

## Preliminary contamination investigation

99 Mount Pleasant Lane, Buckaroo NSW



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## **Summary report**

### **Background**

Five accommodation cabins are proposed for 99 Mount Pleasant Lane, Buckaroo NSW. The development area is approximately 3,600m<sup>2</sup>. The development area has a mixed-use agricultural history comprising pasture and vineyard.

An investigation of the development area is required to determine soil contamination status and suitability for the proposed land-use.

### **Objectives of investigation**

The objective of the investigation was to determine suitability of the development area for the proposed land-use.

### **Scope**

The scope was to identify past potentially contaminating activities, identify potential contamination types, discuss the site condition, provide an assessment of site contamination and assess the need for remediation or suitability for residential land-use. The scope of works included site inspection, review of available information, soil sampling and analysis.

### **Summary**

An inspection of the development area was made on the 16 June 2022. The development area was vacant pasture on the day of inspection with a mixed agriculture land-use history comprising grazing and vineyard.

Soil samples were collected from the development area from the 0-100mm soil depth for analysis of metals and organochlorine pesticides.

No building or infrastructure was located on the development area. Vegetation on the development area was 100% and dominated by slender rats tail grass, clover and paspalum. No signs of visible contamination such as discolouration or staining was identified on the surface of the development area. Vegetation on the development area was not showing signs of stress.

The historical parish maps include the notation "Gulgong Gold Fields" on the development area. No evidence of mining activities was identified on the development area in historical imagery or during the site inspection. No evidence of fill, sheep dips, mixing sheds or contaminating industrial activities were identified at the development area.

Levels of copper in one soil sample slightly exceeded the ecological investigation level. No impact was observed on potential receptors.

The soil sampling program did not detect elevated levels of other analysed metals across the development area. OCP were not detected in the soil samples collected. The levels of all substances evaluated were below the adopted thresholds for residential land-use with access to soil.

### **Recommendations**

The development area is suitable for residential land-use including accommodation cabins.

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## 1. Introduction

Five accommodation cabins are proposed for 99 Mount Pleasant Lane, Buckaroo NSW. The development area is approximately 3,600m<sup>2</sup>. The development area has a mixed-use agricultural history comprising pasture and vineyard.

An investigation of the development area is required to determine soil contamination status and suitability for the proposed land-use.

## 2. Objectives

The objective of the investigation was to determine suitability of the development area for the proposed land-use.

## 3. Scope of work

Envirowest Consulting Pty Ltd was commissioned by Michael and Emma Ferris to undertake a preliminary contamination investigation, in accordance with the contaminated land management planning guidelines, from the *Contaminated Land Management Act 1997* and the *State Environmental Policy No. 55 (SEPP 55)*, of the proposed development area at 99 Mount Pleasant Lane, Buckaroo NSW. The scope of works included site inspection, review of available information, soil sampling and analysis.

## 4. Site identification

Address	99 Mount Pleasant Lane Buckaroo NSW
Deposited plans	Lot 147 DP755418
Latitude and longitude	-32.56° 149.63°
Geographic coordinates	55H E746503m N6393903m
Client	Michael and Emma Ferris
Owner	Michael and Emma Ferris
Current occupier	Michael and Emma Ferris
Area	Lot 11.5ha Development area approximately 3,600m <sup>2</sup>
Local government area	Mid-Western Regional Council
Current zoning	RU4 – Primary Production Small Lots (Mid-Western Regional LEP 2012)
Trigger for investigation	Change in land-use
Locality map	Figure 1

## **5. Site history**

### **5.1 Land-uses**

The development area is currently vacant pasture. The development area has a mixed-use agricultural history comprising grazing and vineyard.

### **5.2 Summary of council records**

The development area is identified as an area of vulnerable groundwater on the Groundwater Vulnerability Map (Mid-Western LEP 2012).

### **5.3 EPA databases**

The site is not listed on the NSW EPA register of contaminated sites (7 July 2022) or sites notified to the EPA (7 July 2022).

No sites listed on NSW EPA register of contaminated sites or sites notified to the EPA have been identified within 1km of the site.

### **5.4 Safework NSW Storage of hazardous chemicals**

A search of the SafeWork dangerous goods database was considered not necessary as no use of fuels was indicated from the searches and past land-uses.

### **5.5 POEO public register**

The site is not listed on the NSW EPA POEO public register. No sites listed on NSW EPA POEO public register have been identified within 1km of the site.

### **5.6 Other government agency databases**

The site is not listed on the following databases:

- National Liquid Fuel Facilities database
- The NSW Government PFAS Investigation Program
- Defence PFAS Investigation Program
- Defence PFAS Management Program
- Defence 3 Year Regional Contamination Investigation Program
- Airservices Australia National PFAS Management Program

No sites listed on government agency databases have been identified within 1km of the investigation area.

### **5.7 Sources of information**

Site inspection 16 June 2022 by Leah Desborough of Envirowest Consulting Pty Ltd

NSW EPA records of public notices under the CLM Act 1997

Soil and geological maps

Historical aerial photographs (1964, 1971, 1980, 1988, 1990, 1994, 2003, 2009, 2013, 2015, 2017, 2018, 2020, 2021) including NSW Government historical imagery and Google Earth

Mid-Western Regional LEP 2012

## **5.8 Review of historic aerial photographs, maps and plans**

### **5.8.1 Aerial photographs**

Year	Comment
1964	Scattered trees are located on the development area. The development area appears to be part of a larger holding extending to the south and east. The land-use appears agricultural potentially grazing.
1971	No significant changes to the development area.
1980	No significant changes to the development area.
1988	No significant changes to the development area.
1990	No significant changes to the development area.
1994	No significant changes to the development area. The development area and locality appear dry due to climatic stress
2003	Scattered trees have been removed. Intensive agriculture assumed vineyard is located on the development and surrounding area.
2009	No significant changes to the development area.
2013	No significant changes to the development area.
2015	No significant changes to the development area.
2017	No significant changes to the development area.
2018	No significant changes to the development area.
2020	No significant changes to the development area.
2021	Vineyard has been removed. Small areas of disturbance are located in the development area assumed due to removal of vineyard infrastructure.

### **5.8.2 Topographic maps**

The 1979 topographic map based in 1971 aerial and field revision in 1977 depicts the development area as scattered timber. The 1987 topographic map based on 1980 field revision depicts the development area as agricultural with a power transmission line traversing the site north to south.

The current topographic map (Six Maps) depicts the development areas as horticultural.

### **5.8.3 Historical parish maps**

The 1884 historical parish map indicates the development area was part of a temporary common.

The 1895, 1905, 1911 and 1921 historical parish map indicates the development area was part of 30 acres owned by Joseph Boyling Jr. The portion and surrounding area include the notation "Gulgong Gold Fields".

The 1931 historical parish map indicates the development area was part of 30 acres sold by Joseph Boyling Jr and purchased by Abernathy. The 1961 and 1967 historical parish maps show the site is owned by Percy Abernathy. The portion and surrounding area include the notation "Gulgong Gold Fields".

## **5.9 Chronological list of site uses**

The current owner purchased the property in approximately 1995. The site was reportedly cleared and grape vines were planted soon after the purchase of the property. In 2006, the decision was made to stop maintaining, irrigating and spraying the vines in the development and surrounding areas. The vines and associated irrigation infrastructure were removed in 2020. The development area was vacant pasture on the day of inspection.

No mining infrastructure was identified.

No sheep dips, mixing sheds, underground storage tanks (UST) or contaminating industrial activities have been identified as occurring on the site from the site history.

### **5.10 Heritage listings**

The site is not listed on the following government heritage databases:

- Commonwealth Heritage List
- National Heritage List
- State Heritage Register
- Local Environmental Plan (Mid-Western LEP 2012)

The development area is identified as being within 1km of one general item being the Mudgee Cemetery (I376) on the Mid-Western LEP (2012) heritage map. The historical site is not expected to have impacted on the contamination status of the site.

No items listed on the Commonwealth Heritage List, National Heritage List or State Heritage Register are located within 1km of the site.

### **5.11 Buildings and infrastructure**

No buildings or infrastructure were identified in the development area.

### **5.12 Spills, losses or discharges**

No records for spills or losses on the site were available. No records for discharges to land, water or air were available.

### **5.13 Relevant complaint history**

None expected

### **5.14 Previous investigations**

A previous investigation was undertaken in 2021 on the neighbouring parcel to the east (Envirowest Consulting Pty Ltd report number R12670c). The parcels are considered part of the one property. The 2021 investigation recommended the building envelope is suitable for the proposed residential land-use.

No previous investigations are known have been undertaken on 99 Mount Pleasant Lane.

### **5.15 Historical neighbouring land-use**

North – Grape vines

South – Grape vines

East – Grape vines

West – Grape vines, Mudgee Cemetery

Historical neighbouring land-uses may have impacted on the site.

### **5.16 Contaminant sources**

The historic vineyard land-use is likely to have resulted in application of pesticides and fertilisers in routine management. Fertilisers applied may contain heavy metal contaminants. Organochlorine pesticides may have been applied in general management of vineyard and pastures. No bio solids are known to have been applied to the site.

The historical parish maps include the notation “Gulgong Gold Fields” on the development area. No evidence of mining activities was identified on the development area during the site inspection.



### **5.17 Contaminants of concern**

Based on historical activities and site inspection the contaminants of concern associated with the development area:

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead and zinc)
- Organochlorine pesticides (OCP)

### **5.18 Integrity assessment**

The site history was obtained from a site inspection and history review. The information is consistent with the current site condition and to the best of the assessor's knowledge is accurate.

## **6. Site condition and surrounding environment**

### **6.1 Site inspection**

The site was inspected by Leah Desborough, Senior Environmental Scientist with Envirowest Consulting Pty Ltd on 16 June 2022.

### **6.2 Land-use**

The development area was vacant pasture at the time of inspection.

### **6.3 Current neighbouring land-use**

North – Grazing

South – Grazing

East – Grazing

West – Grazing, Mudgee Cemetery

### **6.4 Surface cover and vegetation**

Vegetation cover on the development area was 100% dominated by slender rates tail grass, clover and paspalum.

### **6.5 Evidence of visible contamination**

No signs of visible contamination such as discolouration or staining was identified on the surface of the development area. Vegetation on the development area was not showing signs of stress.

No evidence of mining activities was identified on the development area during the site inspection.

No evidence of fill, sheep dips, mixing sheds or contaminating industrial activities was identified at the development area.

No signs of settlement or subsidence was identified on the development area.

### **6.6 Topography**

The morphology on-site is a mid-slope. The site was very gently inclined slope of 1% to the south west. Elevation is approximately 478 to 480 metres above sea level.

### **6.7 Soils and geology**

The site is within the Craigmores Soil Landscape (NSW Government nd). Soils in the Craigmores Soil Landscape are dominated by non-calcic brown soils occurring on the alluvial terraces with Red Earths co-dominant. Non-calcic brown soils comprise dark reddish brown fine sandy loam to loam topsoil with a clear change to reddish brown light clay subsoil.

The geological unit is Cainozoic Undifferentiated unconsolidated quartz and quartz lithic gravel, sand, silt, clay (NGMA 2000). Sources of alluvium are mostly metasediments of the Capertee Rise ((NSW Government nd).

## **6.8 Water**

### **6.8.1 Surface water**

Surface water is expected to infiltrate or flow south west.

### **6.8.2 Groundwater**

No groundwater bores were located on the development area. One registered groundwater bore identified within 500m of the development area on the NSW Government Water NSW website (2020). The bore is licenced for irrigation. Water-bearing zone (WBZ) was from 61m and standing water level was at 28m.

<b>No.</b>	<b>Date drilled</b>	<b>Location</b>	<b>SWL (m)</b>	<b>Use</b>	<b>Status</b>
GW800941	1997	200m SW	28	Irrigation	-

## **6.9 Evidence of possible naturally occurring contaminants**

No natural sources of PAH were identified.

The site is not mapped as an acid sulphate soil risk (State Government of NSW and Department of Planning, Industry and Environment 1998).

The site is not mapped as a geological unit with asbestos potential (State Government of NSW and Department of Regional New South Wales 2015).

## **6.10 Environmentally sensitive features or habitats**

The development area is identified as an area of vulnerable groundwater on the Groundwater Vulnerability Map (Mid-Western LEP 2012). No additional environmentally sensitive features or habitats are located on the development area.

Vegetation along Mt Pleasant Lane is identified as high biodiversity sensitivity on the Sensitivity Biodiversity Map (Mid-Western LEP 2012).

## **6.11 Integrity assessment**

The site history was obtained from a site inspection and history review. The information is consistent with the current site condition and to the best of the assessor's knowledge is accurate.

## **7. Conceptual site model**

### **7.1 Contaminant sources**

Potential exists for contaminating activities to have been undertaken on the development area which may impact on the suitability for the proposed land-use. The historic mixed agricultural land-use comprising vineyard and pasture may have resulted in application of pesticides, fertilisers and contaminating activities to the development area.

### **7.2 Contaminants of concern**

Based on historical activities and site inspection the contaminants of concern associated with the development area are:

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead and zinc)
- Organochlorine pesticides (OCP)

### **7.3 Potential receptors**

The proposed land-use of the site is five accommodation cabins and is expected to include hard surface areas comprising driveways and landscaped areas. The proposed land-use is considered residential in accordance with NEPM (1999). The site has historically been used for mixed agriculture.

Human receptors include:

- Visitors (adults and children)
- Site workers
- Construction workers
- Intrusive maintenance workers

Ecological receptors include

- Flora and fauna on the site and adjacent to the site
- Aquatic flora and fauna receptors off-site

### **7.4 Exposure pathways**

Pathways for exposure to contaminants are:

- Dermal contact following soil disturbance
- Ingestion and inhalation after soil disturbance
- Surface water and sediment runoff into waterways
- Leaching of contaminants into the groundwater
- Direct contact of flora and fauna with the soil

### **7.5 Source receptor linkages**

Potential source pathway receptor linkages are identified to enable evaluation of any adverse impact on human health or ecology.

The proposed land-use of the site is residential and human receptors to the investigation area are likely. Proposed users of the site may have a risk of exposure if contaminants are present and the soil is disturbed. Construction workers, residents, visitors and intrusive maintenance workers to the site may potentially be receptors to soil contaminants through direct contact to soil which includes ingestion and dermal contact.

Inhalation may occur as a result of soil disturbance and dust production. Major soil disturbance before and after the development of the site is considered unlikely. Soil disturbance during construction and development of the site is expected to be accompanied by erosion control measures which will reduce the incidence of dust production.

Vegetation on the site may be potential receptors to soil contamination through direct uptake of contaminants.

The source receptor linkage to aquatic organisms and ecosystems is considered incomplete as the site is well vegetated and movement of sediments from the site is unlikely. During construction work it is expected that erosion control measures will be implemented and movement of sediment off site will be unlikely. Following development of the site it is expected that vegetation will be re-established which will control sediment movement from the site.

Groundwater is not identified as a potential receptor to contamination. Contaminants are expected to originate from the soil surface and groundwater levels in the locality are at depths greater than 28m below the soil surface. A clay subsoil layer reduces infiltration of water through the soil profile.

Source/contaminants	Transport	Potential exposure pathways	Receptors
<input checked="" type="checkbox"/> Use of pesticides and fertilisers (heavy metals and OCP)	<input type="checkbox"/> Wind <input type="checkbox"/> Sedimentation <input type="checkbox"/> Groundwater <input type="checkbox"/> Surface water <input type="checkbox"/> Volatilisation	<input checked="" type="checkbox"/> Direct contact (ingestion and absorption) (human and environment) <input checked="" type="checkbox"/> Inhalation <input checked="" type="checkbox"/> Runoff <input checked="" type="checkbox"/> Leaching	<input checked="" type="checkbox"/> Visitors (adults and children) <input checked="" type="checkbox"/> Construction workers <input checked="" type="checkbox"/> Intrusive maintenance workers <input checked="" type="checkbox"/> Terrestrial flora and fauna <input type="checkbox"/> Aquatic flora and fauna

☒ Potential, ☐ unknown/unlikely

## 8. Data quality objectives (DQO)

### 8.1 State the problem

Five accommodation cabins are proposed for the development area. Accommodation cabins with areas of garden and hard surfaces are expected. The site has historically been used for mixed agriculture which may have resulted in application of pesticides, fertilisers and contaminating activities to the development area.

### 8.2 Identify the decision

Five accommodation cabins are proposed for the development area. Residential land-use is considered the most appropriate land-use and the levels of contaminants should be less than the thresholds listed in Section 11. The decision problem is, do the levels of potential contaminants exceed the assessment criteria listed in Section 11.

### 8.3 Identify the inputs decision

Investigations of the site is required to identify any potential contaminants from historical land-use.

### 8.4 Define the boundaries of the study

The investigation area is a 3,600m<sup>2</sup> development area located at 99 Mount Pleasant Lane, Buckaroo NSW.

### 8.5 Develop a decision rule

The initial guidelines for soil were the health and ecological investigation levels for residential land-use (NEPC 1999).

If soil contamination was identified then the contaminant source and extent of contamination was determined.

### 8.6 Specify acceptable limits on the decision errors.

The 95% upper confidence limit of average levels of samples collected is less than the threshold levels and the results are less than 250% of relevant thresholds.

### 8.7 Optimize the design for obtaining data

The site was investigated by collecting soil samples from the nominated development area on an approximate 20m grid pattern and combine to form composite samples. Composite samples were analysed for heavy metals and discrete soil samples were analysed for organochlorine pesticides (OCP).

## **9. Sampling analysis plan and sampling methodology**

### **9.1 Sampling strategy**

#### **9.1.1 Sampling design**

Visual inspections were undertaken over the site for indicators of contamination.

A systematic sampling pattern was adopted to assess the probable location of contamination. Uniform management practices are expected to have occurred across the development area. The development area has been historically managed as part of a single unit and is expected to have been treated similarly.

#### **9.1.2 Sampling locations**

Discrete soil samples were collected from the development area on the site on an approximate 20m grid pattern. Four discrete samples were combined to form a composite soil sample. A total of twelve discrete soil samples were collected and combined to form three composite samples for analysis of heavy metals. Three discrete samples were analysed for OCP.

The sampling locations are described in Figure 2.

#### **9.1.3 Sampling density**

The sampling density can detect a potential hot spot across the site with a radius of 12m at a 95% level of confidence.

The sampling frequency is in accordance with the minimum recommended by EPA (1995).

#### **9.1.4 Sampling depth**

Any heavy metals or persistent pesticides present are generally immobile and expected to be contained in the 0 to 100mm which was the target sampling depth as minimal soil disturbance has occurred.

### **9.2 Analytes**

Composite soil samples collected from the development area were evaluated for arsenic, cadmium, chromium, copper, lead, nickel and zinc. Discrete soil samples were evaluated for organochlorine pesticides (OCP). Heavy metals and OCP were identified as the contaminants of concern possibly present as a result of historical mixed agricultural activities.

### **9.3 Sampling methods**

Soil samples were taken using a stainless steel hand spade. Soil was taken at each individual sampling location below the vegetative and detrital layer.

The soil was transferred to a clean plastic bag, mixed and transferred to a solvent rinsed glass jar with a Teflon lid. Four discrete samples were combined to create each composite sample for chemical analysis. Discrete soil samples were transferred directly to a solvent rinsed glass jar with a Teflon lid.

Tools were decontaminated between sampling locations to prevent cross contamination by: brushing to remove caked or encrusted material, rinsing with clean tap water and allowing to air dry or using a clean towel.

Soil sampling protocols are outlined in Appendix 4.

## 10. Quality assurance and quality control

### 10.1 Sampling design

The sampling program is intended to provide data as to the presence and levels of contaminants.

Discrete soil samples were collected from the development area on a systematic grid pattern of approximately 20 metres. This sampling density will enable the detection of an area with an elevated concentration on a radius of 12m with a 95% confidence level.

The number of sampling locations is in accordance with the recommended density in the EPA sampling guidelines.

### 10.2 Field

The collection of samples was undertaken in accordance with accepted standard protocols (NEPC 1999). Composite sampling was undertaken to reduce the cost of chemical analysis. Combining equal amounts from four discrete samples created the composite samples. A composite sample represents the average concentration of the sub-sample.

The rules for composite sampling were observed (EPA 1995). All composite samples were analysed for arsenic, cadmium, chromium, copper, lead, nickel and zinc. Selected discrete soil samples collected from the development area were analysed for OCP.

Sampling equipment was decontaminated between each sampling event. The appropriate storage conditions and duration were observed between sampling and analysis. A chain of custody form accompanied the samples to the laboratory (Appendix 3).

A single sampler was used to collect the samples using standard methods. Soil collected was a fresh sample from drill tip. After collection the samples were immediately placed in new glass sampling jars and placed in a cooler.

One duplicate sample was collected. No field blank, rinsate, trip blank or matrix spikes were submitted for analysis. Some samples from all batches did not contain contaminants which confirm the absence of cross contamination during transport and storage. Some samples in the sampling batch did not form part of the investigation.

A field sampling log is presented in Appendix 2.

**Table 1.** Schedule of samples and analyses

Sample ID	Discrete sample ID	Depth (mm)	Analysis undertaken
MF1	11, 12, 13, 14	0-100	Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn)
MF2	21, 22, 23, 24	0-100	As, Cd, Cr, Cu, Pb, Ni, Zn
MF3	31, 32, 33, 34	0-100	As, Cd, Cr, Cu, Pb, Ni, Zn
MF11D	11	0-100	Organochlorine pesticides (OCP)
MF21D	21	0-100	OCP
MF31D	31	0-100	OCP

### 10.3 Laboratory

Chemical analysis was conducted by SGS Laboratories, Alexandria, which is NATA accredited for the tests undertaken. The laboratories have quality assurance and quality control programs in place, which include internal replication and analysis of spike samples and recoveries.

Method blanks, matrix duplicates and laboratory control samples were within acceptance criteria. The quality assurance and quality control report is presented together with the laboratory report as Appendix 3.

#### 10.4 Data evaluation

The laboratory quality control report indicates the data variability is within acceptable industry limits. The data is considered representative and usable for the purposes of the investigation. Data quality indicators are presented in Appendix 1.

### 11. Assessment criteria

The proposed land-use is accommodation cabins. The laboratory results were assessed against the proposed land-use of residential (HIL A) which is considered the most appropriate land-use category. The health-based investigation levels of contaminants in the soil for residential sites, for the substances for which criteria are available, are listed in Table 3, as recommended in the NEPC (1999).

Ecological investigation levels (EIL) have been developed for the protection of terrestrial ecosystems for selected metals and organic substances in the soil in the guideline (NEPC 1999). The EILs consider the properties of the soil and contaminants and the capacity of the local ecosystem to accommodate increases in contaminant levels.

Typical CEC value for the site is >10 to 20cmol(+)/kg, clay content of 40%, pH values of between 4.5 and 5 and organic carbon of 4% (NSW Government nd). The proposed land-use is residential (urban residential areas and open space). The contaminants have been identified in the soil for at least two years and are considered aged.

EILs vary with land-use and apply to contaminants up to 2m depth below the surface. The EILs for residential land-use are listed in Table 3.

The investigation threshold was adjusted to enable the detection of an individual location being diluted in the composting process (EPA 1995). For composite sampling, the analyte result was divided against the number of discrete samples making up the composite. This is based on a worst-case scenario in which one sample has a high concentration whilst other discrete samples have zero concentration. This is a conservative approach.

**Table 2.** EIL Calculation sheet, residential land-use

Analyte	Rationale	EIL (mg/kg)
Arsenic	Generic	100
Chromium (III)	Clay content 40%	580
Copper	CEC 20cmol/kg, pH 5, organic carbon 4%	150
Lead	Generic	1,100
Nickel	CEC 20cmol/kg	350
Zinc	CEC 20cmol/kg, pH 5	350

Chromium is analysed as total chromium which is the sum of chromium (III) and chromium (VI). Chromium (VI) is a potential contaminant from industrial processes including ferrochrome production, electroplating, pigment production and tanning (WHO 1998). Chromium (VI) is reduced to chromium (III) when it comes into contact with organic matter in biota, soil and water. Chromium in the environment is present in the trivalent state (WHO 1998).

**Table 3.** Soil investigation levels (mg/kg) (NEPC 1999) for residential land-use

Analyte	HIL A Residential		EIL Urban Residential and public open space	
	Composite	Discrete	Composite	Discrete
Arsenic	25	100	25	100
Cadmium	5	20	-	-
Chromium (total)	25 <sup>1</sup>	100 <sup>1</sup>	160 <sup>2</sup>	640 <sup>2</sup>
Copper	1,500	6,000	25	100
Lead	75	300	275	1,100
Nickel	100	400	67.5	270
Zinc	1,850	7,400	65	260
OCP (total)	-	-	-	-
DD's	-	240	-	180

HIL – health investigation level, EIL – ecological investigation level, <sup>1</sup> Threshold for Chromium (VI), <sup>2</sup> Threshold for Chromium (III)

## 12. Results and discussion

The development area was vacant pasture on the day of inspection. The development area has a historical mixed agricultural land-use comprising grazing and vineyard.

No building or infrastructure was located on the development area. Vegetation on the development area was 100% and dominated by slender rats tail grass, clover and paspalum. No signs of visible contamination such as discolouration or staining was identified on the surface of the development area. Vegetation on the development area was not showing signs of stress.

The historical parish maps include the notation “Gulgong Gold Fields” on the development area. No evidence of mining activities was identified on the development area in historical imagery or during the site inspection.

No evidence of fill, sheep dips, mixing sheds or contaminating industrial activities were identified at the development area.

Levels of copper in composite sample MF2C was 30mg/kg which is above the ecological investigation level of 25mg/kg (Table 4). Vegetation was identified in the conceptual site model as a potential receptor to contamination. Vegetation on the development area was 100% and not showing signs of impact from elevated copper levels or stress. Levels of copper in the soil are not expected to be impacting on vegetation. No other ecological receptors were identified.

Levels of remaining heavy metals in all samples collected from the development area were near environmental background levels and less than the adopted thresholds for human health and the environment (Table 4).

The level of OCP in all soil samples collected from the site were below the level of detection and less than the adopted thresholds for human health and environment (Table 4).



**Table 4.** Analytical results and threshold concentrations, metals and OCP (mg/kg)

Sample ID Figure 3	Sample Type	Arsenic	Cadmium	Chromium (total)	Copper	Lead	Nickel	Zinc	OCP (total)	DD' s
MF1C	Composite	3	<0.3	20	11	9	4.4	8	-	-
MF2C	Composite	3	<0.3	17	<b>30</b>	6	3.2	14	-	-
MF3C	Composite	3	<0.3	21	20	9	4.8	15	-	-
MF11D	Discrete	-	-	-	-	-	-	-	<1	<0.6
MF21D	Discrete	-	-	-	-	-	-	-	<1	<0.6
MF31D	Discrete	-	-	-	-	-	-	-	<1	<0.6
<b>Health Investigation Level- Residential land-use threshold (NEPC 1999)</b>										
<i>Composite</i>		25	5	25	1,500	75	100	1,850	-	-
<i>Discrete</i>		100	20	100 <sup>1</sup>	6,000	300	400	7,400	-	240
<b>Ecological Investigation Level- Urban residential and public open space land-use threshold (NEPC 1999)</b>										
<i>Composite</i>		25	-	160	25	275	67.5	65	-	-
<i>Discrete</i>		100	-	640	100	1,100	270	260	-	180

<sup>1</sup> Chromium (IV), <sup>2</sup> Chromium (III)

### 13. Site characterisation

#### 13.1 Environmental contamination

Levels of copper exceeded the EIL for residential land-use.

#### 13.2 Chemical degradation production

Heavy metals do not degrade.

#### 13.3 Exposed population

##### 13.3.1 Human health

All potential contaminants were less than the HIL.

##### 13.3.2 Ecological

Potential ecological receptors identified in the conceptual site model was vegetation. Vegetation on the site was 100% and dominated by slender rats tail grass, clover and paspalum. No adverse indicators of exposure to elevated copper in the soil was observed in the vegetation. The levels of copper are not expected to be impacting on vegetation growth. No other ecological receptors were identified.

### 14. Conclusions and recommendations

#### 14.1 Summary

An inspection of the development area was made on the 16 June 2022. The development area was vacant pasture on the day of inspection with a mixed agriculture land-use history comprising grazing and vineyard.

Soil samples were collected from the development area from the 0-100mm soil depth for analysis of metals and organochlorine pesticides.

No building or infrastructure was located on the development area. Vegetation on the development area was 100% and dominated by slender rats tail grass, clover and paspalum. No signs of visible

contamination such as discolouration or staining was identified on the surface of the development area. Vegetation on the development area was not showing signs of stress.

The historical parish maps include the notation “Gulgong Gold Fields” on the development area. No evidence of mining activities was identified on the development area in historical imagery or during the site inspection. No evidence of fill, sheep dips, mixing sheds or contaminating industrial activities were identified at the development area.

Levels of copper in one soil sample slightly exceeded the ecological investigation level. No impact was observed on potential receptors.

The soil sampling program did not detect elevated levels of other analysed metals across the development area. OCP were not detected in the soil samples collected. The levels of all substances evaluated were below the adopted thresholds for residential land-use with access to soil.

#### **14.2 Assumptions in reaching the conclusions**

It is assumed the sampling sites are representative of the site. An accurate history has been obtained and typical past farming practices were adopted.

#### **14.3 Extent of uncertainties**

The analytical data relate only to the locations sampled. Soil conditions can vary both laterally and vertically and it cannot be excluded that unidentified contaminants may be present. The sampling density was designed to detect a ‘hot spot’ with a radius of approximately 12m and with a 95% level of confidence.

#### **14.4 Suitability for proposed use of the site**

The development area is suitable for residential land-use including accommodation cabins.

#### **14.5 Limitations and constraints on the use of the site**

No constraints are recommended.

#### **14.6 Recommendation for further work**

No further investigations are required.

## **15. Report limitations and intellectual property**

This report has been prepared for the use of the client to achieve the objectives given the clients requirements. The level of confidence of the conclusion reached is governed by the scope of the investigation and the availability and quality of existing data. Where limitations or uncertainties are known, they are identified in the report. No liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been predicted using the scope of the investigation and the information obtained.

The investigation identifies the actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing is interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of the contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how well qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock or time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. It is thus important to understand the limitations of the investigation and recognise that we are not responsible for these limitations.

This report, including data contained and its findings and conclusions, remains the intellectual property of Envirowest Consulting Pty Ltd. A licence to use the report for the specific purpose identified is granted for the persons identified in that section after full payment for the services involved in preparation of the report. This report should not be used by persons or for purposes other than those stated and should not be reproduced without the permission of Envirowest Consulting Pty Ltd.

## 16. References

Environment Protection Authority (2020) *Consultants reporting on contaminated land* (NSW Environment Protection Authority, Chatswood)

EPA (2017) *Contaminated Sites: Guidelines for the NSW Site Auditors Scheme* (NSW Department of Environment and Conservation, Chatswood)

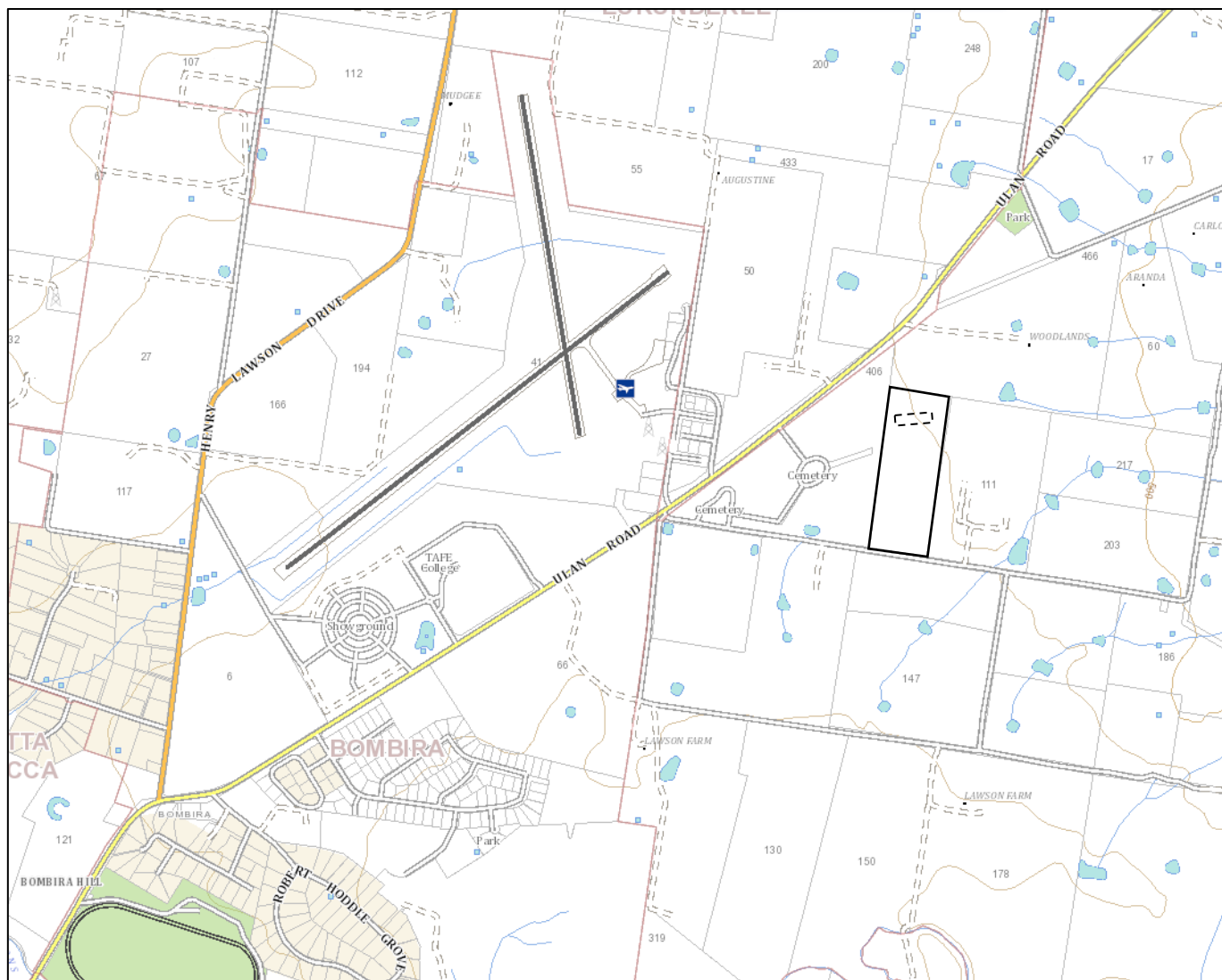
NEPC (1999 revised 2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council Service Corporation, Adelaide)

NSW Government (nd) eSpadev2 (<https://www.environment.nsw.gov.au/eSpade2WebApp>)

State Government of NSW and Department of Regional New South Wales (2015) *Naturally occurring asbestos*, viewed 8 June 2022 ([datasets.seed.nsw.gov.au/dataset/naturally-occurring-asbestos](https://datasets.seed.nsw.gov.au/dataset/naturally-occurring-asbestos))

State Government of NSW and Department of Planning, Industry and Environment (1998) *Acid sulphate soils risk*, viewed 8 June 2022 ([datasets.seed.nsw.gov.au/dataset/ acid-sulfate-soils-risk0196c](https://datasets.seed.nsw.gov.au/dataset/acid-sulfate-soils-risk0196c))

## Figures

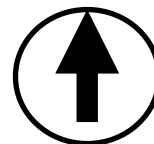


— Lot boundary  
 [ ] Development area

99 Mount Pleasant Lane, Buckaroo NSW



Date: 06/07/2022



### Legend

- Lot boundary
- Development area
- ⊗ Sampling location

Approximate Scale 1: 2500



**Figure 2.** Site layout and sampling locations

99 Mount Pleasant Lane, Buckaroo NSW



Envirowest Consulting Pty Ltd

Job: R14453c

Drawn by: TS

Date: 06/07/2022

**Figure 4.** Photographs of the site



Photograph taken looking south west



## Appendices

## Appendix 1. Sample analysis, quality assurance and quality control (QAQC) report

### 1. Data quality indicators (DQI) requirements

#### 1.1 Completeness

A measure of the amount of usable data for a data collection activity. Greater than 95% of the data must be reliable based on the quality objectives. Where greater than two quality objectives have less reliability than the acceptance criterion the data may be considered with uncertainty.

##### 1.1.1 Field

Consideration	Requirement
Locations and depths to be sampled	Described in the sampling plan. The acceptance criterion is 95% data retrieved compared with proposed. Acceptance criterion is 100% in crucial areas.
SOP appropriate and compiled	Described in the sampling plan.
Experienced sampler	Sampler or supervisor
Documentation correct	Sampling log and chain of custody completed

##### 1.1.2 Laboratory

Consideration	Requirement
Samples analysed	Number according to sampling and quality plan
Analytes	Number according to sampling and quality plan
Methods	EPA or other recognised methods with suitable PQL
Sample documentation	Complete including chain of custody and sample description
Sample holding times	Metals 6 months, OCP 14 days

#### 1.2 Comparability

The confidence that data may be considered to be equivalent for each sampling and analytical event. The data must show little or no inconsistencies with results and field observations.

##### 1.2.1 Field

Consideration	Requirement
SOP	Same sampling procedures to be used
Experienced sampler	Sampler or supervisor
Climatic conditions	Described as may influence results
Samples collected	Sample medium, size, preparation, storage, transport

##### 1.2.2 Laboratory

Consideration	Requirement
Analytical methods	Same methods, approved methods
PQL	Same
Same laboratory	Justify if different
Same units	Justify if different

#### 1.3 Representativeness

The confidence (expressed qualitatively) that data are representative of each media present on the site.

##### 1.3.1 Field

Consideration	Requirement
Appropriate media sampled	Sampled according to sampling and quality plan or in accordance with the EPA (1995) sampling guidelines.
All media identified	Sampling media identified in the sampling and quality plan. Where surface water bodies on the site sampled.

### 1.3.2 Laboratory

Consideration	Requirement
Samples analysed	Blanks

### 1.4 Precision

A quantitative measure of the variability (or reproduced of the data). Is measured by standard deviation or relative percent difference (RPD). An RPD analysis is calculated and compared to the practical quantitation limit (PQL) or absolute difference AD.

- Levels greater than 10 times the PQL the RPD is 50%
- Levels between 5 and 10 times the PQL the RPD is 75%
- Levels between 2 and 5 times the PQL the RPD is 100%
- Levels less than 2 times the PQL, the AD is less than 2.5 times the PQL

Data not conforming to the acceptance criterion will be examined for determination of suitability for the purpose of site characterisation.

#### 1.4.1 Field

Consideration	Requirement
Field duplicates	Frequency of 5%, results to be within RPD or discussion required indicate the appropriateness of SOP

#### 1.4.2 Laboratory

Consideration	Requirement
Laboratory and inter lab duplicates	Frequency of 5%, results to be within RPD or discussion required. Inter laboratory duplicates will be one sample per batch.
Field duplicates	Frequency of 5%, results to be within RPD or discussion required
Laboratory prepared volatile trip spikes	One per sampling batch, results to be within RPD or discussion required

### 1.5 Accuracy

A quantitative measure of the closeness of the reported data to the true value.

#### 1.5.1 Field

Consideration	Requirement
SOP	Complied
Inter laboratory duplicates	Frequency of 5%. Analysis criterion 60% RPD for levels greater than 10 times the PQL 85% RPD for levels between 5 to 10 times the PQL 100% RPD at levels between 2 to 5 times the PQL Absolute difference, 3.5 times the PQL where levels are, 2 times PQL

#### 1.5.2 Laboratory

Recovery data (surrogates, laboratory control samples and matrix spikes) data subject to the following control limits:

- 60-140% acceptable data
- 20-60% discussion required, may be considered acceptable
- 10-20% data should considered as estimates
- 10% data should be rejected

Consideration	Requirement
Field blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Rinsate blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Method blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	Frequency of 5%, results to be within +/-40% or discussion required
Matrix duplicates	Sample injected with a known concentration of contaminants with tested. Frequency of 5%, results to be within +/-40% or discussion required
Surrogate spikes	QC monitoring spikes to be added to samples at the extraction process in the laboratory where applicable. Surrogates are closely related to the organic target analyte and not normally found in the natural environment. Frequency of 5%, results to be within +/-40% or discussion required
Laboratory control samples	Externally prepared reference material containing representative analytes under investigation. These will be undertaken at one per batch. It is to be within +/-40% or discussion required
Laboratory prepared spikes	Frequency of 5%, results to be within +/-40% or discussion required

## 2. Laboratory analysis summary

One analysis batch was undertaken over the preliminary investigation program. Samples were collected on 16 June 2022. A total of 17 samples were submitted for analytical testing. The batch contained samples which did not form part of the investigation. The samples were collected in the field by an environmental scientist from Envirowest Consulting Pty Ltd, placed into laboratory prepared receptacles as recommended in NEPM (1999). The samples preservation and storage was undertaken using standard industry practices. A chain of custody form accompanied transport of the samples to the laboratory.

The samples were analysed at the laboratories of SGS Laboratories, Alexandria NSW which is National Association of Testing Authorities (NATA) accredited for the tests undertaken. The analyses undertaken, number of samples tested and methods are presented in the following tables:

### Laboratory analysis schedule

Sample id.	Number of samples	Duplicate	Analyses	Date collected	Substrate	Laboratory report
MF1C, MF2C, MF3C, MF4C, MF5C, MF6C, MF7C, MF8C	8	1	Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn)	16/06/2022	Soil	SE233323
MF11D, MF21D, MF31D, MF41D, MF51D, MF61D, MF71D, MF81D	8	0	Organochlorine pesticides (OCP)	16/06/2022	Soil	SE233323

### Analytical methods

Analyte	Extraction	Laboratory methods
Metals	USEPA 200.2 Mod	APHA USEPA SW846-6010
Chromium (III)	-	APHA 3500 CR-A&B & 3120 and USEPA SW846-3060A
Chromium (VI)	USEPA SW846-3060A	USEPA SW846-3060A
Mercury	USEPA 200.2 Mod	APHA 3112
TRH(C6-C9)	USPEA SW846-5030A	USPEA SW 846-8260B
TRH(C10-C40), PAH	Tumbler extraction of solids	USEPA SW 846-8270B
PCB	Tumbler extraction of solids	USEPA SW 846-8270B
BTEX	Tumbler extraction of solids	USEPA SW 846-8260B
OC Pesticides	Tumbler extraction of solids	USEPA SW 846-8270B

### 3. Field quality assurance and quality control

One intra laboratory duplicate sample was collected for the investigation. The frequency was 6% which was in accordance with the recommended frequency of 5%. Table A1 outlines the samples collected and differences in replicate analyses. Relative differences were deemed to pass if they were within the acceptance limits of +/- 40% for replicate analyses or less than 5 times the detection limit.

#### Field duplicate frequency

Sample id.	Number of samples	Duplicate	Frequency (%)	Date collected	Substrate	Laboratory report
MF1C, MF2C, MF3C, MF4C, MF5C, MF6C, MF7C, MF8C, MF11D, MF21D, MF31D, MF41D, MF51D, MF61D, MF71D, MF81D	16	1	6	16/06/2022	Soil	SE233323

**Table A1.** Relative differences for intra laboratory duplicates

	MF2C, MFA			
	MF2C	MFA	Relative difference (%)	Pass/Fail
Arsenic	3	2	40	Pass
Cadmium	<0.3	<0.3	NA	-
Chromium	17	14	19	Pass
Copper	30	29	3	Pass
Lead	6	5	18	Pass
Nickel	3.2	2.6	20	Pass
Zinc	14	16	13	Pass

NA – relative difference unable to be calculated as results are less than laboratory detection limit, <sup>1</sup> Result less than 5 times the detection limit, <sup>2</sup> where an exceedance has occurred the higher result was used in the results

No trip blanks or spikes were submitted for analysis. This is not considered to create significant uncertainty in the analysis results because of the following rationale:

- The fieldwork was completed within a short time period and consistent methods were used for soil sampling.
- Soil samples were placed in insulated cooled containers after sampling to ensure preservation during transport and storage.
- The samples were placed in single use jars using clean sampling tools and disposable gloves from material not in contact with other samples. This reduces the likelihood of cross contamination.
- Samples in the analysis batch contain analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.
- Target analytes were not volatile

## 4. Laboratory quality assurance and quality control

Sample holding times are recommended in NEPM (1999). The time between collection and extraction was generally less than the criteria listed below:

Analyte	Maximum holding time
Metals	6 months
Mercury	28 days
BTEXN, TRH, PAH, OCP, OPP	14 days

The laboratory interpretative reports are presented with individual laboratory report. Assessment is made of holding time, frequency of control samples and quality control samples. No outliers exist for the sampling batch. The laboratory report also contains a detailed description of preparation methods and analytical methods.

The results, quality report, interpretative report and chain of custody are presented in the attached appendices. The quality report contains the laboratory duplicates, spikes, laboratory control samples, blanks and where appropriate matrix spike recovery (surrogate).

## 5. Data quality indicators (DQI)

### 5.1 Completeness

A measure of the amount of usable data for a data collection activity (total to be greater than 90%)

#### 5.1.1 Field

Consideration	Accepted	Comment
Locations to be sampled	Yes	In accordance with sampling methodology, described in the report.
SOP appropriate and compiled	Yes	In accordance with sampling methodology
Experienced sampler	Yes	Environmental scientist
Documentation correct	Yes	Chain of custody completed

#### 5.1.2 Laboratory

Consideration	Accepted	Comment
Samples analysed	Yes	In accordance with chain of custody and analysis plan.
Analytes	Yes	In accordance with chain of custody and analysis plan.
Methods	Yes	Analysed in NATA accredited laboratory with recognised methods and suitable PQL
Sample documentation	Yes	Completed including chain of custody and sample results and quality results
Sample holding times	Yes	Metals < 6 months Mercury < 28 days OCP, OPP, PAH, TRH, PCB, BTEXN < 14 days

### 5.2 Comparability

The confidence that data may be considered to be equivalent for each sampling and analytical event.

#### 5.2.1 Field

Consideration	Accepted	Comment
SOP	Yes	Same sampling procedures used and sampled on one date
Experienced sampler	Yes	Experienced environmental scientist
Climatic conditions	Yes	Sampling log
Samples collected	Yes	Suitable size and storage

### 5.2.2 Laboratory

Consideration	Accepted	Comment
Analytical methods	Yes	Same methods all samples
PQL	Yes	Suitable for analytes
Same laboratory	Yes	-
Same units	Yes	-

### 5.3 Representativeness

The confidence (expressed qualitatively) that data are representative of each media present on the site.

#### 5.3.1 Field

Consideration	Accepted	Comment
Appropriate media sampled	Yes	Sampled according to sampling and quality plan
All media identified	Yes	Soil sampling media identified in the sampling and quality plan

#### 5.3.2 Laboratory

Consideration	Accepted	Comment
Samples analysed	Yes	Undertaken in NATA accredited laboratory. Samples in the analysis batch contain analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.

### 5.4 Precision

A quantitative measure of the variability (or reproduced of the data)

#### 5.4.1 Field

Consideration	Accepted	Comment
SOP	Yes	Complied
Field duplicates	Yes	Collected

#### 5.4.2 Laboratory

Consideration	Accepted	Comment
Laboratory duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required
Field duplicates (intra and inter laboratory)	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Laboratory prepared volatile trip spikes	NA	Frequency of 5%, results to be within +/-40% or discussion required.

### 5.5 Accuracy

A quantitative measure of the closeness of the reported data to the true value

#### 5.5.1 Field

Consideration	Accepted	Comment
SOP	Yes	Complied
Field blanks	No	Not collected

### 5.5.2 Laboratory

Consideration	Accepted	Comment
Method blanks	Yes	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	No	Frequency of 5%, results to be within +/-40% or discussion required. Recovery failed acceptance criteria due to matrix interference.
Matrix duplicates	No	Frequency of 5%, results to be within +/-40% or discussion required. RPD failed acceptance criteria due to sample heterogeneity.
Surrogate spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Laboratory control samples	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Laboratory prepared spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required.

No trip blanks, field spikes or sample rinsates were submitted for analysis. This is not considered to create significant uncertainty in the analysis results because of the following rationale:

- The fieldwork methods used for soil sampling were consistent throughout the project with all in situ samples collected from material which had not been subject to exposure.
- The fieldwork was completed within a short time period and consistent methods were used for soil sampling.
- Soil samples were placed in insulated cooled containers as quickly as possible, with the containers filled to minimize headspace. The sample containers were sealed immediately after the sample was collected and chilled in an esky containing ice.
- The samples were stored in a refrigerator and transported with ice bricks to ensure preservation during transport and storage.
- The samples were placed in single use jars using clean sampling tools and disposable gloves from material not in contact with other samples. This reduces the likelihood of cross contamination.
- Samples in the analysis batches contained analytes below the level of detection. It is considered unlikely that contamination has occurred as a result of transport and handling.
- Target analytes were not volatile

## 6. Conclusion

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 usable for the purposes of the investigation.



## Sampling log

[illegible]

**Appendix 3.** Soil analysis results – SGS report number SE233323 and chain of custody form

## CLIENT DETAILS

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Project **14453**  
 Order Number **14453**  
 Samples **17**

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SGS Reference **SE233323 R0**  
 Date Received **21/6/2022**  
 Date Reported **28/6/2022**

## COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

## SIGNATORIES

**Bennet LO**  
 Senior Chemist

**Dong LIANG**  
 Metals/Inorganics Team Leader

**Huong CRAWFORD**  
 Production Manager

**Shane MCDERMOTT**  
 Inorganic/Metals Chemist

OC Pesticides in Soil [AN420]    Tested: 24/6/2022

PARAMETER	UOM	LOR	MF11D	MF21D	MF31D	MF41D	MF51D
			SOIL	SOIL	SOIL	SOIL	SOIL
			16/6/22 13:00 SE233323.009	16/6/22 13:00 SE233323.010	16/6/22 13:00 SE233323.011	16/6/22 13:00 SE233323.012	16/6/22 13:00 SE233323.013
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total CLP OC Pesticides	mg/kg	1	<1	<1	<1	<1	<1
Total OC VIC EPA	mg/kg	1	<1	<1	<1	<1	<1

OC Pesticides in Soil [AN420]    Tested: 24/6/2022    (continued)

PARAMETER	UOM	LOR	MF61D	MF71D	MF81D
			SOIL - 16/6/22 13:00 SE233323.014	SOIL - 16/6/22 13:00 SE233323.015	SOIL - 16/6/22 13:00 SE233323.016
Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	<0.1
Alpha BHC	mg/kg	0.1	<0.1	<0.1	<0.1
Lindane	mg/kg	0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	0.1	<0.1	<0.1	<0.1
Beta BHC	mg/kg	0.1	<0.1	<0.1	<0.1
Delta BHC	mg/kg	0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1
Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2
Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1
Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.2	<0.2	<0.2	<0.2
Endrin	mg/kg	0.2	<0.2	<0.2	<0.2
o,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1
Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	<0.2
p,p'-DDD	mg/kg	0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	0.1	<0.1	<0.1	<0.1
Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	0.1	<0.1	<0.1	<0.1
Isodrin	mg/kg	0.1	<0.1	<0.1	<0.1
Mirex	mg/kg	0.1	<0.1	<0.1	<0.1
Total CLP OC Pesticides	mg/kg	1	<1	<1	<1
Total OC VIC EPA	mg/kg	1	<1	<1	<1

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 27/6/2022

PARAMETER	UOM	LOR	MF1C	MF2C	MF3C	MF4C	MF5C
			SOIL	SOIL	SOIL	SOIL	SOIL
			16/6/22 13:00 SE233323.001	16/6/22 13:00 SE233323.002	16/6/22 13:00 SE233323.003	16/6/22 13:00 SE233323.004	16/6/22 13:00 SE233323.005
Arsenic, As	mg/kg	1	3	3	3	3	5
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	20	17	21	19	26
Copper, Cu	mg/kg	0.5	11	30	20	68	36
Lead, Pb	mg/kg	1	9	6	9	9	8
Nickel, Ni	mg/kg	0.5	4.4	3.2	4.8	3.0	3.5
Zinc, Zn	mg/kg	2	8	14	15	15	14

PARAMETER	UOM	LOR	MF6C	MF7C	MF8C	MFA
			SOIL	SOIL	SOIL	SOIL
			16/6/22 13:00 SE233323.006	16/6/22 13:00 SE233323.007	16/6/22 13:00 SE233323.008	16/6/22 13:00 SE233323.017
Arsenic, As	mg/kg	1	2	4	2	2
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	12	17	13	14
Copper, Cu	mg/kg	0.5	12	17	7.9	29
Lead, Pb	mg/kg	1	7	13	7	5
Nickel, Ni	mg/kg	0.5	1.3	3.7	2.1	2.6
Zinc, Zn	mg/kg	2	6	9	5	16

Moisture Content [AN002]    Tested: 24/6/2022

			MF1C	MF2C	MF3C	MF4C	MF5C
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			16/6/22 13:00	16/6/22 13:00	16/6/22 13:00	16/6/22 13:00	16/6/22 13:00
PARAMETER	UOM	LOR	SE233323.001	SE233323.002	SE233323.003	SE233323.004	SE233323.005
% Moisture	%w/w	1	16.6	17.1	19.1	17.1	19.2

			MF6C	MF7C	MF8C	MF11D	MF21D
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			16/6/22 13:00	16/6/22 13:00	16/6/22 13:00	16/6/22 13:00	16/6/22 13:00
PARAMETER	UOM	LOR	SE233323.006	SE233323.007	SE233323.008	SE233323.009	SE233323.010
% Moisture	%w/w	1	17.5	21.1	20.4	16.3	16.8

			MF31D	MF41D	MF51D	MF61D	MF71D
			SOIL	SOIL	SOIL	SOIL	SOIL
			-	-	-	-	-
			16/6/22 13:00	16/6/22 13:00	16/6/22 13:00	16/6/22 13:00	16/6/22 13:00
PARAMETER	UOM	LOR	SE233323.011	SE233323.012	SE233323.013	SE233323.014	SE233323.015
% Moisture	%w/w	1	16.7	20.6	23.4	16.7	20.1

			MF81D	MFA
			SOIL	SOIL
			-	-
			16/6/22 13:00	16/6/22 13:00
PARAMETER	UOM	LOR	SE233323.016	SE233323.017
% Moisture	%w/w	1	17.2	19.2

## METHOD

## METHODOLOGY SUMMARY

### AN002

The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.

### AN040/AN320

A portion of sample is digested with nitric acid to decompose organic matter and hydrochloric acid to complete the digestion of metals. The digest is then analysed by ICP OES with metals results reported on the dried sample basis. Based on USEPA method 200.8 and 6010C.

### AN040

A portion of sample is digested with Nitric acid to decompose organic matter and Hydrochloric acid to complete the digestion of metals and then filtered for analysis by ASS or ICP as per USEPA Method 200.8.

### AN420

SVOC Compounds: Semi-Volatile Organic Compounds (SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D).

## FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received. Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- 1 Bq is equivalent to 27 pCi
- 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: [www.sgs.com.au/en-gb/environment-health-and-safety](http://www.sgs.com.au/en-gb/environment-health-and-safety).

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## STATEMENT OF QA/QC PERFORMANCE

SE233323 R0

### CLIENT DETAILS

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Project **14453**  
Order Number **14453**  
Samples 17

### LABORATORY DETAILS

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SGS Reference **SE233323 R0**  
Date Received 21 Jun 2022  
Date Reported 28 Jun 2022

### COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.

This QA/QC Statement must be read in conjunction with the referenced Analytical Report.

The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Duplicate	Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES	2 items
Matrix Spike	Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES	1 item

### SAMPLE SUMMARY

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	SGS	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	17 Soil
Date documentation received	21/6/2022	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	Yes
Sample temperature upon receipt	10.4°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the

## Moisture Content

Method: ME-(AU)-ENVJAN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
MF1C	SE233323.001	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF2C	SE233323.002	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF3C	SE233323.003	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF4C	SE233323.004	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF5C	SE233323.005	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF6C	SE233323.006	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF7C	SE233323.007	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF8C	SE233323.008	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF11D	SE233323.009	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF21D	SE233323.010	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF31D	SE233323.011	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF41D	SE233323.012	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF51D	SE233323.013	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF61D	SE233323.014	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF71D	SE233323.015	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MF81D	SE233323.016	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022
MFA	SE233323.017	LB251800	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	29 Jun 2022	28 Jun 2022

## OC Pesticides in Soil

Method: ME-(AU)-ENVJAN020

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
MF11D	SE233323.009	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022
MF21D	SE233323.010	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022
MF31D	SE233323.011	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022
MF41D	SE233323.012	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022
MF51D	SE233323.013	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022
MF61D	SE233323.014	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022
MF71D	SE233323.015	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022
MF81D	SE233323.016	LB251788	16 Jun 2022	21 Jun 2022	30 Jun 2022	24 Jun 2022	03 Aug 2022	28 Jun 2022

## Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-ENVJAN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
MF1C	SE233323.001	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MF2C	SE233323.002	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MF3C	SE233323.003	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MF4C	SE233323.004	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MF5C	SE233323.005	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MF6C	SE233323.006	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MF7C	SE233323.007	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MF8C	SE233323.008	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022
MFA	SE233323.017	LB251873	16 Jun 2022	21 Jun 2022	13 Dec 2022	27 Jun 2022	13 Dec 2022	28 Jun 2022

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

**OC Pesticides in Soil****Method: ME-(AU)-[ENV]AN420**

Parameter	Sample Name	Sample Number	Units	Criteria	Recovery %
Tetrachloro-m-xylene (TCMX) (Surrogate)	MF11D	SE233323.009	%	60 - 130%	105
	MF21D	SE233323.010	%	60 - 130%	101
	MF31D	SE233323.011	%	60 - 130%	106
	MF41D	SE233323.012	%	60 - 130%	102
	MF51D	SE233323.013	%	60 - 130%	109
	MF61D	SE233323.014	%	60 - 130%	105
	MF71D	SE233323.015	%	60 - 130%	106
	MF81D	SE233323.016	%	60 - 130%	103

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

## OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR	Result
LB251788.001	Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1
	Alpha BHC	mg/kg	0.1	<0.1
	Lindane	mg/kg	0.1	<0.1
	Heptachlor	mg/kg	0.1	<0.1
	Aldrin	mg/kg	0.1	<0.1
	Beta BHC	mg/kg	0.1	<0.1
	Delta BHC	mg/kg	0.1	<0.1
	Heptachlor epoxide	mg/kg	0.1	<0.1
	Alpha Endosulfan	mg/kg	0.2	<0.2
	Gamma Chlordane	mg/kg	0.1	<0.1
	Alpha Chlordane	mg/kg	0.1	<0.1
	p,p'-DDE	mg/kg	0.1	<0.1
	Dieldrin	mg/kg	0.2	<0.2
	Endrin	mg/kg	0.2	<0.2
	Beta Endosulfan	mg/kg	0.2	<0.2
	p,p'-DDD	mg/kg	0.1	<0.1
	p,p'-DDT	mg/kg	0.1	<0.1
	Endosulfan sulphate	mg/kg	0.1	<0.1
	Endrin Aldehyde	mg/kg	0.1	<0.1
	Methoxychlor	mg/kg	0.1	<0.1
	Endrin Ketone	mg/kg	0.1	<0.1
	Isodrin	mg/kg	0.1	<0.1
	Mirex	mg/kg	0.1	<0.1
Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	%	-	93

## Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result
LB251873.001	Arsenic, As	mg/kg	1	<1
	Cadmium, Cd	mg/kg	0.3	<0.3
	Chromium, Cr	mg/kg	0.5	<0.5
	Copper, Cu	mg/kg	0.5	<0.5
	Nickel, Ni	mg/kg	0.5	<0.5
	Lead, Pb	mg/kg	1	<1
	Zinc, Zn	mg/kg	2	<2

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula:  $RPD = | \text{OriginalResult} - \text{ReplicateResult} | \times 100 / \text{Mean}$

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula:  $MAD = 100 \times \text{SDL} / \text{Mean} + \text{LR}$

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

NOTE: The RPD reported is calculated from the unrounded data for the original and replicate result. Manual calculation of the RPD from the rounded data reported may

## Moisture Content

Method: ME-(AU)-ENVJAN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE233323.010	LB251800.011	% Moisture	%w/w	1	16.8	19.0	36	12
SE233343.003	LB251800.022	% Moisture	%w/w	1	43.2	42.0	32	3
SE233498.008	LB251800.031	% Moisture	%w/w	1	41.4	34.9	33	17

## OC Pesticides in Soil

Method: ME-(AU)-ENVJAN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE233498.006	LB251788.026	Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
		Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
		Lindane	mg/kg	0.1	<0.1	<0.1	200	0
		Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
		Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
		Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
		Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
		Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
		o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
		Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
		Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
		Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
		trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
		p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
		Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
		Endrin	mg/kg	0.2	<0.2	<0.2	200	0
		o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
		o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
		Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
		p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
		p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
		Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
		Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
		Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
		Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0
		Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
		Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Total CLP OC Pesticides	mg/kg	1	<1	<1	200	0
		Total OC VIC EPA	mg/kg	1	<1	<1	200	0
		Surrogates						
		Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.17	0.17	30	3
SE233498.008	LB251788.024	Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	200	0
		Alpha BHC	mg/kg	0.1	<0.1	<0.1	200	0
		Lindane	mg/kg	0.1	<0.1	<0.1	200	0
		Heptachlor	mg/kg	0.1	<0.1	<0.1	200	0
		Aldrin	mg/kg	0.1	<0.1	<0.1	200	0
		Beta BHC	mg/kg	0.1	<0.1	<0.1	200	0
		Delta BHC	mg/kg	0.1	<0.1	<0.1	200	0
		Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	200	0
		o,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
		Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
		Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
		Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	200	0
		trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	200	0
		p,p'-DDE	mg/kg	0.1	<0.1	<0.1	200	0
		Dieldrin	mg/kg	0.2	<0.2	<0.2	200	0
		Endrin	mg/kg	0.2	<0.2	<0.2	200	0
		o,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
		o,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
		Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	200	0
		p,p'-DDD	mg/kg	0.1	<0.1	<0.1	200	0
		p,p'-DDT	mg/kg	0.1	<0.1	<0.1	200	0
		Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	200	0
		Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	200	0
		Methoxychlor	mg/kg	0.1	<0.1	<0.1	200	0
		Endrin Ketone	mg/kg	0.1	<0.1	<0.1	200	0

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula:  $RPD = | \text{OriginalResult} - \text{ReplicateResult} | \times 100 / \text{Mean}$

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula:  $MAD = 100 \times \text{SDL} / \text{Mean} + \text{LR}$

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

NOTE: The RPD reported is calculated from the unrounded data for the original and replicate result. Manual calculation of the RPD from the rounded data reported may

#### OC Pesticides in Soil (continued)

Method: ME-(AU)-[ENV]AN420

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE233498.008	LB251788.024	Isodrin	mg/kg	0.1	<0.1	<0.1	200	0
		Mirex	mg/kg	0.1	<0.1	<0.1	200	0
		Total CLP OC Pesticides	mg/kg	1	<1	<1	200	0
		Total OC VIC EPA	mg/kg	1	<1	<1	200	0
		Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.17	0.16	30

#### Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE233401.001	LB251873.014	Arsenic, As	mg/kg	1	4	4	55	6
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.5	9.7	7.2	36	29
		Copper, Cu	mg/kg	0.5	16	9.5	34	53 @
		Nickel, Ni	mg/kg	0.5	4.5	4.0	42	14
		Lead, Pb	mg/kg	1	22	26	34	15
		Zinc, Zn	mg/kg	2	23	25	38	10
SE233498.008	LB251873.024	Arsenic, As	mg/kg	1	<1	1	141	29
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.5	2.7	3.6	46	26
		Copper, Cu	mg/kg	0.5	1.2	<0.5	97	79
		Nickel, Ni	mg/kg	0.5	0.5	<0.5	135	4
		Lead, Pb	mg/kg	1	4	4	54	9
		Zinc, Zn	mg/kg	2	15	8	48	59 @

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

#### OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN420

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB251788.002	Heptachlor	mg/kg	0.1	0.2	0.2	60 - 140	87
	Aldrin	mg/kg	0.1	0.2	0.2	60 - 140	86
	Delta BHC	mg/kg	0.1	0.1	0.2	60 - 140	61
	Dieldrin	mg/kg	0.2	<0.2	0.2	60 - 140	88
	Endrin	mg/kg	0.2	<0.2	0.2	60 - 140	97
	p,p'-DDT	mg/kg	0.1	0.2	0.2	60 - 140	87
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.14	0.15	40 - 130

#### Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB251873.002	Arsenic, As	mg/kg	1	330	318.22	80 - 120	103
	Cadmium, Cd	mg/kg	0.3	4.6	4.81	70 - 130	96
	Chromium, Cr	mg/kg	0.5	37	38.31	80 - 120	97
	Copper, Cu	mg/kg	0.5	310	290	80 - 120	105
	Nickel, Ni	mg/kg	0.5	190	187	80 - 120	99
	Lead, Pb	mg/kg	1	93	89.9	80 - 120	103
	Zinc, Zn	mg/kg	2	280	273	80 - 120	101

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub-sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

## OC Pesticides in Soil

Method: ME-(AU)-[ENV]AN420

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE233323.009	LB251788.004	Hexachlorobenzene (HCB)	mg/kg	0.1	<0.1	<0.1	-	-
		Alpha BHC	mg/kg	0.1	<0.1	<0.1	-	-
		Lindane	mg/kg	0.1	<0.1	<0.1	-	-
		Heptachlor	mg/kg	0.1	0.2	<0.1	0.2	96
		Aldrin	mg/kg	0.1	0.2	<0.1	0.2	95
		Beta BHC	mg/kg	0.1	<0.1	<0.1	-	-
		Delta BHC	mg/kg	0.1	0.2	<0.1	0.2	102
		Heptachlor epoxide	mg/kg	0.1	<0.1	<0.1	-	-
		o,p'-DDE	mg/kg	0.1	<0.1	<0.1	-	-
		Alpha Endosulfan	mg/kg	0.2	<0.2	<0.2	-	-
		Gamma Chlordane	mg/kg	0.1	<0.1	<0.1	-	-
		Alpha Chlordane	mg/kg	0.1	<0.1	<0.1	-	-
		trans-Nonachlor	mg/kg	0.1	<0.1	<0.1	-	-
		p,p'-DDE	mg/kg	0.1	<0.1	<0.1	-	-
		Dieldrin	mg/kg	0.2	<0.2	<0.2	0.2	95
		Endrin	mg/kg	0.2	0.2	<0.2	0.2	106
		o,p'-DDD	mg/kg	0.1	<0.1	<0.1	-	-
		o,p'-DDT	mg/kg	0.1	<0.1	<0.1	-	-
		Beta Endosulfan	mg/kg	0.2	<0.2	<0.2	-	-
		p,p'-DDD	mg/kg	0.1	<0.1	<0.1	-	-
		p,p'-DDT	mg/kg	0.1	0.2	<0.1	0.2	100
		Endosulfan sulphate	mg/kg	0.1	<0.1	<0.1	-	-
		Endrin Aldehyde	mg/kg	0.1	<0.1	<0.1	-	-
		Methoxychlor	mg/kg	0.1	<0.1	<0.1	-	-
		Endrin Ketone	mg/kg	0.1	<0.1	<0.1	-	-
		Isodrin	mg/kg	0.1	<0.1	<0.1	-	-
		Mirex	mg/kg	0.1	<0.1	<0.1	-	-
		Total CLP OC Pesticides	mg/kg	1	1	<1	-	-
		Total OC VIC EPA	mg/kg	1	1	<1	-	-
	Surrogates	Tetrachloro-m-xylene (TCMX) (Surrogate)	mg/kg	-	0.15	0.16	-	99

## Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES

Method: ME-(AU)-[ENV]AN040/AN320

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
SE233323.001	LB251873.004	Arsenic, As	mg/kg	1	49	3	50	91
		Cadmium, Cd	mg/kg	0.3	42	<0.3	50	84
		Chromium, Cr	mg/kg	0.5	66	20	50	93
		Copper, Cu	mg/kg	0.5	80	11	50	138
		Nickel, Ni	mg/kg	0.5	49	4.4	50	90
		Lead, Pb	mg/kg	1	58	9	50	99
		Zinc, Zn	mg/kg	2	59	8	50	101



Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula:  $RPD = | \text{OriginalResult} - \text{ReplicateResult} | \times 100 / \text{Mean}$

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula:  $MAD = 100 \times \text{SDL} / \text{Mean} + \text{LR}$

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here : [https://www.sgs.com.au/~media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022\\_QA\\_QC\\_Plan.pdf](https://www.sgs.com.au/~media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022_QA_QC_Plan.pdf)

- \* NATA accreditation does not cover the performance of this service.
- \*\* Indicative data, theoretical holding time exceeded.
- \*\*\* Indicates that both \* and \*\* apply.
- Sample not analysed for this analyte.
- IS Insufficient sample for analysis.
- LNR Sample listed, but not received.
- LOR Limit of reporting.
- QFH QC result is above the upper tolerance.
- QFL QC result is below the lower tolerance.
- ① At least 2 of 3 surrogates are within acceptance criteria.
- ② RPD failed acceptance criteria due to sample heterogeneity.
- ③ Results less than 5 times LOR preclude acceptance criteria for RPD.
- ④ Recovery failed acceptance criteria due to matrix interference.
- ⑤ Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
- ⑥ LOR was raised due to sample matrix interference.
- ⑦ LOR was raised due to dilution of significantly high concentration of analyte in sample.
- ⑧ Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
- ⑨ Recovery failed acceptance criteria due to sample heterogeneity.
- ⑩ LOR was raised due to high conductivity of the sample (required dilution).
- † Refer to relevant report comments for further information.

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# Chain of Custody Form – Ref 14453

Sheet 1 of 1

<b>Ref:</b> 14453 <b>Investigator:</b> Envirowest Consulting 9 Cameron Place PO Box 8158 ORANGE NSW 2800 (02) 6361 4954  <b>Telephone:</b>  <b>Email:</b> leah@envirowest.net.au <b>Contact Person:</b> Leah Desborough <b>Invoice:</b> accounts@envirowest.net.au			<b>Sample matrix</b>  Water    Soil    Sludge			<b>Sample preservation</b>  Cool    HNO3/HCl    Unpreserved			<b>Analysis</b>						
<b>SGS Method Code</b>															
CL1T	CL10	OCP													
<b>Laboratory:</b> SGS SYDNEY 16/33 Maddox Street ALEXANDRIA NSW 2015  <b>Quotation #:</b> Envir_70119_2019 <b>Courier/CN:</b> Grants Express			Water	Soil	Sludge	Cool	HNO3/HCl	Unpreserved	CL1T (7 metals)	CL10 (TRH, BTEXN, PAH, 8 metals)	OCP				
Sample ID	Container*	Sampling Date/Time													
MF1C	A	16/6/2022		X		X		X	X						
MF2C	A	16/6/2022		X		X		X	X						
MF3C	A	16/6/2022		X		X		X	X						
MF4C	A	16/6/2022		X		X		X	X						
MF5C	A	16/6/2022		X		X		X	X						
MF6C	A	16/6/2022		X		X		X	X						
MF7C	A	16/6/2022		X		X		X	X						
MF8C	A	16/6/2022		X		X		X	X						
MF11D	A	16/6/2022		X		X		X			X				
MF21D	A	16/6/2022		X		X		X			X				
MF31D	A	16/6/2022		X		X		X			X				
MF41D	A	16/6/2022		X		X		X			X				
MF51D	A	16/6/2022		X		X		X			X				
MF61D	A	16/6/2022		X		X		X			X				
MF71D	A	16/6/2022		X		X		X			X				
MF81D	A	16/6/2022		X		X		X			X				
MFA	A	16/6/2022		X		X		X	X						
Investigator: I attest that the proper field sampling procedures were used during the collection of these samples.						Sampler name: Leah Desborough Date: 16/6/2022    Time: 13:00									
Relinquished by: (print and signature)			Date: 20/6/2022    Time: 1300			Received by: (print and signature)			Date: 21/06/22    Time: 7:30						

SGS EHS Sydney COC  
**SE233323**



Please return comp with red label

envirowest Consulting, \*A = Solvent rinsed glass jar with Teflon lined lid and

label, C= Amber with green label, D= Vial with white label, E= Plastic

## **Appendix 4. Soil sampling protocols**

### **1. Sampling**

The samples will be collected from the auger tip, mattock, hand auger or excavator bucket immediately on withdrawal.

The time between retrieval of the sample and sealing of the sample container will be kept to a minimum.

The material will be collected using single use disposal gloves or a stainless-steel spade which represented material which has not been exposed to the atmosphere prior to sampling.

All sampling jars will be filled as close to the top as possible to minimise the available airspace within the jar.

### **2. Handling, containment and transport**

Daily sampling activities will be recorded including sampling locations, numbers, observations, measurements, sampler, date and time and weather condition.

The sampling jars will be new sterile glass jars fitted with plastic lid and airtight Teflon seals, supplied by the laboratories for the purpose of collecting soil samples for analysis. Sample containers will be marked indelibly with the sample ID code to waterproof labels affixed to the body of the container.

All samples will be removed from direct sunlight as soon as possible after sampling and placed in insulated containers. Samples will be stored in a refrigerator at 4°C prior to transportation to the laboratory in insulated containers with ice bricks in accordance with AS4482.1.

Handling and transportation to the laboratory will be accompanied with a chain of custody form to demonstrate the specimens are properly received, documents, processed and stored.

Maximum holding time for extraction (AS4482.1) are:

<b>Analyte</b>	<b>Maximum holding time</b>
Metals	6 months
Mercury	28 days
Sulfate	7 days
Organic carbon	7 days
OCP, OPP, PCB	14 days
TRH, BTEX, PAH, phenols	14 days

### **3. Decontamination of sampling equipment**

Sampling tools will be decontaminated between sampling locations by

- Removing soil adhering to the sampling equipment by scraping, brushing or wiping
- Washing with a phosphate-free detergent
- Rinsing thoroughly with clean water
- Repeating if necessary
- Collect rinsate per sampling time and preserve according to AS 2031.1
- Dry equipment with disposable towels or air