coincide with that of the geotechnical bore locations, samples were also collected from high traffic areas, such as near the access gate, as well as inside gilgai focussed on areas of the site proposed for potential redevelopment.

Table 5.1 is a summary description of the collected samples submitted for analysis. Figure 5.4 presents an outline of the of the Investigation Area with the locations of the surface soil samples indicated.

Table 5.1: Summary of sample details.

Sample Number	Collected samples Reference - Figure 5.4	Description
CL-01	1	Surface soil (0-150mm) sample collected from geotechnical bore near south-eastern corner of the investigation area
CL-02	2	Surface soil (0-150mm) sample collected from geotechnical bore near north-eastern corner of the investigation area.
CL-03	3	Surface soil (0-150mm) sample collected from geotechnical bore in central part of the investigation area, near dam.
CL-04	4	Surface soil (0-150mm) sample collected from vehicle path at gate in internal paddock fencing
CL-05	5	Surface soil (0-150mm) sample collected from central portion of the Investigation Area near vehicle path.
CL-06	6	Surface soil (0-150mm) sample collected in gilgai.
CL-07	7	Surface soil (0-150mm) sample collected from high traffic area inside Investigation Area near access gate.
CL-08	8	Surface Soil (0-150mm) sample collected inside shallow channel letting overland flow into gilgai area.
CL-09	9	Surface soil (0-150mm) sample collected from south-west corner of investigation area.
CL-10	10	Surface Soil (0-150mm) sample collected from geotechnical bore near eastern boundary of the investigation area

The pattern followed for the soil sampling can be described as Judgement Sampling, where points are selected on the basis of the investigator's knowledge of the proposed land use and likely distribution of contaminants at a site. It is an efficient sampling method for confirmatory sampling that utilises knowledge of the site history and field observations to direct sample collection (NSW EPA, 1995).

All samples were submitted to the Australian Laboratory Services (ALS) laboratory in Mudgee, for determination of the following parameters:

- metallic element (cadmium, chromium, copper, lead, nickel and zinc) concentrations, including arsenic and mercury in soil;
- Extraction with organic solvent and analysis of Total Recoverable Hydrocarbons (TRH) fractions C6 to C40, benzene, toluene, ethylbenzene and total xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and phenols; and
- Extraction with organic solvent and analysis of Organochlorine (OCP) and Organophosphorus (OPP) pesticide compounds.

The ALS laboratory is NATA accredited for all the analysis indicated above.

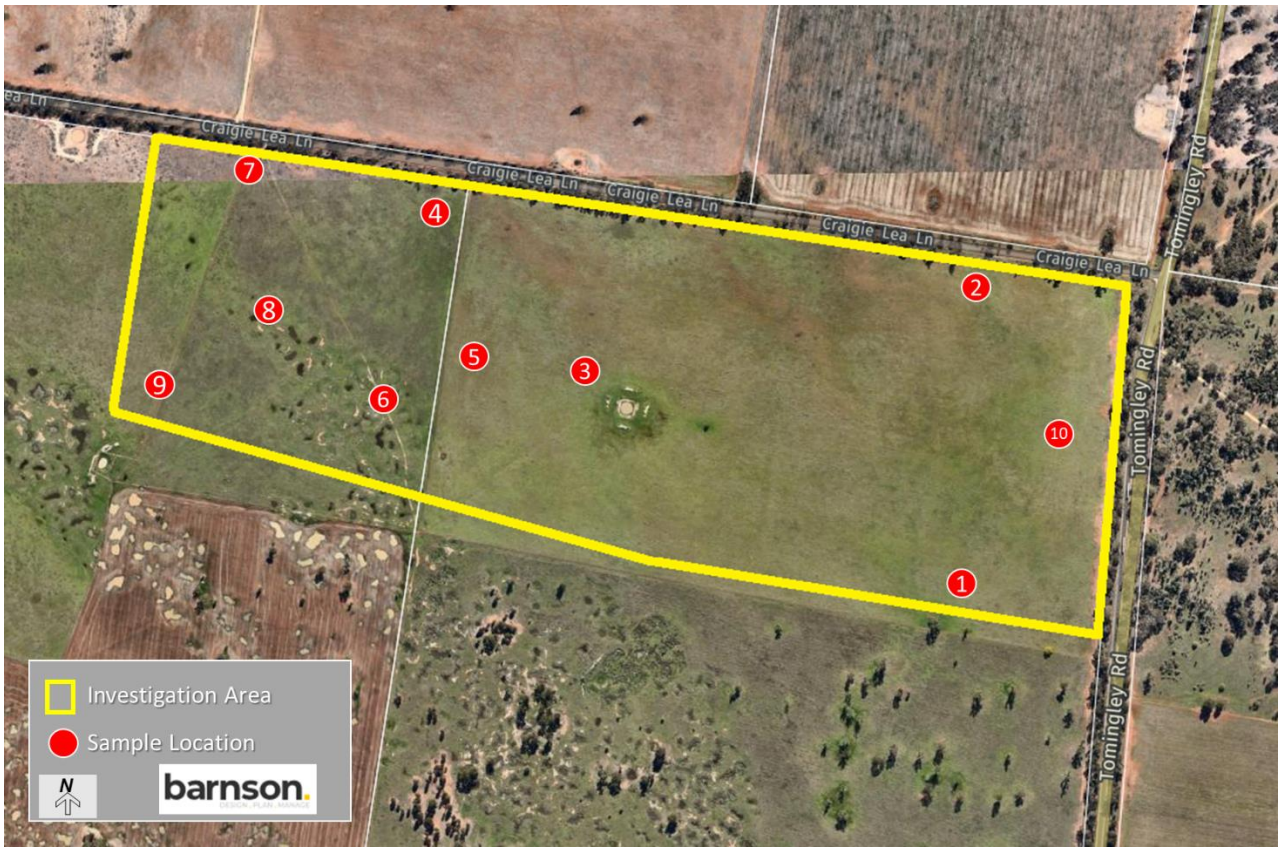

Figure 5.4: Surface soil sample locations.

5.3. Analytical Results

5.3.1. Surface Soil

The ALS report for the samples is attached as Appendix A. The laboratory report indicates that only metals were detected in the soil. The concentrations of petroleum hydrocarbons, pesticides, polycyclic organic compounds as well as total polychlorinated biphenyls are indicated as below the limits of detection in all surface soil samples.

The metals detected include chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), Mercury (Hg), and zinc (Zn). Concentrations of cadmium and arsenic are reported to be below the limit of detection in all samples.

Table 5.2 presents a summary of the elements detected above the limit of detection in samples collected from the Subject Site.

Table 5.2: Summary of metal concentrations detected in soil samples collected from the Subject Site.

Analyte	CL-01	CL -02	CL -03	CL -04	CL -05	CL -06	CL-07	CL-08	CL-09	CL-10
	mg.kg^{-1}									
Arsenic (As)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cadmium (Cd)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium (Cr)	14	11	17	14	15	17	15	16	12	15
Copper (Cu)	6	<5	6	7	7	15	5	6	8	6
Lead (Pb)	6	5	6	7	7	12	6	6	7	7
Mercury (Hg)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel (Ni)	5	3	5	7	7	10	5	4	7	5
Zinc (Zn)	8	5	7	9	9	25	7	9	11	9

5.4. Analytical Data Quality

Samples were collected in new, clean containers using cleaned equipment and soils were placed in glass jars provided by the laboratory that were refrigerated after filling and transported in an insulated container to the laboratory. Chain of custody was recorded for all samples. A copy of the signed sheet is attached as Appendix A.

The analyses were undertaken at a NATA accredited laboratory. The laboratory quality control procedures in the form of duplicates as well as analyte and surrogate spikes were applied to all contaminant classes analysed. The results reported for the duplicate is within the Relative Percent Difference range of the acceptance criteria for a duplicate sample. The analyte spike recoveries reported for the different sets of organic analytes are indicated as within the acceptance criteria (see Appendix A).

All media appropriate to the objectives of this investigation have been adequately analysed and no area of significant uncertainty exist. It is concluded the data is suitable for the purposes of the contaminated site investigation.

6. ASSESSMENT

6.1. Assessment Criteria – Human Health and Environmental Risk

Screening for human health and ecological risk, utilises published human health investigation levels (HILs) and ecological screening and investigation levels (ESLs & EILs) from the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999) to identify contaminant concentrations in soil that may pose a risk to future residents, people visiting the site, or to ecological receptors.

HILs are scientifically based, generic assessment criteria designed to be used in the screening of potential risks to human health from chronic exposure to contaminants. HIL's are conservatively derived and are designed to be protective of human health under the majority of circumstances, soil types and human susceptibilities and thus represent a reasonable 'worst-case' scenario for specific land-use settings. The HILs selected for evaluation of the Subject Site, and its continued use for industrial purposes, are those derived for commercial/industrial land use (HIL-D) and assumes a commercial land use such as shops, offices, factories or industrial sites with associated levels of access to potentially contaminated soil.

Although the primary concern in most site assessments is protection of human health, the assessment should also include consideration of ecological risks and protection of groundwater resources that may result from site contamination. EILs provide screening criteria to assess the effect of contaminants on a soil ecosystem and afford species level protection for organisms that frequent or inhabit soil and protect essential soil processes.

Ecological investigation levels (EILs) have been derived for common metallic contaminants in soil. The values selected for the evaluation of the heavy metals detected in the soil samples from the Subject Site considers the physicochemical properties of soil and contaminants and the capacity of the soil to accommodate increases in contaminant levels above natural background while maintaining ecosystem protection for identified land uses.

Table 6.1 presents a summary of the health-risk based criteria and ecological investigation levels selected for assessment of the detected metal concentrations.

6.2. Findings

Direct comparison of the analytical results presented in Table 5.2 with the assessment criteria (refer Table 6.1) show that the detected metal concentrations in samples collected from the Investigation Area are well below the health and ecological risk-based criteria values. The general low concentrations of heavy metals detected suggest naturally occurring element abundance and is most likely not related to any of the potential sources of contamination identified for the Investigation Area.

The samples of soil collected in the high traffic areas contained no elevated concentrations of hydrocarbons or heavy metals, while the samples collected from the gilgai contained no detectable concentrations of either pesticides or hydrocarbons. These results verify the assertion that the activities previously undertaken at the site did not contribute significant or widespread contamination to the surface soils.

Table 6.1: Human health and ecological risk screening levels for metals.

Element	Health-based Investigation Levels Commercial/Industrial D mg.kg^{-1}	Ecological Investigation Levels (EIL) Commercial/Industrial mg.kg^{-1}
Arsenic (As)	3,000	160
Cadmium (Cd)	900	NA
Chromium (Cr) (Total)	NR	660
Copper (Cu)	240,000	830
Lead (Pb)	1,500	1,800
Mercury (Hg)	730	NA
Nickel (Ni)	6,000	55
Zinc (Zn)	400,000	360

Note: NR=not relevant due to low human toxicity of Cr(III). NA=No applicable screening level. EILs selected are most conservative values relevant to commercial land use scenarios.

7. CONCLUSIONS AND RECOMMENDATIONS

In accordance with the objectives stated in Section 1.2, and based on the information contained within this assessment, the following conclusions are presented (subject to the limitations noted in Section 1.5):

- Activities associated with the historical and current use of the Subject Site were identified as having a potential to contaminate surface soil at the site.
- The following potential sources of contamination were identified:
  - Historical and current livestock farming and grazing activities;
  - Historical and current feed-crop cultivation;
  - Use, maintenance and storage of motorised vehicles and equipment, and
  - Localised waste disposal
- A review of the available historical information, including contaminated sites databases and aerial photographs indicated a low potential for significant environmental contamination to be present across the site.
- A site investigation conducted to determine the presence and significance of potential contamination associated with the identified sources, revealed that none of the potential sources identified are likely to have contributed significant quantities of contamination to the surface soils of the Investigation Area.
- Based on the findings of the desktop review, site investigation and confirmatory sampling and analysis, it is concluded that the Investigation Area is suitable for the future proposed development and use. The environmental media such as surface soils and surface water at the Investigation Area are unlikely to present a risk of impact to the health of humans or the environment and further investigation is not required.
- It is recommended that any material excavated at the Subject Site as part of the redevelopment, be classified in accordance with the general solid waste (NSW EPA, 2014) guidelines and appropriately disposed.

8. REFERENCES

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NEPC. (1999). *National Environment Protection (Assessment of Site Contamination) Measure (as amended, 2013).* National Environment Protection Council.

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NSW EPA. (2014a). *Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014, The excavated natural material order 2014.* Sydney: NSW Environment Protection Authoroty.

NSW EPA. (2020). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.* NSW Environmental Protection Agency.

WaterNSW. (2023). *Real Time Data.* Retrieved February 27, 2023, from Water NSW: https://realtimedata.waternsw.com.au/water.stm

barnson.

APPENDIX A

Chain of Custody and Laboratory Report

CERTIFICATE OF ANALYSIS

Work Order	: **ME2300735**	Page	: 1 of 13
Client	: **BARNSON**	Laboratory	: Environmental Division Mudgee
Contact	: Nardus Potgieter	Contact	: Mary Monds (ALS Mudgee)
Address	: Unit 4 108-110 Market Street MUDGEE NSW 2850	Address	: 1/29 Sydney Road Mudgee NSW Australia 2850
Telephone	: 0429 464 067	Telephone	: +61 2 6372 6735
Project	: Soil	Date Samples Received	: 17-Apr-2023 14:40
Order number	: ----	Date Analysis Commenced	: 18-Apr-2023
C-O-C number	: ----	Issue Date	: 27-Apr-2023 18:01
Sampler	: Nardus Potgieter (Client Sampler)		
Site	: ----		
Quote number	: SY/053/14		
No. of samples received	: 14		
No. of samples analysed	: 14		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. 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.

Signatories	*Position*	*Accreditation Category*
Aleksandar Vujkovic	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) 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 as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	CL-01 Surface Soil	CL-02 Surface Soil	CL-03 Surface Soil	CL-04 Surface Soil	CL-05 Surface Soil
			Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
Compound	CAS Number	LOR	Unit	ME2300735-001	ME2300735-002	ME2300735-003	ME2300735-004	ME2300735-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**7.6**	**5.8**	**7.4**	**6.9**	**8.1**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**14**	**11**	**17**	**14**	**15**
Copper	7440-50-8	5	mg/kg	**6**	<5	**6**	**7**	**7**
Lead	7439-92-1	5	mg/kg	**6**	**5**	**6**	**7**	**7**
Nickel	7440-02-0	2	mg/kg	**5**	**3**	**5**	**7**	**7**
Zinc	7440-66-6	5	mg/kg	**8**	**5**	**7**	**9**	**9**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	CL-01 Surface Soil	CL-02 Surface Soil	CL-03 Surface Soil	CL-04 Surface Soil	CL-05 Surface Soil
				Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
Compound	CAS Number	LOR	Unit		ME2300735-001	ME2300735-002	ME2300735-003	ME2300735-004	ME2300735-005
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-29-3	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	CL-01 Surface Soil	CL-02 Surface Soil	CL-03 Surface Soil	CL-04 Surface Soil	CL-05 Surface Soil
				Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
Compound	CAS Number	LOR	Unit		ME2300735-001	ME2300735-002	ME2300735-003	ME2300735-004	ME2300735-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	CL-01 Surface Soil	CL-02 Surface Soil	CL-03 Surface Soil	CL-04 Surface Soil	CL-05 Surface Soil
				Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
Compound	CAS Number	LOR	Unit		ME2300735-001	ME2300735-002	ME2300735-003	ME2300735-004	ME2300735-005
					Result	Result	Result	Result	Result
EP080: BTEXN - Continued									
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		**96.6**	**122**	**113**	**111**	**125**
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**74.1**	**94.5**	**86.5**	**94.0**	**88.6**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**61.4**	**53.2**	**50.0**	**61.0**	**64.6**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**79.9**	**82.1**	**76.9**	**76.2**	**77.0**
2-Chlorophenol-D4	93951-73-6	0.5	%		**81.8**	**86.6**	**79.8**	**78.9**	**79.4**
2.4.6-Tribromophenol	118-79-6	0.5	%		**54.2**	**61.8**	**47.6**	**44.0**	**43.8**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**82.9**	**82.5**	**81.4**	**80.5**	**81.8**
Anthracene-d10	1719-06-8	0.5	%		**88.9**	**89.0**	**85.0**	**89.0**	**88.2**
4-Terphenyl-d14	1718-51-0	0.5	%		**84.2**	**83.4**	**80.2**	**81.0**	**79.9**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**110**	**125**	**119**	**120**	**116**
Toluene-D8	2037-26-5	0.2	%		**85.4**	**82.9**	**88.3**	**86.4**	**88.6**
4-Bromofluorobenzene	460-00-4	0.2	%		**84.3**	**89.4**	**87.7**	**87.7**	**85.8**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	CL-06 Surface Soil	CL-07 Surface Soil	CL-08 Surface Soil	CL-09 Surface Soil	CL-10 Surface Soil
			Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
Compound	CAS Number	LOR	Unit	ME2300735-006	ME2300735-007	ME2300735-008	ME2300735-009	ME2300735-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**22.7**	**7.9**	**6.3**	**11.0**	**5.9**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**17**	**15**	**16**	**12**	**15**
Copper	7440-50-8	5	mg/kg	**15**	**5**	**6**	**8**	**6**
Lead	7439-92-1	5	mg/kg	**12**	**6**	**6**	**7**	**7**
Nickel	7440-02-0	2	mg/kg	**10**	**5**	**4**	**7**	**5**
Zinc	7440-66-6	5	mg/kg	**25**	**7**	**9**	**11**	**9**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	CL-06 Surface Soil	CL-07 Surface Soil	CL-08 Surface Soil	CL-09 Surface Soil	CL-10 Surface Soil
				Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
Compound	CAS Number	LOR	Unit		ME2300735-006	ME2300735-007	ME2300735-008	ME2300735-009	ME2300735-010
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-29-3	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Sample ID	CL-06 Surface Soil	CL-07 Surface Soil	CL-08 Surface Soil	CL-09 Surface Soil	CL-10 Surface Soil
				Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
					ME2300735-006	ME2300735-007	ME2300735-008	ME2300735-009	ME2300735-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg		<50	<50	<50	<50	<50
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	CL-06 Surface Soil	CL-07 Surface Soil	CL-08 Surface Soil	CL-09 Surface Soil	CL-10 Surface Soil
				Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00
Compound	CAS Number	LOR	Unit		ME2300735-006	ME2300735-007	ME2300735-008	ME2300735-009	ME2300735-010
					Result	Result	Result	Result	Result
EP080: BTEXN - Continued									
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		114	110	121	110	103
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		73.7	90.8	92.6	108	133
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		70.9	67.1	53.8	98.4	70.8
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		83.7	78.3	81.9	76.5	81.1
2-Chlorophenol-D4	93951-73-6	0.5	%		86.2	81.1	84.6	76.5	82.6
2.4.6-Tribromophenol	118-79-6	0.5	%		66.7	53.0	57.2	46.8	47.1
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		81.7	79.7	81.4	78.8	81.8
Anthracene-d10	1719-06-8	0.5	%		86.6	84.2	86.0	81.9	89.2
4-Terphenyl-d14	1718-51-0	0.5	%		81.5	79.2	80.4	79.4	87.1
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		102	104	120	119	120
Toluene-D8	2037-26-5	0.2	%		76.0	75.7	96.0	87.8	92.4
4-Bromofluorobenzene	460-00-4	0.2	%		79.2	77.1	106	86.7	101

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	CL-A-S Surface Soil	CL-A-D Sub-soil	CL-B-S Surface Soil	CL-B-D Sub-soil	----
			Sampling date / time	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	30-Mar-2023 00:00	----
Compound	CAS Number	LOR	Unit	ME2300735-011	ME2300735-012	ME2300735-013	ME2300735-014	--------
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.3	----	6.5	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	10	----	26	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	7.4	----	8.7	----	----
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	Dark Reddish Brown (5YR 3/4)	Dark Red (2.5YR 3/6)	Dark Grayish Brown (10YR 4/2)	Very Dark Grayish Brown (10YR 3/2)	----
Texture	----	-	-	Silty Loam	Silty Clay Loam	Medium Heavy Clay	Clay Loam	----
Emerson Class Number	EC/TC	-	-	2	2	1	2	----
EA150: Soil Classification - National Committee on Soil and Terrain (2009)								
Clay (<2 µm)	----	1	%	20	27	13	35	----
Silt (2-20 µm)	----	1	%	9	9	10	7	----
Fine Sand (0.02-0.2 mm)	----	1	%	37	32	35	26	----
Coarse Sand (0.2-2.0 mm)	----	1	%	31	30	34	26	----
Gravel (>2mm)	----	1	%	3	2	8	6	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.57	2.59	2.47	2.61	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	3.2	----	3.5	----	----
Exchangeable Magnesium	----	0.1	meq/100g	1.0	----	1.3	----	----
Exchangeable Potassium	----	0.1	meq/100g	0.8	----	1.0	----	----
Exchangeable Sodium	----	0.1	meq/100g	<0.1	----	0.1	----	----
Cation Exchange Capacity	----	0.1	meq/100g	5.0	----	5.8	----	----
Exchangeable Sodium Percent	----	0.1	%	0.4	----	1.8	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	340	----	1090	----	----
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	649	----	506	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	63	125
Toluene-D8	2037-26-5	67	124
4-Bromofluorobenzene	460-00-4	66	131

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EA058: Emerson Aggregate Test

Analysis conducted by ALS Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA150: Soil Classification - National Committee on Soil and Terrain (2009)

(SOIL) EA152: Soil Particle Density

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(SOIL) EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions

(SOIL) EP080/071: Total Petroleum Hydrocarbons

(SOIL) EP080: BTEXN

(SOIL) EP080S: TPH(V)/BTEX Surrogates

(SOIL) EP075(SIM)B: Polynuclear Aromatic Hydrocarbons

(SOIL) EP075(SIM)S: Phenolic Compound Surrogates

(SOIL) EP075(SIM)T: PAH Surrogates

(SOIL) EP068A: Organochlorine Pesticides (OC)

(SOIL) EP068B: Organophosphorus Pesticides (OP)

(SOIL) EP068T: Organophosphorus Pesticide Surrogate

(SOIL) EP068S: Organochlorine Pesticide Surrogate

(SOIL) EA055: Moisture Content (Dried @ 105-110°C)

(SOIL) EP066: Polychlorinated Biphenyls (PCB)

(SOIL) EP066S: PCB Surrogate

(SOIL) EG035T: Total Recoverable Mercury by FIMS

(SOIL) EG005(ED093)T: Total Metals by ICP-AES

(SOIL) EK062: Total Nitrogen as N (TKN + NOx)

(SOIL) EK072: Phosphate Sorption Capacity

(SOIL) EA002: pH 1:5 (Soils)

(SOIL) EA010: Conductivity (1:5)

(SOIL) ED007: Exchangeable Cations

Environmental Division
Mudgee
Work Order Reference
ME2300735

barnson

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CHAIN OF CUSTODY AND ANALYTICAL REQUEST

Job Number	40038	Date	17/04/2023
Laboratory	ALS Mudgee	Report to	Nardus Potgieter npotgieter@barnson.com.au
Sample Temperature on Receipt		Notes	
20 °C	Signature: mmorda		

Sample ID	Sample Description	Sample Date	Sample type	Analysis request					
				1	2	3	4	5	6
CL-01	Surface soil	30/03/2023	Soil	X					
CL-02	Surface soil	30/03/2023	Soil	X					
CL-03	Surface soil	30/03/2023	Soil	X					
CL-04	Surface soil	30/03/2023	Soil	X					
CL-05	Surface soil	30/03/2023	Soil	X					
CL-06	Surface soil	30/03/2023	Soil	X					
CL-07	Surface soil	30/03/2023	Soil	X					
CL-08	Surface soil	30/03/2023	Soil	X					
CL-09	Surface soil	30/03/2023	Soil	X					
CL-10	Surface soil	30/03/2023	Soil	X					
CL-A-S	Surface soil	30/03/2023	Soil		X	X	X	X	X
CL-A-D	Sub-soil	30/03/2023	Soil					X	X
CL-B-S	Surface soil	30/03/2023	Soil		X	X	X	X	X
CL-B-D	Sub-soil	30/03/2023	Soil					X	X

Analysis request		Method Code
1	TRH (C6-C40) / BTEXN / PAH / OC / OP / PCB / 8 Metals	S-16
2	pH plus EC (Saturated Paste) plus Exchangeable Cations and ECEC plus ESP	AG-1
3	P Sorption Capacity	EK072
4	Total Nitrogen as N*	EK062
5	Soil Classification by Particle Size Analysis (Sieve Hydrometer and SPD analysis to "Yellow Book" spec)	EA150H-Y
6	Emerson Aggregate Testing	EA058

Relinquished by / Affiliation	Accepted by / Affiliation	Date
/ Barnson	/ ALS Mudgee	17/04/2023 240