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Site Contamination Investigation

Client: Mid-Western Regional Council

Site Address: 10-12 Burrundulla Avenue,
Mudgee, NSW 2850

9 June 2023

Our Reference: 40777 ER01_A

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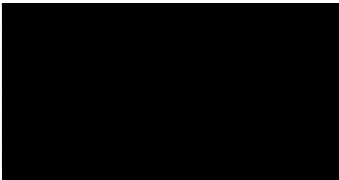

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Client:	Mid-Western Regional Council
Project Number:	40777
Report Reference:	40777 ER01_A
Date:	18/01/2023

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Executive Summary

Barnson Pty Ltd was engaged by the Mid-Western Regional Council to undertake a preliminary contaminated site investigation (PSI) of the property located at Lot 122 DP 1074283 (10-12 Burrundulla Avenue, Mudgee, NSW 2850).

The objective of the PSI is to identify any contamination issues that may affect the suitability of the site for the proposed development and to assess the need for possible further investigations or remediation.

A desktop review of information available for the site identified activities associated with the historical and current use as having a potential to contaminate surface soils. The following potential sources of contamination were identified:

- Landscape maintenance
- Vehicles and equipment
- Fill material, hazardous materials and unregulated waste disposal

A site inspection, supplemented with the collection and chemical analysis of confirmatory soil samples, was undertaken to determine the presence and significance of potential contamination associated with the identified sources. This investigation revealed that the surface soils, contain low concentrations of heavy metals and hydrocarbons. The concentrations detected were all found to be below health-risk based criteria suited for the evaluation of contamination in a residential land use scenario.

Based on the findings of the desktop review and site investigation it can be stated with a reasonable level of confidence that the contaminants detected at the Subject Site poses no significant risk to the health or the environment of humans and the site can be considered suitable for the proposed development and land use.

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1. INTRODUCTION

1.1. Background and Objectives

Barnson was engaged by Mid-Western Regional Council (the Client) to undertake a preliminary site contamination investigation (PSI) of the property located at Lot 122 DP 1074283 (10 Burrundulla Avenue, Mudgee, 2850 NSW) hereafter referred to as the Subject Site.

The Preliminary Site Investigation (PSI) is in support of the planned future development of the Subject Site, involving the construction of future residential development. The development will require planning consent. In accordance with the State Environmental Planning Policy (Resilience and Hazards, 2021) a consent authority must determine if land is contaminated and, if so, whether it is suitable for the intended purpose or require remediation, before development consent may be given.

A previous investigation of the Subject Site was undertaken by Barnson in 2016, following the demolition of a Bowling Club facility which formerly occupied the site (Barnson, 2016). The Barnson investigation identified asbestos containing material as well as trace quantities of hydrocarbon and organochlorine pesticides in the surface soils of the Subject Site. The investigation concluded that all contaminants investigated were below screening criteria for residential land use.

Barnson has now undertaken this PSI to confirm the findings of the previous investigation and identify any potential contamination which may have been introduced in the interim. This report presents an assessment of the conditions at the subject site in relation to the planning requirements and considers the contaminants potentially relevant to a residential land use scenario.

1.2. Objectives

The objectives of the Investigation are:

- Identify contamination that may affect the site's suitability for development,
- Determine the potential risks, if any, 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 hydrology.
- Desktop review and assessment of potential sources of contamination.
- Development of a conceptual site model (CSM) with regards to contaminant sources and exposure pathways, based on information gathered from the data review.

- Site inspection to assess site conditions.
- Assessment of the risk/impact of the identified contamination sources within the context of the site and the CSM.
- Provide conclusions as to whether the site is suitable for intended development.

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 investigations.

1.5. Assumptions and Limitations

The following assumptions have been made in preparing this report:

- The nature of the intended future use of the site is for residential purposes. This assumption forms the basis for the conceptual site model.
- All information pertaining to the contamination status of the site has been obtained through public record searches, a previous investigation report, 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	10 Burrundulla Avenue, Mudgee, NSW 2850
Site area (approx.)	1.67 hectares
Lot and Deposited Plan No.	Lot 122 DP1074283
Land Zoning	R3 – Medium Density Residential RE2 – Private Recreation
County	Wellington
Parish	Mudgee
Local Government Area	Mid-Western Regional Council

Figure 2.1 illustrates the subject site's location approximately 1.1km south-east of the town of Mudgee CBD. The subject site which is identified as Lot 122 DP 1074283 has an area of approximately 1.67ha and a land zoning of R3 – Medium Density Residential & RE2 – Private Recreation.



Figure 2.1: Location of the Subject Site.

Source: SixMaps, (accessed 29 May 2023)

2.2. Site Layout and Proposed Development

Figure 2.2 shows an aerial photo of the Subject Site. Features of the Subject Site are indicated as sketch plan overlay on Figure 2.2.

A portion of the site has direct frontage to Burrundulla Avenue to the east, George Street and residential lots to the west, and further residential lots to the north and south. The site is evident to have vehicle tracks and hardstands areas evident on site. The site used to be utilised by the Mudgee Bowling Club.

The Subject Site is being considered for the development of residential re-development.

2.3. Historical Land Use

The information detailing the history of 10 Burrundulla Avenue, presented below, was summarised from the Preliminary Investigation Report prepared by Barnson in 2016 (Barnson, 2016):

- Early 1860s: The site was subdivided from George Cox's Burrundulla Estate by John Dickson and the Annan Lodge built.
- 1890-1906: The Annan Lodge was utilised by various tenants. The lodge contained 13 rooms, servants quarters, super stabling, and extensive flower and vegetable gardens.
- 1906: Additional stables built, Annan Lodge renamed to 'Lochiel'
- 1930s: Cubs and scouts use the stables for meetings. Subdivision of the site occurs under Dunn family from 1928 until sold in 1959.
- 1959: The site was purchased by the Mudgee Bowling Club, and Lochiel demolished.
- 1963: BA11/63 (Bowling Club) approved for construction. It was understood fill was utilised by the builders.
- 1964: the Bowling Club officially opens.
- 1967-1992: Various approvals for alterations and additions to the site; including:
 - Club rooms alterations (BA19/67)
 - Addition of a concrete water tank. Used for irrigation of the greens (BA76/68)
 - Stage 1 extension of the club (BA179/76)
 - Verandah around greenskeepers shed (BA127/77)
 - Stage 2 extension of the club (DA198/79)
 - Development of a bistro (DA177/89)
 - Approval for the installation of signage for site directions (DA33/90)
- 2002: There was evidence of a stormwater drain coming onto site from the property adjoining the northern boundary.
- 2003: Adjoining property was finished and the stormwater drain buried.
- 2004: DA546/2004 approved – Lot 121 subdivided off with existing house onsite.



Figure 2.2: Layout of Subject Site.

Source: Sixmaps (Accessed 29 May 2023)

- 2010: Club Mudgee and Mudgee Bowling Club merge.
- 2015: Bowling Club officially closes, and Development Consent (DA0117/2016) approved for the demolition of the bowling club. The demolition included specialist asbestos removal by licensed contractors.
- Current: The site is vacant, however, some land features remain. Remaining features include bitumen carparking areas and roadways. The site is generally well covered by grass where the site allows. The vegetation appears healthy across the site. The demolition activities on site allow the footprint of the bowling club to be easily distinguished. Footings and an asbestos pipe remain in situ.

2.4. 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

2.5. Previous Site Investigations

A Preliminary Site Investigation was undertaken and prepared by Barnson in March 2016. Soil samples were collected and submitted for analysis of various potential contaminants including heavy metals, persistent pesticides and hydrocarbon compounds. A judgemental sampling scheme was employed where points were selected on the basis of the investigators observations, knowledge of the proposed land use and likely distribution of contaminants at a site. Excavations across the site revealed a significant portion of the grassed car park area was predominately fill

consisting of bricks and soil. Although the source of this fill is unknown, it was noted that the bricks are in good condition and uniform in size and shape.

A total of fifteen (15) samples of surface and sub-soil collected during the site investigation were submitted for analysis. The samples included a range of materials from across the site, from imported filled material to natural earth. The results of the analysis indicated that soils include heavy metals, hydrocarbon compounds (mainly petroleum fractions), as well as trace quantities of organochlorine pesticides. However, all contaminant concentrations were noted to be below health-risk based criteria suitable for the assessment of residential land use. Appendix A presents site plan indicating the locations at which samples were collected and include a summary of the analytical results.

The report (Barnson, 2016), concluded that although all samples were found to be well below the selected criteria for all analytes, the unknown nature of the imported fill discovered under the greens area of the site means that there is a potential for contaminants to be present and further investigations may be required once earthworks and excavations at the site uncover sources of potential contamination

Off-site migration of contaminants was also identified as a potential ecological exposure pathway through surface water. The report (Barnson, 2016) recommends that further investigation may be required if discolouration or odours are discovered.

2.6. Proposal

The current proposal to utilise the Subject Site for future residential re-development.

3. SITE SETTING

3.1. Geology

A review of the Mudgee 1:100,000 Geology map (refer to Figure 3.1) shows the majority of the site is underlain with Cainozoic aged alluvial silt, clay and sand, variable humic content, sporadic pebble – to cobble sized unconsolidated conglomeratic lenses.

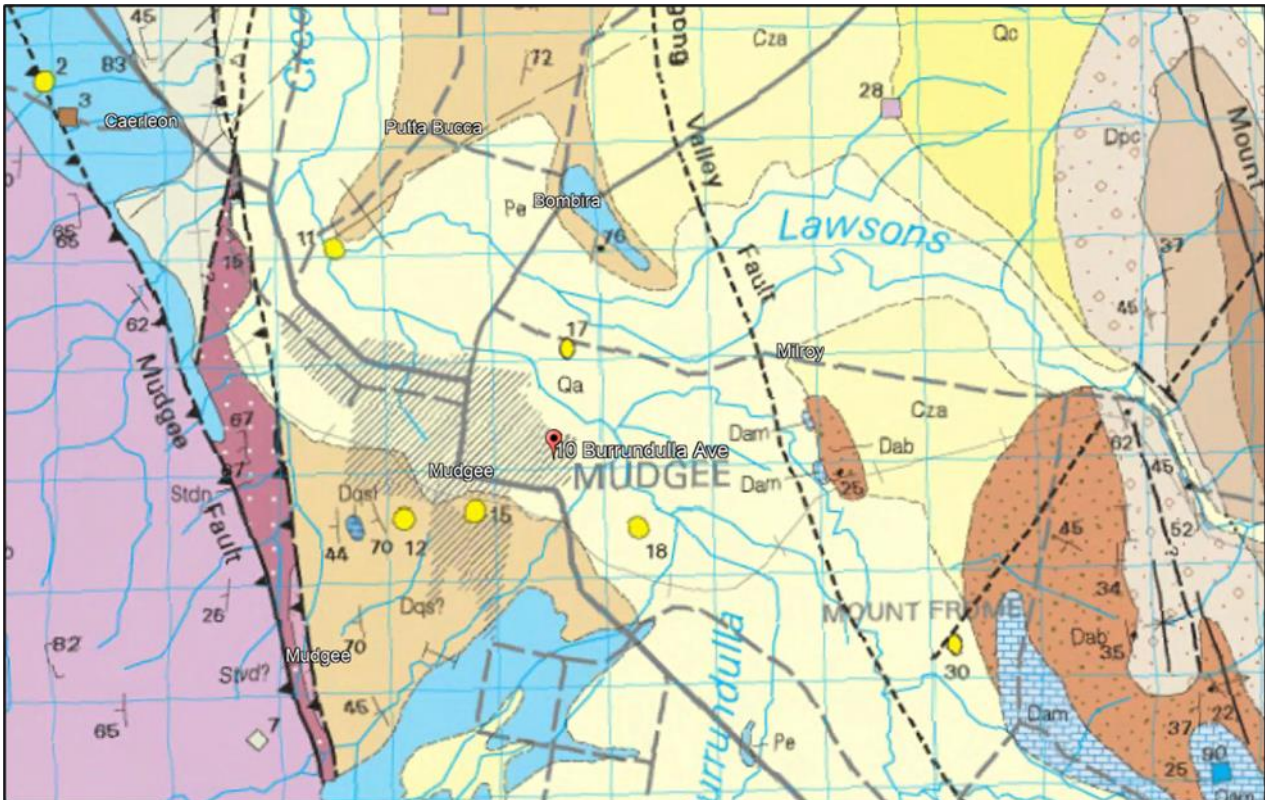


Figure 3.1: Mudgee 1:100,000 geology map showing the location of the Subject Site

Source: Google Earth, accessed 21/12/2022

An examination of the Geological Survey of NSW maps of Naturally Occurring Asbestos (accessed on 07 June 2023), shows that the geological units underlying the Subject Site area has no asbestos potential.

3.2. Soils

The Subject Site is mapped mainly within the Craigmore soil landscape. Red Earths and Non-calcic Brown Soils are co-dominant in the area.

The soils of the area are described as having moderate to high fertility whilst being weakly structured. The soil has moderate to high available water holding capacity, moderate to high erosion hazard under cultivation of and are moderately well drained.

The Atlas of Australian Acid Sulfate Soil has the subject site in an area of 'extremely low' probability of occurrence (a 1-5% chance of occurrence). Surface soils in the area are not considered saline.

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 Subject Site is relatively flat throughout. Generally, the site and surrounding locality have an elevation of slight fall to the north.



Figure 3.2: Subject Site topography.

Source: en-au.topographic-map.com, accessed 14/09/2022

The closest natural water body to the Subject Site is the Oaky Creek, located approximately 400m to the north.

3.4. Groundwater Resources

A review of existing groundwater bore records (WaterNSW, 2022) indicate eight (8) groundwater bores within 500m of the Subject Site, the three (3) closest have been recorded below. There are no registered bores inside the boundaries of the Subject Site.

The Preliminary Site Investigation report (Barnson, 2016) notes that during demolition of the site infrastructure surrounding the former bowling greens, an unlicensed water bore was uncovered between Green 1 and Green 2. The bore is constructed of bricks. The report (Barnson, 2016) continues to note that the historical information available for the site notes a well in the advertisement for Lochiel, dating from the 23rd December 1918, and that a local resident that undertook an apprenticeship at the facility during the 1960s, recalls the on-site well being used for irrigation of the greens prior to the construction of the water tank in 1968. No further investigations regarding the on-site well was undertaken.

Figure 3.3 show the location of the off-site, registered, groundwater bores. The information recorded in the database for the groundwater bores indicate the depths of the bores range from 18.90m to 42.00m with the shallowest Stand Water Level (S.W.L) recorded for GW051650 at 3.60m. the same bore has a Water Bearing Zone (W.B.Z) of 12.0m. According to the database, the bores were used for Domestic, recreational and general purposes.

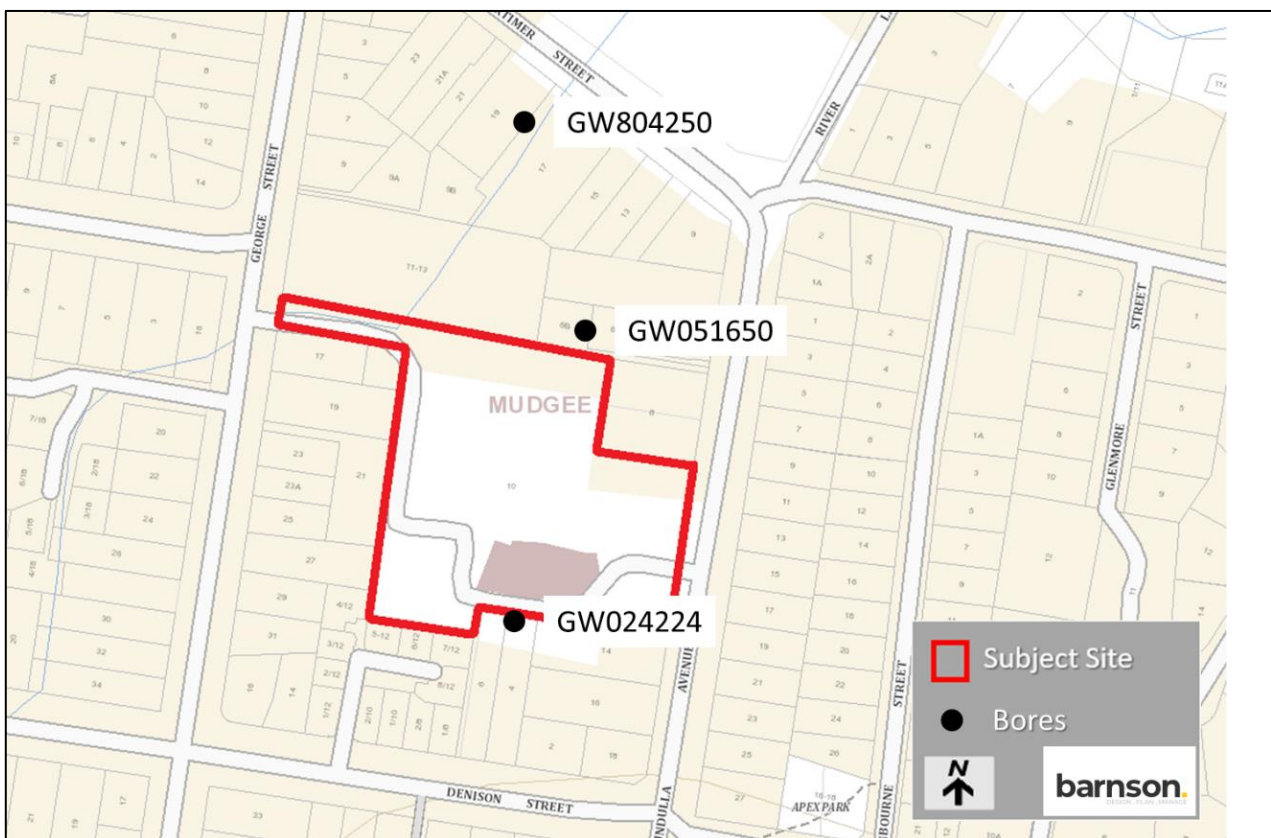


Figure 3.3: Groundwater bores near the subject site

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 previous investigation of the Subject Site (Barnson, 2016), identified six source areas to be investigated, and listed these as follows:

1. the sealed main carpark area
2. the bowling greens
3. the grassed overflow carpark area
4. the green keepers shed
5. a waste oil drum found on the site
6. fill used during the construction of the club house building

Analytical results of the soil samples collected during the previous investigation (Barnson, 2016) from these source areas, no contaminant concentrations exceeding the selected risk-based criteria was identified.

Since the previous investigation was undertaken the site has remained vacant and under stewardship of Mid-Western Regional Council. The site is fenced and access controlled, at least as far as vehicle access is concerned. Pedestrian access to the site is possible and it is expected that members of the public may trespass onto the site periodically. The site has been used as storage area by Council and some large vehicles are expected to have been driven onto the site. The vegetation (lawn) covering the unpaved areas of the Site is periodically mowed and maintained by Council.

Based on this understanding of the site use and activities in the interim between the 2016 investigation and the current PSI, the potential sources that may have contributed to the contamination of surface soils are:

- Vehicles and equipment

The use of motorised vehicles and equipment would have occurred with the Subject Site being utilised as storage area. Motorised equipment would likely also have been used for mowing and maintaining the landscape. Vehicles and equipment have the potential to contribute to localised hydrocarbon contamination of surface soils.

- Landscape maintenance

The Subject Site is covered with maintained lawn, the maintenance of which may have required use of pesticides and fertilisers.

- Fill material, hazardous materials and unregulated waste disposal

It is understood that as part of previous developments fill material of unknown origin was used as part of the development. A stockpile of demolition waste is also noted in the previous assessment, and is still present on site. Both the fill and stockpile were investigated as part of the previous site investigation and no contamination was discovered. The previous assessment (Barnson, 2016) identified a buried pipe consisting of asbestos containing material and recommended that this pipe be removed. Excavations to remove the pipe may potentially have led to the transfer of contaminants from the sub-surface fill material to the surface. Unregulated pedestrian access to the site and the potential indiscriminate disposal of waste is considered as a potential source of localised contamination.

4.3. Contaminants of Potential Concern

Considering the potential sources listed in Section 4.2, a wide variety of contaminants may be present. With vehicle movements & landscaping maintenance considered the primary sources of potential contamination, the residues of fertilisers and pesticides as well as petroleum hydrocarbons are accepted as the most likely contaminants. To a lesser extent, the potential presence of contaminated or hazardous materials in existing fill brought to the surface through localised excavation is considered.

The parking of vehicles or use of motorised equipment for mowing and maintenance of the site could further have contributed to localised hydrocarbon contamination of surface soils associated with small leaks or spillages of fuels and lubricants.

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

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

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 migration to underlying groundwater is considered the most unlikely. Although the site is located in a zone of groundwater vulnerability (Mid-Western Regional Council LEP, 2011), this is mainly due to a high yielding alluvial aquifer underlying the town, and proximity to the Cudgegong River.

4.5. Receptors

Potential site receptors may include:

Human receptor populations

- Construction workers involved in the proposed redevelopment of the Subject Site.
- Visitors to the site (e.g. workers conducting maintenance, members of the public).

Environmental Receptors

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

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

Table 4.1 summarises the potential areas of environmental concern based on the results of the desktop review.

Table 4.1: Potential areas of environmental concern

Description	Rationale	Potential Contaminants
Landscape maintenance.	Possible use of fertiliser, herbicides and insecticide means that the contaminants could accumulate and build up to significant concentrations in the underlying soil.	Pesticides, heavy metals.
Motorised vehicle and equipment usage	Leaked oils, fuels and grease from vehicles used or parked in the area.	TPH, BTEX, PAHs, phenols, heavy metals.
Unclassified Fill Material	Unknown materials in fill onsite.	Hazardous materials

Based on the results of the desktop assessment the overall likelihood for significant chemical contamination to be present within the Subject Site is considered to be low.

5. SITE INVESTIGATION

5.1. General

The objective of the investigation is to determine whether there are any environmental risk associated with the Subject Site 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 uses 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 was contracted to, in addition to the desktop assessment, conduct an inspection of the Subject Site and collect soil samples in conjunction with the intrusive geotechnical investigation of the proposed development areas. The site inspection and sampling were undertaken on 28 April 2023.

Based on the findings of the CSM the inspection and sampling were focussed on the surface soils (0-150mm) of area's identified in the previous assessment. Sampling was planned with consideration of the NSW EPA Sampling Design Guidelines for contaminated sites (NSW EPA, 1995), and the sensitivity of the proposed land use (residential) in mind.

During the site inspection the following observations were made.

- Vegetation cover of the site was in good condition and appears to be regularly managed (Figure 5.1).



Figure 5.1: Photo of managed vegetation

- An area of hardstand, historically utilised for car parking, is located in the southwestern corner of the site (Figure 5.2). Paved driveways link up to the parking area from the north (see Figure 5.3) and east.



Figure 5.2: Hardstand car park



Figure 5.3: Northern driveway providing access from George Street

- The former carpark area is used for the storage of large sandstone blocks (Figure 5.4).



Figure 5.4: Sandstone blocks stored at the Subject Site

- A retaining wall and a line of trees separate the former bowling greens from an overflow parking area to the north (Figure 5.5).



Figure 5.5: Trees and retaining wall dissecting Subject Site

- No visible discoloration or staining of open ground or soil was observed during the site inspection.
- There is evidence of excavations at the corner of the former carpark. This is the area in which the buried asbestos pipe, noted in the previous assessment, was discovered (see Figure 5.2)
- The site is fenced and secured and in general good order without any visible sign of disturbance to the soils or site infrastructure.
- No drainage channels were noted to be present at the site and no surface water was present on the site at the time of inspection. The well noted in the previous assessment was found in the area where the former bowling greens were located but was covered over with concrete (Figure 5.6). The well was not inspected.



Figure 5.6: Covered well in centre of the property.

- The land use of the immediately surrounding area remains the same as noted in the historical review of the site.

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. The collection of

surface soil samples at the site was therefore focussed on areas investigated as part of the previous investigation, with the purpose of confirming the previous findings, as well as areas where contamination of the surface soil could most likely have occurred in the interim.

Table 5.1 present a summary description of the collected samples.

Table 5.1: Summary of sample details.

Sample ID	Reference in Figure 5.7	Description
BA-01	1	Surface soil (0-150mm) collected from northern boundary.
BA-02	2	Surface soil (0-150mm) collected from north-eastern vacant land.
BA-03	3	Surface soil (0-150mm) collected from bitumen access from George Street to car park.
BA-04	4	Surface soil (0-150mm) collected from bitumen car park (South-Western corner).
BA-05	5	Surface soil (0-150mm) collected from vacant area in central portion of site (Previous bowling green).
BA-06	6	Surface soil (0-150mm) collected from eastern boundary vacant land (Previous bowling green)
BA-07	7	Surface soil (0-150mm) collected from eastern boundary access.
BA-08	8	Sample of disturbed soil (0-150mm) collected from presumed excavation area near carpark.
BA-09	9	Surface soil (0-150mm) collected from vacant land.
BA-10	10	Surface soil (0-150mm) collected from stormwater drain receiving stormwater runoff from former carpark and northern driveway.
BA-02a	2	Composite sample for asbestos analysis
BA-07a	7	Composite sample for asbestos analysis
BA-08a	8	Composite sample for asbestos analysis
BA-10a	10	Composite sample for asbestos analysis

Figure 5.7 present a map indicating the approximate location of the samples collected. The pattern followed for the 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).



Figure 5.7: Locations of confirmatory surface soil samples.

The site investigation was undertaken in conjunction with a geotechnical investigation of the site. Most of the soil samples were therefore collected from geotechnical bores undertaken across the site by means of a vehicle mounted auger drill (Figure 5.8).

The surface soil samples were submitted to the Australian Laboratory Services (ALS) Pty Ltd 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);
- Extraction with organic solvent and analysis of Organochlorine (OCP) and Organophosphorus (OPP) Pesticides; and
- Laboratory QC duplicates and spikes.

Although there is no reason to believe that asbestos contamination may be present in the surface soils of the Subject Site, the composite surface soil sample comprising all three sample locations was analysed for the presence of asbestos fibres.



Figure 5.8: Geotechnical auger drill bore into hardstand of the former carpark.

5.3. Analytical Results

5.3.1. Surface Soil

A copy of the laboratory reports for the confirmatory samples is attached as Appendix B.

The laboratory report indicates that only low concentrations of metallic elements, and Total Recoverable Hydrocarbons, were detected in the surface soil samples. In all of the surface soil samples, alkane fractions (straight chain hydrocarbons) as well as persistent pesticide and herbicide compounds are indicated as below the limits of detection.

The metals detected include chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), and zinc (Zn). Concentrations of arsenic (As), cadmium (Cd) and mercury (Hg), are indicated as below the limit of reporting in all samples.

Table 5.2 presents a summary of the compounds and elements detected above the limit of detection in samples of surface soil.

Table 5.2: Summary of contaminant concentrations detected in soil samples collected from the Investigation Area.

Element	BA-01	BA-02	BA-03	BA-04	BA-05	BA-06	BA-07	BA-08	BA-09	BA-10
mg.kg ⁻¹										
Arsenic (As)	11	<5	18	6	<5	<5	7	<5	9	6
Cadmium (Cd)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium (Cr)	28	10	14	10	9	5	18	4	20	15
Copper (Cu)	9	7	9	10	7	<5	9	<5	12	32
Lead (Pb)	12	14	22	11	6	5	19	7	33	40
Mercury (Hg)	<0.1	0.1	<0.1	<0.1	1.3	0.2	<0.1	<0.1	<0.1	0.1
Nickel (Ni)	12	7	7	9	5	2	7	<2	10	24
Zinc (Zn)	17	50	65	35	25	13	30	<5	95	1930
>C16-C34 Fraction (F3)	<100	<100	110	<100	<100	<100	<100	<100	<100	410
>C34-C40 Fraction (F4)	<100	<100	140	<100	<100	<100	<100	<100	<100	460

The laboratory report further indicate that no asbestos fibres were detected in the composite samples of soil analysed (BA-02a, -07a, -08a and -10a).

5.4. Analytical Data Quality

Samples were collected in glass jars provided by the laboratory, refrigerated after collection and transported in an insulated container to the laboratory. Chain of custody was recorded for all samples. A copy of the signed sheets are attached as Appendix B.

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 B).

All media appropriate to the objectives of this investigation have been adequately analysed and no area of significant uncertainty exist. It is concluded that the data is usable for the purposes of the 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 are those derived for a standard residential scenario (HIL-A) and assumes a residential land use with garden/accessible soil (home grown produce <10% fruit and vegetable intake, and no poultry).

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.

Table 6.1: Human health and ecological risk screening levels.

Element	Health-based Investigation Levels HIL A Residential mg.kg-1	Ecological Investigation Levels (EIL) Urban residential and public open space mg.kg-1
Arsenic (As)	100	100
Cadmium (Cd)	20	NA
Chromium	NR	190
Copper (Cu)	6,000	190

Lead (Pb)	300	1,100
Mercury (Hg)	40	NA
Nickel (Ni)	400	30
Zinc (Zn)	7,400	400

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 residential land use scenario.

The health risks associated with petroleum hydrocarbon compounds are assessed using Health Screening Levels (HSLs) developed to be protective of human health by determining the reasonable maximum exposure from sources for a range of situations commonly encountered on contaminated sites. HSLs are derived for soil, groundwater and soil vapour and relate to exposure to petroleum hydrocarbons through the vapour inhalation exposure pathway only. Direct exposure pathways such as incidental soil ingestion and dermal exposure pathways are generally not the risk drivers when compared to inhalation exposure (NEPC, 1999). HSLs have been developed for BTEX and naphthalene plus four hydrocarbon fractions namely:

- C6-C10- Fraction number F1
- >C10-C16- Fraction number F2
- >C16-C34- Fraction number F3
- >C34-C40- Fraction number F4

Ecological risks associated with hydrocarbons are evaluated by using ecological screening levels (ESLs), which are based on EC₂₅ weight-of-evidence ecotoxicity data, evaluated for a residential land use scenario (NEPC, 1999). The ESLs (Table 6.2) are evaluated for the same four carbon chain fraction ranges (F1 to F4) listed above. Screening values for a residential/public open space exposure scenario are listed.

Table 6.2: Human health and ecological risk screening levels for hydrocarbon fractions.

Fraction	Management limits for TPH in Soil	Health Screening Levels (HSLs) for vapour intrusion	Ecological Screening Levels (ESL)
	Residential/public open space mg.kg ⁻¹	Residential/public open space (silt) mg.kg ⁻¹ (soil)	Residential/public open space (fine) mg.kg ⁻¹
F1	800	40	180
F2	1,000	230	120
F3	3,500	NA	1,300
F4	10,000	NA	5,600

NA=No applicable screening level.

It was confirmed that limits of detection reported by the laboratory are below the criteria values. All other contaminants analysed for in the soil samples that are reported below the limit of detection by the laboratory can therefore be excluded from further assessment.

6.2. Findings

Direct comparison of the analytical results presented in Table 5.2 with the assessment criteria (refer Table 6.1 and Table 6.2) show that metal element concentrations are well below health-risk based values. The general low concentrations of heavy metals detected suggest naturally occurring element abundance and is most likely not related to contamination.

The elevated concentration of zinc and trace quantities of hydrocarbons were detected in a sample of sediment collected from an unlined stormwater drainage channel. Although the zinc concentrations do not exceed the health risk-based concentration value used for assessment, it does exceed the ecological investigation level. Concentrations of zinc detected at all other locations are significantly lower (below 100mg/kg) indicating that the elevated concentration is localised to the area where the drainage channel is located. If the elevated concentration was due to zinc compounds dispersed over the site, in for example fertiliser, one would expect that the average concentration of this element would be elevated across the site, which is not the case. The source of the elevated zinc is therefore most likely related to a substance introduced specifically to this area of the site, or to areas of the site from which stormwater runoff passes through this portion of the site.

Given these constraints, the most likely source of the elevated zinc most likely relate to the stormwater runoff from the car park and access driveway draining across this area. The sample of soil from the drainage channel is also the only sample to include detectable concentrations of hydrocarbons, which further reinforces this notion.

More specifically, the elevated zinc concentration is accepted to relate to tire-tread material lost from vehicles to the surfaces of the driveway and carpark. Tire-tread material has a zinc (Zn) content of about 1 wt %.and has been shown to contribute measurable concentrations of zinc to the urban and sub-urban environment (Counsell, Duckenfield, Landa, & Callender, 2004). The tread particles include zinc as part of its structure and it is therefore not considered to be water soluble. The zinc containing particulates would be entrained in the sediment settling out of the stormwater runoff and is likely to remain in the area it was identified unless the sediments are disturbed.

The concentrations of zinc in this area is therefore expected to be similar to sediments in table drains near roads and other stormwater management infrastructure draining roads and parking areas.

No asbestos was identified in any of the soil samples analysed and no potentially asbestos containing materials were noted on site at the time of the site investigation. The stockpile of demolition waste and soil located in the northern portion of the Subject Site was excavated and inspected during the previous site investigation (Barnson, 2016). No contamination or hazardous materials were noted. This stockpile was again visually inspected during his recent investigation and no potentially contaminating material was noted.

No evidence of indiscriminate waste disposal, which could contribute contaminants to the surface soils of the Subject Site, was observed during the site inspection.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions

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

- Activities associated with the 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 evaluated:
 - Landscape maintenance
 - Vehicles and equipment
 - Fill material, hazardous materials and unregulated waste disposal
- A review of the available information indicated a low potential for significant environmental contamination to be present across the site.
- A previous site investigation was undertaken by Barnson in 2016. Features of the site noted at the time of the previous investigation remain, including bitumen carparking areas and roadways, lights and paths around the bowling greens and a well. All above ground structures have been demolished and removed and it is understood that the asbestos pipe noted in the previous investigation has been extracted and disposed.
- The Subject Site in its current state is predominantly covered in managed grasses and some existing hardstand area. The bowling greens have been removed.
- A site investigation and confirmatory sampling conducted to determine the presence and significance of potential contamination associated with the identified sources, revealed that none of the contaminants investigated are present above health-risk based criteria in the surface soils of the Subject Site.
- Elevated concentrations of zinc discovered in the sediment of an unlined drainage channel does exceed ecological investigation levels, but it was reasoned that the contaminant is likely not soluble and will likely remain in the location it was discovered unless the sediment is disturbed or eroded. The elevated concentration of zinc discovered at the Subject Site is expected to be similar to concentrations present in sediment from roads and parking areas and is therefore not considered to pose significant a risk to aquatic ecosystems.
- Findings of the site inspection and sampling confirm the conclusions of the previous investigation of the site that no widespread contamination of any significance is present at the Subject Site.
- Based on the findings of the desktop review and site investigation it is concluded that the surface soils of the Subject Site poses no significant risk to the health of humans or the environment.

7.2. Recommendations

- Based on the findings of the desktop review and site investigation it can be stated with a reasonable level of confidence that the Subject Site is suitable for the proposed residential re-development and land use.
 - It is recommended that the stockpile of demolition waste located in the northern portion of the site be removed and disposed to a licenced landfill facility.
 - Given the complex nature of imported fill and the known presence of significant quantities of it at the Subject Site, it is recommended that an unexpected finds protocol be implemented as part of any future earthmoving or construction activities undertaken at the site.
 - An unexpected finds protocol is intended to provide guidance for the management and handling of potentially contaminated material uncovered during excavation or earthmoving works. A copy of a typical protocol is attached as Appendix C.
 - It is recommended that any material excavated at the Subject Site as part of the redevelopment, be classified in accordance with the Natural Excavated Materials Order (NSW EPA, 2014a) and appropriately disposed.
 - Any considerations provided in the previous report in regards to the unregistered well should also be considered.
-

8. REFERENCES

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APPENDIX A

**Previous Laboratory Report, and
Sample Locations**



FIGURE 5: SAMPLING LOCATIONS

Club Mudgee
22703

Phase 1 Contaminated Site
Investigation, 10 Burrundulla
Avenue, Mudgee



Description					1S	2S	8	10	12d	13d	14d	15a	15b
Sample Date					#####	#####	#####	#####	#####	#####	#####	#####	#####
Matrix					Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
TRH													
Analyte Name	Units	Reporting Limit	Intrusion Silt /Clay	Management Limits- Fine Soils	ESL Fine Soils	Result	Result	Result	Result	Result	Result	Result	Result
Benzene (F0)	mg/kg	0.1	0.6/0.7			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRH C6-C9	mg/kg	20				<20	<20	<20	<20	<20	<20	<20	<20
TRH C6-C10	mg/kg	25		800	180	<25	<25	<25	<25	<25	<25	<25	<25
TRH C6-C10 minus BTEX (F1)	mg/kg	25	40/50			<25	<25	<25	<25	<25	<25	<25	<25
TRH C10-C14	mg/kg	20				<20	<20	<20	<20	<20	<20	<20	<20
TRH C15-C28	mg/kg	45				<45	<45	<45	54	<45	<45	120	170
TRH C29-C36	mg/kg	45				<45	<45	<45	270	<45	<45	220	330
TRH C37-C40	mg/kg	100				<100	<100	<100	<100	<100	<100	<100	<100
TRH >C10-C16 (F2)	mg/kg	25		1000	120	<25	<25	<25	<25	<25	<25	<25	39
TRH >C10-C16 (F2) - Naphthalene	mg/kg	25	230/280			<25	<25	<25	<25	<25	<25	<25	39
TRH >C16-C34 (F3)	mg/kg	90		3500	1300	<90	<90	<90	170	<90	<90	250	350
TRH >C34-C40 (F4)	mg/kg	120		10000	5600	<120	<120	<120	180	<120	<120	<120	140
TRH C10-C36 Total	mg/kg	110				<110	<110	<110	330	<110	<110	340	500
TRH C10-C40 Total	mg/kg	210				<210	<210	<210	330	<210	<210	340	500

Club Mudgee
22703

Phase 1 Contaminated Site
Investigation, 10 Burrundulla
Avenue, Mudgee



		Description			1S	2S	8	10	12d	13d	14d	15a	15b
		Sample Date			30/3/2016	#####	#####	#####	#####	#####	#####	#####	#####
PAH		Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	Units	Reporting Limit	ESL	HIL-A	Result	Result	Result	Result	Result	Result	Result	Result	Result
Naphthalene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2-methylnaphthalene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.6	<0.1	<0.1	<0.1	<0.1	<0.1
1-methylnaphthalene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.6	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.4	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b&j)fluoranthene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	mg/kg	0.1	0.7		<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a&h)anthracene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	mg/kg	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carcinogenic PAHs, BaP TEQ <LOR=0	TEQ	0.2		3.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carcinogenic PAHs, BaP TEQ <LOR=LOR	TEQ (mg/kg)	0.3		3.0	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Carcinogenic PAHs, BaP TEQ <LOR=LOR/2	TEQ (mg/kg)	0.2		3.0	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2
Total PAH	mg/kg	0.8		300.0	<0.8	<0.8	<0.8	1.4	<0.8	<0.8	<0.8	<0.8	<0.8

Club Mudgee

22703

Phase 1 Contaminated Site
Investigation, 10 Burrundulla
Avenue, Mudgee



		Description	1S	2S	8	10	12d	13d	14d	15a	15b	3s	3d	4s	4d	5s	5d	6s	6d	7	9s	9d	11s	11d	
		Sample Date	30/3/2016	30/3/2016	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	
Metals	Matrix	Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	
Analyte Name	Units	Reporting Limit	HL-A	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Arsenic, As	mg/kg	3	100.0	6	<3	4	6	10	7	6	4	5	<3	5	<3	5	<3	6	<3	4	7	4	5	6	8
Cadmium, Cd	mg/kg	0.3	20.0	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.5	0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.3	100.0	16	6.2	9.3	10	25	12	14	15	14	7.5	19	6.8	23	7.5	19	6.4	13	15	13	16	16	15
Copper, Cu	mg/kg	0.5	6000.0	5.4	5.7	8	13	11	10	7.6	24	24	5.5	6.7	4.2	5.3	8.4	6.6	8.9	6.4	7.4	14	10	5.9	12
Lead, Pb	mg/kg	1	300	25	5	34	18	48	27	29	35	33	5	13	5	18	5	21	6	9	32	60	74	18	8
Nickel, Ni	mg/kg	0.5	400.0	6	3.9	4.4	6.1	14	7.6	6.4	26	23	3.5	12	3	8.8	5.2	12	3.9	13	9.8	7.1	7.4	7.9	11
Zinc, Zn	mg/kg	0.5	7400.0	30	22	120	75	23	49	50	2100	2300	17	11	14	18	26	21	27	9.3	38	93	30	21	37
Mercury	mg/kg	0.01	40.00	0.08	0.01	0.54	0.04	0.02	0.17	0.07	0.04	0.04	0.33	<0.01	0.2	0.02	2.3	0.16	2	0.03	0.06	0.29	0.31	0.03	0.01
% Moisture	%ww	0.5		14	6.5	3.2	5.8	14	5.1	3.7	23	26	2.6	14	2.3	12	3.6	13	3.7	16	13	8.1	8.1	6.1	12

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APPENDIX B

**Chain of Custody and Laboratory
Report**



Telephone . 02 6372 6795

CHAIN OF CUSTODY AND ANALYTICAL REQUEST

Job Number	40777	Date	01/05/2023	
Laboratory	ALS Mudgee	Report to	Nardus Potgieter npotgieter@barnson.com.au	
Sample Temperature on Receipt				
14 °C	Signature:	[Redacted Signature]		
Notes				

Sample ID	Description	Sample Date/Time	Sample Matrix	Analysis request					
				1	2	3	4	5	6
BA-01	In-situ soil	28/04/2023	Soil	X					
BA-02	In-situ soil	28/04/2023	Soil	X					
BA-03	In-situ soil	28/04/2023	Soil	X					
BA-04	In-situ soil	28/04/2023	Soil	X					
BA-05	In-situ soil	28/04/2023	Soil	X					
BA-06	In-situ soil	28/04/2023	Soil	X					
BA-07	In-situ soil	28/04/2023	Soil	X					
BA-08	In-situ soil	28/04/2023	Soil	X					
BA-09	In-situ soil	28/04/2023	Soil	X					
BA-10	In-situ soil	28/04/2023	Soil	X					
BA-02a	In-situ soil	28/04/2023	Soil		X				
BA-07a	In-situ soil	28/04/2023	Soil		X				
BA-08a	In-situ soil	28/04/2023	Soil		X				
BA-10a	In-situ soil	28/04/2023	Soil		X				

Analysis request	Method Code
1 TRH (C6-C40) / BTEXN / PAH / OC / OP / PCB / 8 Metals	S-16
2 Asbestos - in 50g Soil (Grab sample) presence/absence for free fibres	EA200G
3	
4	
5	
6	

[Redacted]	Accepted by / Affiliation	[Redacted]	Date
	/ Barnson	/ ALS Mudgee	01/05/2023

Eoby xl



CERTIFICATE OF ANALYSIS

Work Order : **ME2300803**
Client : **BARNSON**
Contact : Nardus Potgieter
Address : Unit 4 108-110 Market Street
MUDGEE NSW 2850
Telephone : 0429 464 067
Project : Soil
Order number : ----
C-O-C number : ----
Sampler : Client Sampler
Site : ----
Quote number : SY/053/14
No. of samples received : 14
No. of samples analysed : 14

Page : 1 of 13
Laboratory : Environmental Division Mudgee
Contact : Mary Monds (ALS Mudgee)
Address : 1/29 Sydney Road Mudgee NSW Australia 2850
Telephone : +61 2 6372 6735
Date Samples Received : 01-May-2023 10:35
Date Analysis Commenced : 02-May-2023
Issue Date : 08-May-2023 17:57



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
- Descriptive 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>
Alana Smylie	Team Leader - Asbestos	Newcastle - Asbestos, Mayfield West, NSW
Ankit Joshi	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.
- EG005: Poor precision was obtained for Copper on sample ES2314404-#007. Results have been confirmed by re-extraction and reanalysis.
- EG035: Positive Mercury results ME2300803 #2, 5, 6, 10 have been confirmed by reanalysis.
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Trace' - Asbestos fibres ("Free Fibres") detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200 Legend
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200: For samples larger than 30g, the <2mm fraction may be sub-sampled prior to trace analysis as outlined in ISO23909:2008(E) Sect 6.3.2-2
- EA200: 'Yes' - Asbestos detected by polarised light microscopy including dispersion staining.
- EA200: 'No*' - No asbestos found, at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining. Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg.
- EA200: 'No' - No asbestos found at the reporting limit 0.1g/kg, by polarised light microscopy including dispersion staining.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BA-01	BA-02	BA-03	BA-04	BA-05
Sampling date / time					28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00
Compound	CAS Number	LOR	Unit	ME2300803-001	ME2300803-002	ME2300803-003	ME2300803-004	ME2300803-005	
				Result	Result	Result	Result	Result	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%	11.9	9.0	4.8	7.7	7.7	
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg	11	<5	18	6	<5	
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1	
Chromium	7440-47-3	2	mg/kg	28	10	14	10	9	
Copper	7440-50-8	5	mg/kg	9	7	9	10	7	
Lead	7439-92-1	5	mg/kg	12	14	22	11	6	
Nickel	7440-02-0	2	mg/kg	12	7	7	9	5	
Zinc	7440-66-6	5	mg/kg	17	50	65	35	25	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg	<0.1	0.1	<0.1	<0.1	1.3	
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	BA-01	BA-02	BA-03	BA-04	BA-05
Sampling date / time				28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	
Compound	CAS Number	LOR	Unit	ME2300803-001	ME2300803-002	ME2300803-003	ME2300803-004	ME2300803-005	
				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	72-54-8/72-55-9/5 0-2	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	BA-01	BA-02	BA-03	BA-04	BA-05
Sampling date / time					28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00
Compound	CAS Number	LOR	Unit		ME2300803-001	ME2300803-002	ME2300803-003	ME2300803-004	ME2300803-005
					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	110	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	140	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	250	<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	BA-01	BA-02	BA-03	BA-04	BA-05
Sampling date / time				28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	
Compound	CAS Number	LOR	Unit	ME2300803-001	ME2300803-002	ME2300803-003	ME2300803-004	ME2300803-005	
				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	%	103	112	91.2	79.8	120	
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%	122	101	77.2	90.2	103	
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%	120	94.4	71.1	87.8	98.2	
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%	81.1	74.4	82.1	80.7	81.2	
2-Chlorophenol-D4	93951-73-6	0.5	%	85.1	80.2	85.7	84.2	85.3	
2,4,6-Tribromophenol	118-79-6	0.5	%	74.7	69.8	77.3	74.8	75.2	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%	101	96.5	99.8	99.3	98.3	
Anthracene-d10	1719-06-8	0.5	%	98.5	93.8	98.5	97.6	97.4	
4-Terphenyl-d14	1718-51-0	0.5	%	92.4	92.1	91.8	91.3	91.3	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%	87.3	92.8	91.6	89.5	86.3	
Toluene-D8	2037-26-5	0.2	%	99.2	102	103	94.8	72.8	
4-Bromofluorobenzene	460-00-4	0.2	%	114	119	122	122	132	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BA-06	BA-07	BA-08	BA-09	BA-10
Sampling date / time				28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	
Compound	CAS Number	LOR	Unit	ME2300803-006	ME2300803-007	ME2300803-008	ME2300803-009	ME2300803-010	
				Result	Result	Result	Result	Result	
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%	4.9	9.2	3.6	9.2	37.9	
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg	<5	7	<5	9	6	
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1	
Chromium	7440-47-3	2	mg/kg	5	18	4	20	15	
Copper	7440-50-8	5	mg/kg	<5	9	<5	12	32	
Lead	7439-92-1	5	mg/kg	5	19	7	33	40	
Nickel	7440-02-0	2	mg/kg	2	7	<2	10	24	
Zinc	7440-66-6	5	mg/kg	13	30	<5	95	1930	
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg	0.2	<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	BA-06	BA-07	BA-08	BA-09	BA-10
Sampling date / time				28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	
Compound	CAS Number	LOR	Unit	ME2300803-006	ME2300803-007	ME2300803-008	ME2300803-009	ME2300803-010	
				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	72-54-8/72-55-9/5 0-2	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	BA-06	BA-07	BA-08	BA-09	BA-10
Sampling date / time				28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	
Compound	CAS Number	LOR	Unit	ME2300803-006	ME2300803-007	ME2300803-008	ME2300803-009	ME2300803-010	
				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	%	81.3	94.3	87.4	76.2	120	
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%	76.9	80.4	90.8	73.1	76.3	
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%	71.7	80.8	84.8	72.4	67.3	
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%	80.1	81.0	80.2	81.6	83.1	
2-Chlorophenol-D4	93951-73-6	0.5	%	83.7	84.3	83.5	84.6	86.1	
2,4,6-Tribromophenol	118-79-6	0.5	%	73.6	72.6	74.8	78.4	86.6	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%	98.5	99.1	97.3	100	100	
Anthracene-d10	1719-06-8	0.5	%	97.6	98.5	97.8	99.4	97.8	
4-Terphenyl-d14	1718-51-0	0.5	%	91.2	91.9	90.5	92.7	91.2	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%	95.1	92.2	93.3	94.1	78.4	
Toluene-D8	2037-26-5	0.2	%	102	100	96.0	96.0	74.0	
4-Bromofluorobenzene	460-00-4	0.2	%	123	120	97.7	97.5	94.9	



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BA-02a	BA-07a	BA-08a	BA-10a	----
Sampling date / time					28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	28-Apr-2023 00:00	----
Compound	CAS Number	LOR	Unit		ME2300803-011	ME2300803-012	ME2300803-013	ME2300803-014	-----
					Result	Result	Result	Result	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils									
Asbestos Detected	1332-21-4	0.1	g/kg		No	No	No	No	----
Asbestos (Trace)	1332-21-4	5	Fibres		No	No	No	No	----
Asbestos Type	1332-21-4	-	--		-	-	-	-	----
Sample weight (dry)	----	0.01	g		248	227	250	288	----
APPROVED IDENTIFIER:	----	-	--		A. SMYLIE	A. SMYLIE	A. SMYLIE	A. SMYLIE	----
Synthetic Mineral Fibre	----	-	--		No	No	No	No	----
Organic Fibre	----	-	--		No	No	No	No	----

Analytical Results

Descriptive Results

Sub-Matrix: SOIL		
Method: Compound	Sample ID - Sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in Soils		
EA200: Description	BA-02a - 28-Apr-2023 00:00	Soil sample.
EA200: Description	BA-07a - 28-Apr-2023 00:00	Soil sample.
EA200: Description	BA-08a - 28-Apr-2023 00:00	Soil sample.
EA200: Description	BA-10a - 28-Apr-2023 00:00	Soil sample.



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 Newcastle, NATA accreditation no. 825, site no. 1656 (Chemistry) 9854 (Biology).

(SOIL) EA200: AS 4964 - 2004 Identification of Asbestos in Soils

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

(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) EP080/071: Total Petroleum Hydrocarbons

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

(SOIL) EP080: BTEXN

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

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

barnson.

APPENDIX C

Unexpected Finds Protocol

Unexpected Finds Protocol:

Many exposures to contaminated soil in the workplace occur when personnel unintentionally, disturb contaminated areas. In the event of a significant disturbance or unexpected find of suspected contaminated soil, materials or debris, the following steps and process, must be implemented;

1. Stop work, vacate the immediate area and alert a supervisor or person in control of the workplace/area.
2. Isolate the area and restrict access, ideally with a 5m exclusion zone.
 - a) Areas immediately surrounding the contaminated area, to be barricaded off (tape/bunting/temporary fencing).
 - b) During excavation - Areas immediately surrounding the excavation to be barricaded off (tape/bunting/temporary fencing).
 - c) Any stockpiled material from the excavation should be covered with tarps or plastic sheeting.
3. Undertake testing to determine contaminant concentrations.
4. Contact Barnson, if required, to assess the area, test the material and provide clear management recommendations.
5. In the event, testing concludes the materials to contain significant quantities of contaminants, initiate removal of the material by a suitable contractor working in accordance with Barnson recommendations including Safe Work NSW Code of Conduct.
7. If required, obtain a validation inspection after the remediation, to ensure the area is contaminant free and safe to access.

Guidance for unexpected asbestos at Work Sites:

Immediately stop work and secure the work area. Securing of the area should restrict access to and generation of dust from the affected areas. Securing of the work area should include (but is not limited to) as a minimum:

- For unexpected asbestos finds in buildings during demolition - All contractors to exit the building. Doors and windows to be shut.
- For unexpected asbestos finds in structures during demolition/removal - Structure should be covered with tarps or plastic sheeting and areas immediately surrounding the structure barricaded off (tape/bunting/temporary fencing).
- For unexpected asbestos finds across site surfaces - Areas immediately surrounding the surface ACM/PACM to be barricaded off (tape/bunting/temporary fencing).
- For unexpected asbestos finds during excavation - Areas immediately surrounding the excavation to be barricaded off (tape/bunting/temporary fencing). Any stockpiled material from the excavation should be covered with tarps or plastic sheeting.