Preliminary contamination investigation

Proposed Lot 3, 51 Winter Lane, Summer Hill Creek NSW

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Summary report

Introduction

A building envelope has been proposed for Lot 3 in the subdivision of 51 Winter Lane, Summer Hill Creek NSW. The building envelope has an area of approximately 0.46ha and is located east of a dam. Drainage lines traverses proposed Lot 3 in the northern and southern sections. Land-use will change from agricultural to residential. Agriculture is considered a potential contaminating activity.

Objectives of the investigation

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

Scope

The scope was to undertake a site inspection, identify past potentially contaminating activities, identify potential types of contamination, discuss the site condition, provide a preliminary assessment of site contamination and assess the need for further investigation to determine suitability for residential land-use. The works included site inspection, soil sampling and analysis of the soil samples for contaminants of concern.

Summary

The site is part of a rural lot located at 51 Winter Lane, Summer Hill Creek NSW. A review of site history indicated that historical land-use over the area was agricultural comprising grazing. An inspection was made on 19 September 2022. The investigation area was dominated by pasture grasses and broadleaved weeds. Vegetation cover was generally 100%.

No buildings or structures are present in the investigation area. A dam is located in the western section of proposed Lot 3. Drainage lines were observed in the northern and southern sections of the proposed lot. The proposed building envelope is located in the eastern section of the site.

Soils observed on-site to a depth of 1.5m consisted of topsoil of black to dark brown fine sandy clay with fine gravel overlaying greyish brown to brownish yellow sandy clay with fine to medium gravel to a depth of 0.9m. The underlaying soil consists of white sandy clay and reddish yellow clayey sand with fine to medium gravel. Mottles were observed from 0.25m.

No signs of visible contamination such as discolouration or staining was identified on the surface of the site. No signs of settlement or subsidence was identified on the site. No cement sheeting was observed during the site inspection. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities were observed on-site from the review of site history or site walkover.

Low levels of heavy metals near environmental background levels and less than adopted thresholds for human health and environment were detected in soil samples collected from the building envelope area.

Recommendations

No further investigations are required. The site is suitable for residential land-use.

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1. Introduction

A building envelope has been proposed for Lot 3 in the subdivision of 51 Winter Lane, Summer Hill Creek NSW. The building envelope has an area of approximately 0.46ha and is located east of a dam. Drainage lines traverses proposed Lot 3 in the northern and southern sections. Land-use will change from agricultural to residential. Agriculture is considered a potential contaminating activity.

A contamination assessment of the building envelope of proposed Lot 3 in accordance with *State Environmental Planing Policy (Resilience and Hazards)* of the site is required to determine the soil contamination status and suitability for the future land-use of the site.

2. Objectives

The objective of the investigation was to determine suitability of the site for the proposed residential land-use.

3. Scope of work

Envirowest Consulting Pty Ltd was commissioned by John Eyles to undertake a contamination assessment, in accordance with the contaminated land management planning guidelines, from the *Contaminated Land Management Act 1997* and the *State Environmental Planing Policy (Resilience and Hazards)* of the building envelope located on proposed Lot 3, in the proposed subdivision of 51 Winter Lane, Summer Hill Creek NSW.

4. Site identification

Address	51 Winter Lane Summer Hill Creek NSW 2800
Deposited plans	Part Lot 6 DP703806
Latitude and longitude	-33.21^{o} 149.15^{o}
Geographic coordinates	55H E700307m N6323600m
Client	John Eyles
Owners	John Eyles
Current occupiers	John Eyles
Area	Proposed Lot 3 Approximately 3.0ha Building envelope 0.46ha
Local government area	Cabonne Shire Council
Current zoning	RU1 – Primary production (Cabonne LEP 2012)
Trigger for investigation	Change in land-use
Locality map	Figure 1

5. Site history

5.1 Setting

The site is located in the rural locality of Summer Hill Creek, approximately 10km north east of Orange. The site is used for rural land-use including stock grazing.

5.2 Summary of council records

The site is mapped as groundwater vulnerable and as an area of terrestrial biodiversity (Cabonne LEP 2012).

5.3 EPA contaminated sites list

The investigation area is not listed on the NSW EPA register of contaminated sites (24 October 2022) or sites notified to the EPA (10 October 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

No structures including UST or AST are expected to be located on site as determined from a review of historical imagery and a site inspection. SafeWork NSW are not expected to hold any records relating to storage of hazardous chemicals at the site.

5.5 POEO public register

No current or delicensed and former licensed activities under the POEO Act 1997 have been identified for the site or 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 on 19 September 2022 by staff of Envirowest Consulting Pty Ltd
NSW EPA records of public notices under the CLM Act 1997
Soil and geological maps
Spatial information exchange historic parish maps
Historical aerial photographs including NSW Government historical imagery, Google Earth and Nearmap
Cabonne LEP 2012

5.8 Review of historic aerial photographs, maps and plans

5.8.1 Aerial photographs

Year	Visual observations on site	Surrounding area
1964	The site is located in a rural lot. Land-use is grazing. Moderate tree coverage is identified in the building envelope location.	Adjacent land-use is grazing. The current dam in the proposed Lot 3 is not visible. Rural residential properties are visible to the south west. Summer Hill Creek is located to south west. Large woodland areas are visible in adjacent land to the north and east.
1971	Tree coverage on-site has been reduced.	Areas of exposed soil are visible in adjacent land to the north.
1982	No obvious changes evident.	A dam has been constructed in adjacent to the proposed building envelope to the west. A track is visible in adjacent land to the west. A dwelling has been built in adjacent land to the north.
1989	No obvious changes evident.	A shed has been built in adjacent land to the east. Winter Lane has been built in adjacent land to the south.
1993	No obvious changes evident.	Additional rural-residential dwellings are visible in adjacent land to the north.
1998	No obvious changes evident.	A tree lot is visible in adjacent land to the north.
2012	No obvious changes evident.	A dwelling has been constructed in adjacent land to the east. Additional rural-residential dwellings have been constructed in adjacent land to the north and south.
2013	No obvious changes evident.	Partially exposed soil is visible in the adjacent dam walls to the west, expected to be due to sheet erosion.
2016	No obvious changes evident.	No obvious changes are evident.
2019	No obvious changes evident.	No obvious changes are evident.
2022	No obvious changes evident.	No obvious changes are evident.

5.8.2 Historical parish maps

Review of historical parish maps indicate that the site is located in the Parish of Clinton, County of Bathurst. The parish map from 1889 indicates the site was part of the Ophir Goldfields proclaimed in 1895. The area is assigned as “reserve from occupation for residence or business purposes”. The parish map from 1907 depicts the site as part of portion 46 owned by Mr Patrick E Fanning. Parish maps from 1916 to 1935 depicts the site as part portions 67, 56 and 46 owned by Mr AE Corby. Maps from 1935 to 1971 depicts the site as owned by Mr MC Pearson. The portion 46 is represented as “set apart for crown lease” in parish maps from 1924 to 1936.

5.8.3 Topographic maps

The 1988 topographic map based on 1982 aerial photography and field revision in 1987 depicts the proposed lot as vacant. Winter Lane is represented to the south. Two dams and a shed are depicted in adjacent land to the west.

5.9 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 (Cabonne LEP 2012).

The site is not identified on the Cabonne LEP (2012) as being within 1km of locally significant sites.

5.10 Chronological list of site uses
Historical land-use of the investigation area is agricultural comprising grazing.

No fill, mines, sheep dips, mixing sheds, underground storage tanks (UST), bunkers or contaminating industrial activities are known to have been located on the site from the site inspection and site history.

5.11 Buildings and infrastructure
Fences divide the proposed lots into stock paddocks. No other buildings or structures were identified on-site.

5.12 Spills, losses or discharges
No records of 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 known

5.14 Previous investigations
None known

5.15 Historical neighbouring land-use
North – Grazing, rural-residential, woodland
South – Winter Lane, grazing, rural-residential
East – Grazing, rural-residential, woodland
West – Grazing, Ophir Road, rural-residential

Historical neighbouring land-uses are not expected to have impacted on the site.

5.16 Contaminant sources
The historic agricultural land-use may have resulted in application of pesticides in routine management. Fertilisers applied may contain heavy metal contaminants. No bio solids are known to have been applied to the site.

5.17 Contaminants of concern
Based on historical activities and site inspection the contaminants of concern across the general site are:

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc)

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 an environmental geologist of Envirowest Consulting Pty Ltd on 19 September 2022.

6.2 Land-use
Current land-use is agricultural comprising stock grazing.

6.3 Current neighbouring land-use
North – Grazing, rural-residential, woodland
South – Winter Lane, grazing, rural-residential
East – Grazing, rural-residential, woodland
West – Grazing, Ophir Road, rural-residential

Present neighbouring land-use is not expected to be impacting on the site.

6.4 Surface cover and vegetation
The investigation area was dominated by pasture grasses and broadleaved weeds. Vegetation cover across the site was generally 100%.

6.5 Evidence of visible contamination
No signs of visible contamination such as discolouration or staining was identified on the surface of the site. No signs of settlement or subsidence was identified on the site.

6.6 Topography
The dominant morphology on-site is a mid-slope. The site was generally gently inclined with slopes of 1- to 3% to the west. Elevation is approximately 853 metres above sea level.

6.7 Soils and geology
The site is within the Mookerawa Soil Landscape. Soil in the Mookerawa Soil Landscape consists of red podzolic soils on crests and upper slopes and yellow soloths and yellow solodic soils on lower slopes and drainage depressions. Lithosols are often observed in hills with rock outcrops (eSPADE 2022). The geological units of the Mookerawa Soil Landscape are the formations of Hill End Trough. Parent rocks include shale, schist, greywacke, conglomerate, slate, phyllite and siltstone (eSPADE 2022).

Soils observed on-site to a depth of 1.5m consisted of topsoil of black to dark brown fine sandy clay with fine gravel overlaying greyish brown to brownish yellow sandy clay with fine to medium gravel to a depth of 0.9m. The underlaying soil consists of white sandy clay and reddish yellow clayey sand with fine to medium gravel. Grey and yellow mottles were observed from a depth of 0.25m.

6.8 Water
6.8.1 Surface water
Surface water flows through the drainage lines located in the southern section of the proposed Lot 3 to the dam located in the western section of proposed lot. Surface water in the northern section of proposed Lot 3 flows to the dam located in the adjacent land to north west.

6.8.2 Groundwater
No bores are located on the site. Three registered groundwater bores were identified within 1km of the site on the NSW Government Water NSW website (2022). Bores in the locality are licensed for domestic and stock uses. Water-bearing zones (WBZ's) were from 23m to 40m in quartz and basalt and standing water levels (SWL) from 20m to 22m.

Groundwater No.	Date drilled	SWL (m)	Use	Status
GW800876	1/01/1994	-	Domestic	Collapsed bore
GW803039	6/10/2005	22.0	Stock, domestic	Supply obtained
GW802012	31/10/2003	20.0	Stock, domestic	Supply obtained

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 (NSW SEED Portal accessed 24 October 2022).

The site is not mapped as a geological unit with asbestos potential (NSW SEED Portal accessed 24 October 2022).

6.10 Environmentally sensitive features or habitats

No environmentally sensitive features or habitats were identified on the site. Summer Hill Creek is located approximately 1km south west of the site and is impacted by upstream rural land-use.

7. Conceptual site model

7.1 Contaminant sources

The historic agricultural land-use may have resulted in application of pesticides in routine management. Fertilisers applied may contain heavy metal contaminants. No bio solids are known to have been applied to the site.

7.2 Contaminants of concern

Based on historical activities and site inspection the contaminants of concern across the general site are:

- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc)

7.3 Potential receptors

The proposed land-use of the site is residential. Residential buildings are proposed and are expected to include hard surface areas comprising driveways and landscaped areas. The site has historically been used for grazing.

Human receptors include:

- Residents (adults and children)
- Visitors
- 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. Residents, visitors, construction workers and intrusive maintenance workers may potentially be receptors to soil contaminants through direct contact to soil which includes ingestion and dermal contact.

Inhalation of soil material and vapours is considered a pathway for exposure and 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.

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 or hard surfaces constructed which will control sediment movement from the site. The nearest waterway to the site is Summer Hill Creek and it is not expected that contaminants from the site will be transported to aquatic receptors within the creek. Summer Hill Creek is considered to be a moderately disturbed ecosystem.

Groundwater is not identified as a potential receptor to contamination. Contaminants are expected to originate from the soil surface. Groundwater level is deeper than 20m and the presence of clay subsoils are expected to restrict downward movement of potential contaminants.

Source/contaminants	Transport	Potential exposure pathways	Receptors
☒ Use of fertilisers (heavy metals)	☒Wind ☒Sedimentation ☐Groundwater ☐Surface water ☐Volatilisation	☒Direct contact (ingestion and absorption) (human and environment) ☒Inhalation ☐Runoff ☐Leaching	☒Residents (adults and children) ☒Visitors (adults and children) ☒Construction workers ☒Intrusive maintenance workers ☒Terrestrial flora and fauna ☐Aquatic flora and fauna

☒Potential, ☐unknown/unlikely

8. Data quality objectives (DQO)

8.1 State the problem

A residential subdivision is proposed for the site. The site has historically been used for agriculture. The land-use may have resulted in application of fertilisers and contaminating activities to the site.

The site requires investigation to ensure suitability for the proposed land-use.

8.2 Identify the decision

The land-use proposed is residential. The levels of contaminants of concern should be suitable for residential based criteria in the proposed building envelope area. The decision problem is, do the levels of potential contaminants exceed the assessment criteria.

8.3 Identify the inputs decision

Investigation of the site is required to characterise the level of contaminants previously identified. The inputs include:

- Field observation of aesthetic impacts or visible contamination
- Soil samples across the building envelopes

8.4 Define the boundaries of the study

The investigation area is the proposed building envelope for proposed Lot 3 in the subdivision of 51 Winter Lane, Summer Hill Creek NSW.

8.5 Develop a decision rule

Data collected for the purpose of the contamination investigation must be sufficiently accurate representative. The accuracy will be assessed by determination of:

- Current and historical land-use to describe potential contamination sources
- Site setting, potential receptors and pathways
- Soil samples to characterise the extent of contamination and analysis in accredited laboratories.

The adopted criteria is suitability for residential land-use is including the thresholds listed in Schedule B1 of the NEPM (1999) *Guideline on Investigation Levels for Soil and Groundwater*. The data must be sufficiently representative to identify the extent of contamination and if further sampling and analysis is needed to delineate the nature and extent of contamination.

The decision rule for the investigation is:

- If the contamination levels were less than the adopted levels are potential risks low and acceptable
- If the levels were equal or greater than the investigations level will exceedances affect the suitability for the proposed land-use.

8.6 Specify acceptable limits on the decision errors.

A decision error in the context of the decision rule would lead to either underestimation or over estimation of the risk level associated with the site. Decision errors include:

- Limitations in available site history information
- Constraints associated with the ability to access certain areas of a site
- Errors in the sampling plan
- Data quality including comparability, representativeness and accuracy for data collection and analysis
- Analytical data validation

Where sample analysis is undertaken the quality of the data collected will be assessed on a range of factors including:

- Documentation and data completeness
- Reference to relevant guidance documents
- Consistency of methodology
- Data quality including comparability, representativeness and accuracy for data collection and analysis
- Analytical data validation
- Acceptable acceptance limits are the 95% upper confidence limit of samples collected is less than the threshold levels, the standard deviation of results should be less than 50% of the relevant investigation or screening level and the levels are less than 250% the relevant thresholds.

8.7 Optimize the design for obtaining data

The methodology described in Section 9 presents a framework for the contamination investigation which has been designed to meet the scope objectives and the nominated DQO.

Optimisation of the data collection process will be informed by a review of historical information and observations made at the time of site inspection. The sampling will be used to inform the potential contamination status of the site. The scope of work will be undertaken to a level of accuracy and confidence in the ASC NEPM (NEPC 1999).

Analytes included heavy metals.

9. Sampling analysis plan and sampling methodology

9.1 Sampling strategy

9.1.1 Sampling design

A systematic sampling pattern was adopted to assess the probable location of contamination. Uniform management practices are expected to have occurred across the site.

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

9.1.2 Sampling locations

Discrete soil samples were collected from the site on an approximate 20m grid pattern. A total of thirteen discrete soil samples were collected for analysis of heavy metals.

The sampling locations are described in Figure 3.

9.1.3 Sampling density

The sampling density across the site can detect a potential hot spot across the site with a radius of 12m at a 95% level of confidence. The number of sampling locations was in accordance with the recommended density in the EPA sampling guidelines (EPA 2022).

Sampling density of areas of environmental concern is expected to the sufficient to enable preliminary characterisation.

9.1.4 Sampling depth

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

9.2 Analytes

Discrete soil samples collected from the site were evaluated for arsenic, cadmium, chromium, copper, lead, nickel and zinc (Table 1). Heavy metals were identified as the contaminants of concern possibly present as a result of historical agricultural activities.

9.3 Sampling methods

Soil samples were taken using a stainless-steel soil push corer and a hand shovel. Soil was taken at each individual sampling location below the vegetated and detrital layer.

Discrete soil samples were transferred to a solvent rinsed glass jar with a Teflon lid.

Tools were decontaminated between sampling locations to prevent cross contamination by rinsing with clean water and drying.

Table 1. Schedule of samples and analyses

Sample ID (Figure 3)	Location	Analysis undertaken
LC1	Proposed building envelope	Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn)
LC2	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC3	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC4	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC5	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC6	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC7	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC8	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC9	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC10	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC11	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC12	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn
LC13	Proposed building envelope	As, Cd, Cr, Cu, Pb, Ni, Zn

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 across the site on a systematic grid pattern of 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).

The rules for sampling were observed (EPA 2022). All discrete samples from the site were analysed for arsenic, cadmium, chromium, copper, lead, nickel and zinc.

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 5).

A single sampler was used to collect the samples using standard methods. Soil collected was a fresh sample from a corer or hand shovel. 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.

A field sampling log is presented in Appendix 2.

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 1.

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 main reference for environmental site assessment in Australia is the ASC NEPM (NEPC 1999 rev 2013). This document includes criteria for use in evaluating potential risk to human health and ecosystems from chemical impacts, which are presented as generic investigation levels and screening levels appropriate to a Tier 1 risk-based assessment applicable for site assessment. The application of these investigation levels and screening levels is subject to a range of limitations, and their selection and use must be in the context of a conceptual site model (CSM) relating to the nature and distribution of impacts and potential exposure pathways.

The proposed land-use is residential. The appropriate initial criteria are described in *Guideline on Investigation Levels for Soil and Groundwater* (NEPC 1999).

The criteria lists health investigation levels (HIL) for a range of land-uses. The appropriate initial comparison for the site is residential with accessible soil (HIL A).

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). Ecological screening levels (ESL) assess the risk to terrestrial ecosystems from petroleum hydrocarbons in the soil. The EILs and ESLs 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 >5 to 10cmol(+)/kg, clay content of 10 to 15%, pH values of between 4.5 and 5 and organic carbon of 1.0 to 1.5% (eSPADE, 2021). The proposed land-use is residential. The contaminants have been identified in the soil for at least two years and are considered aged.

The ASC NEPM EIL calculation spreadsheet was used to determine the EILs. Default ambient background concentrations were adopted for chromium (III), copper, nickel and zinc.

Table 2. EIL Calculation sheet, residential land-use

Analyte	Rationale	EIL (mg/kg)
Arsenic	Generic	100
Chromium (III)	Clay content 15%, aged	460
Copper	CEC 10cmol/kg, pH 5.0, organic carbon 1.5%	100
Lead	Generic	1,100
Nickel	CEC 10cmol/kg	170
Zinc	CEC 10cmol/kg, pH 5.0	260

EIL- Ecological investigation limit

Table 3. Soil assessment criteria (mg/kg) (NEPC 1999) for residential land-use

Analyte	HIL A – Residential	EIL – Residential
Arsenic	100	100
Cadmium	20	-
Chromium (total)	100[1]	460[2]
Copper	6,000	100
Lead	300	1,100
Nickel	400	170
Zinc	7,400	260

[1] Threshold for Chromium (VI), [2] Threshold for Chromium (III), HIL- human investigation level, EIL- ecological investigation level.

12. Results and discussion

The site has been historically used for grazing. The investigation area was dominated by pasture grasses and broadleaved weeds. Vegetation cover across the site was generally 100%.

No surface staining or odours were detected on the site. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities were observed on-site from the review of site history or site walkover.

Low levels of heavy metals near environmental background levels and less than adopted thresholds for human health and environment were detected in soil samples collected from the building envelope (Table 4).

Table 4. Analytical results general site area (mg/kg)

Sample ID	Location (Figure 3)	Arsenic	Cadmium	Chromium (total)	Copper	Lead	Nickel	Zinc
LC1	Proposed building envelope	2	<0.3	2.9	2.5	10	1.4	7
LC2	Proposed building envelope	2	<0.3	2.0	2.5	10	1.2	9
LC3	Proposed building envelope	4	<0.3	2.4	1.9	13	1.1	6
LC4	Proposed building envelope	2	<0.3	2.7	2.4	11	1.5	5
LC5	Proposed building envelope	3	<0.3	3.6	3.5	10	1.4	6
LC6	Proposed building envelope	4	<0.3	2.6	2.7	9	1.3	8
LC7	Proposed building envelope	2	<0.3	2.1	2.1	7	1.1	7
LC8	Proposed building envelope	2	<0.3	2.7	3.3	9	1.6	13
LC9	Proposed building envelope	3	<0.3	2.9	3.1	12	1.5	10
LC10	Proposed building envelope	2	<0.3	2.7	2.7	7	1.2	6
LC11	Proposed building envelope	1	<0.3	2.6	2.5	8	1.4	6
LC12	Proposed building envelope	2	<0.3	2.3	2.6	7	1.2	7
LC13	Proposed building envelope	2	<0.3	3.3	3.6	11	1.9	11
Health Investigation Levels- Residential land-use threshold (NEPC 1999)								
		100	*20*	*100[1]*	*6,000*	*300*	*400*	*7,400*
***Ecological Investigation Levels*- Urban residential and public open space land-use threshold (NEPC 1999)**								
		100	*-*	*460[2]*	*100*	*1,110*	*170*	*260*

[1] Threshold for Chromium (VI), [2]Threshold for Chromium (III).

13. Site characterisation

13.1 Environmental contamination

No contamination was detected

13.2 Chemical degradation production

Not applicable as no contamination was detected.

13.3 Exposed population

13.3.1 Environment

Not applicable as no contamination was detected.

14. Conclusions and recommendations

14.1 Summary

The site is part of a rural lot located at 51 Winter Lane, Summer Hill Creek NSW. A review of site history indicated that historical land-use over the area was agricultural comprising grazing. An inspection was made on 19 September 2022. The investigation area was dominated by pasture grasses and broadleaved weeds. Vegetation cover was generally 100%.

No buildings or structures are present in the investigation area. A dam is located in the western section of the proposed Lot 3. Drainage lines were observed in the northern and southern sections of the proposed lot. The proposed building envelope is located in the eastern section of the site.

Soils observed on-site to a depth of 1.5m consisted of topsoil of black to dark brown fine sandy clay with fine gravel overlaying greyish brown to brownish yellow sandy clay with fine to medium gravel to a depth of 0.9m. The underlaying soil consists of white sandy clay and reddish yellow clayey sand with fine to medium gravel. Mottles were observed from 0.25m.

No signs of visible contamination such as discolouration or staining was identified on the surface of the site. No signs of settlement or subsidence was identified on the site. No cement sheeting was observed during the site inspection. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities were observed on-site from the review of site history or site walkover.

Low levels of heavy metals near environmental background levels and less than adopted thresholds for human health and environment were detected in soil samples collected from the building envelope area.

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’ within a radius of approximately 12m and with a 95% level of confidence.

14.4 Suitability for proposed use of the site

The site is considered suitable for the proposed residential land-use.

14.5 Limitations and constraints on the use of the site

Nil

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.

16. References

Environment Protection Authority (2020) *Consultants Reporting on Contaminated Land* (NSW Environment Protection Authority, Chatswood)

Environment Protection Authority (2022) *Sampling design guidelines for 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)

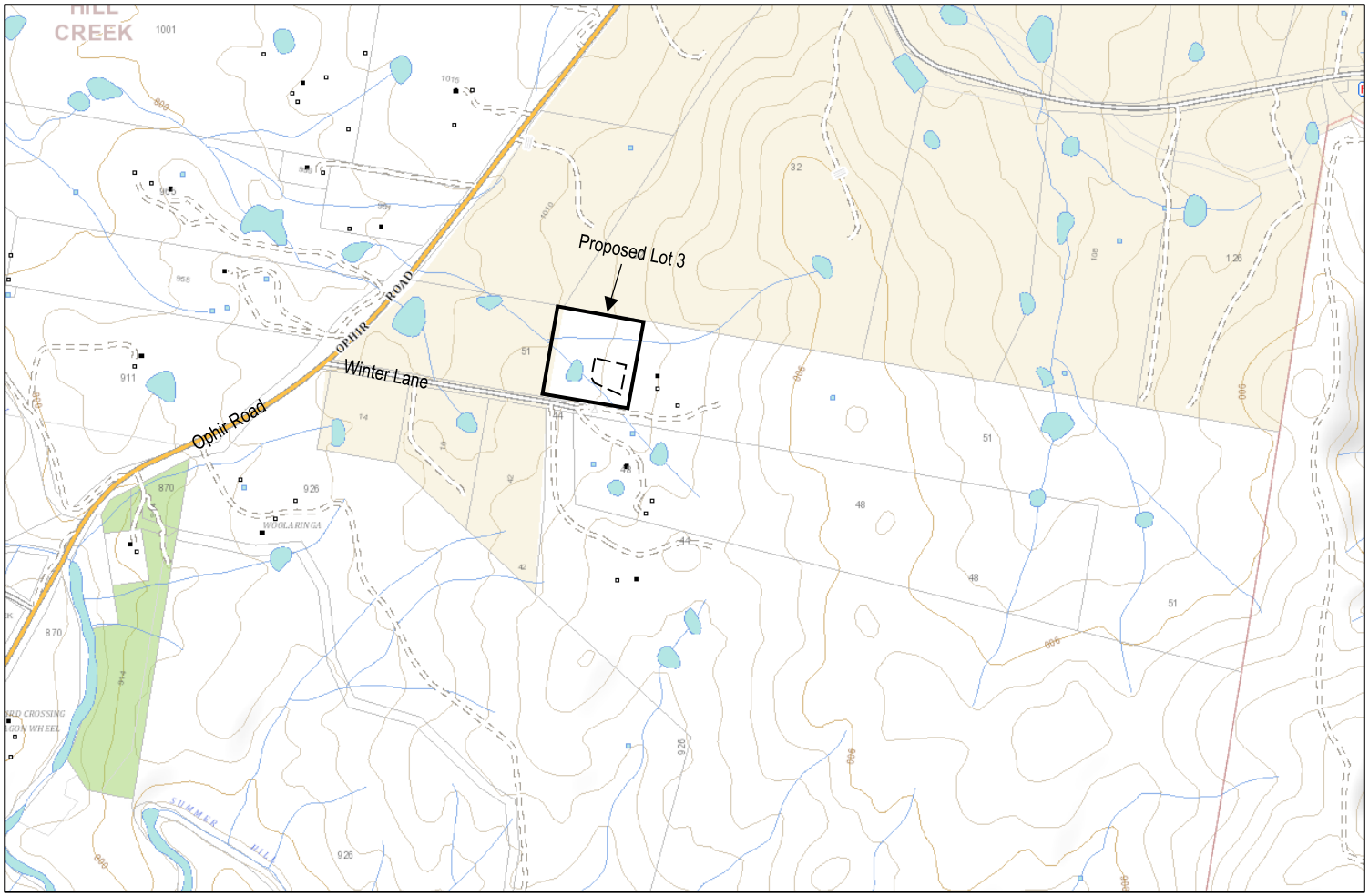
NEPC (1999 revised 2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council Service Corporation, Adelaide)

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

NSW Government (2021) *Naturally occurring asbestos* (datasets.seed.nsw.gov.au/dataset/naturally-occurring-asbestos)

NSW Government (2021) *Acid sulfate soil risk* (https://datasets.seed.nsw.gov.au/dataset/acid-sulfate-soils-risk0196c)

Figures



Legend

——— Proposed lot boundary

– – – Investigation area

Approximate scale 1: 11,000

0 110 220 440m

Figure 1. Locality map		
Lot 3 in the proposed subdivision of 51 Winter Lane, Summer Hill Creek NSW		
	Envirowest Consulting Pty Ltd	
Job: R14064c3	Drawn by: FC	Date: 24/10/2022

Legend

- Proposed lot boundary
- Proposed building envelope
- Dam
- Drainage line

Approximate scale 1: 2,000

0 20 40 80m

Figure 2. Site layout

Lot 3 in the proposed subdivision of 51 Winter Lane, Summer Hill Creek NSW

Envirowest Consulting Pty Ltd

Job: R14064c3	Drawn by: FC	Date: 24/10/2022

Legend

- Proposed lot boundary
- Proposed building envelope
- Dam
- Drainage line
- ⊗ Sampling location

Approximate scale 1: 1,900

0 19 38 76m

Figure 3. Sampling locations

Lot 3 in the proposed subdivision of 51 Winter Lane, Summer Hill Creek NSW

Envirowest Consulting Pty Ltd

Job: R14064c3	Drawn by: FC	Date: 24/10/2022

Figure 4. Photographs of the site

Looking north over the site.

Looking west over the site.

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 site 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 (2022) 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 adopted criteria of 30%

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 – 30%

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 be 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 19 September 2022. A total of thirteen samples were submitted for analytical testing. 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
LC1, LC2, LC3, LC4, LC5, LC6, LC7, LC8, LC9, LC10, LC11, LC12, LC13	13	1	As, Cd, Cr, Cu, Pb, Ni, Zn	19/9/2022	Soil	SE236869

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 8% 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 +/- 30% 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
LC1, LC2, LC3, LC4, LC5, LC6, LC7, LC8, LC9, LC10, LC11, LC12, LC13	13	1	8	19/9/2022	Soil	SE236869

Table A1. Relative differences for intra laboratory duplicates

	LC13, DA3			
	LC13	DA3	Relative difference (%)	Pass/Fail
Arsenic	2	2	0	Pass
Cadmium	<0.3	<0.3	NA	-
Chromium	3.3	3.1	6	Pass
Copper	3.6	3.2	12	Pass
Lead	11	10	10	Pass
Nickel	1.9	1.8	5	Pass
Zinc	11	11	0	Pass

NA – relative difference unable to be calculated as results are less than laboratory detection limit, ^ small exceedance not expected to impact on 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.

4. Laboratory quality assurance and quality control

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

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

The laboratory interpretative reports are presented with individual laboratory report. Assessment is made of site time, frequency of control samples and quality control samples. 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 site 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 +/-30% or discussion required.
Laboratory prepared volatile trip spikes	NA	Not collected due to preliminary nature of investigation.

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	NA	Not collected due to preliminary nature of investigation

5.5.2 Laboratory

Consideration	**Accepted**	**Comment**
Method blanks	Yes	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
Matrix duplicates	Yes	Frequency of 5%, results to be within +/-40% or discussion required.
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.

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.

Appendix 2. Field sampling log

Client	John and Michelle Eyles
Contact	John and Michelle Eyles
Job number	14064
Location	Lot 3 in the proposed subdivision of 51 Winter Lane Summer Hill Creek NSW 2800
Date	19 September 2022
Investigator	Felipe Canavez
Weather conditions	Clear and windy

Sample ID	Matrix	Date	Analysis required	Observations/comments
LC1	Soil	19/09/2022	Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn)	
LC2	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC3	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC4	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC5	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC6	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC7	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC8	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC9	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC10	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC11	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC12	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
LC13	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	
DA3	Soil	19/09/2022	As, Cd, Cr, Cu, Pb, Ni, Zn	Duplicate of sample LC13

Appendix 3. 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 site time for extraction (AS4482.1) are:

Analyte	Maximum site time
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

Appendix 4. Soil analysis results – SGS report number SE236869

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Felipe Canavez
Client	ENVIROWEST CONSULTING PTY LIMITED
Address	PO BOX 8158 NSW 2800
Telephone	61 2 63614954
Facsimile	(Not specified)
Email	felipe@envirowest.net.au
Project	**14064-3**
Order Number	**14064-3**
Samples	14

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE236869 R0**
Date Received	20/9/2022
Date Reported	4/10/2022

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

Kamrul AHSAN
Senior Chemist

Shane MCDERMOTT
Inorganic/Metals Chemist

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 26/9/2022

PARAMETER	UOM	LOR	LC1 SOIL - 19/9/22 14:00 SE236869.001	LC2 SOIL - 19/9/22 14:00 SE236869.002	LC3 SOIL - 19/9/22 14:00 SE236869.003	LC4 SOIL - 19/9/22 14:00 SE236869.004	LC5 SOIL - 19/9/22 14:00 SE236869.005
Arsenic, As	mg/kg	1	2	2	4	2	3
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	2.9	2.0	2.4	2.7	3.6
Copper, Cu	mg/kg	0.5	2.5	2.5	1.9	2.4	3.5
Lead, Pb	mg/kg	1	10	10	13	11	10
Nickel, Ni	mg/kg	0.5	1.4	1.2	1.1	1.5	1.4
Zinc, Zn	mg/kg	2	7	9	6	5	6

PARAMETER	UOM	LOR	LC6 SOIL - 19/9/22 14:00 SE236869.006	LC7 SOIL - 19/9/22 14:00 SE236869.007	LC8 SOIL - 19/9/22 14:00 SE236869.008	LC9 SOIL - 19/9/22 14:00 SE236869.009	LC10 SOIL - 19/9/22 14:00 SE236869.010
Arsenic, As	mg/kg	1	4	2	2	3	2
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	2.6	2.1	2.7	2.9	2.7
Copper, Cu	mg/kg	0.5	2.7	2.1	3.3	3.1	2.7
Lead, Pb	mg/kg	1	9	7	9	12	7
Nickel, Ni	mg/kg	0.5	1.3	1.1	1.6	1.5	1.2
Zinc, Zn	mg/kg	2	8	7	13	10	6

PARAMETER	UOM	LOR	LC11 SOIL - 19/9/22 14:00 SE236869.011	LC12 SOIL - 19/9/22 14:00 SE236869.012	LC13 SOIL - 19/9/22 14:00 SE236869.013	DA3 SOIL - 19/9/22 14:00 SE236869.014
Arsenic, As	mg/kg	1	1	2	2	2
Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	<0.3	<0.3
Chromium, Cr	mg/kg	0.5	2.6	2.3	3.3	3.1
Copper, Cu	mg/kg	0.5	2.5	2.6	3.6	3.2
Lead, Pb	mg/kg	1	8	7	11	10
Nickel, Ni	mg/kg	0.5	1.4	1.2	1.9	1.8
Zinc, Zn	mg/kg	2	6	7	11	11

Moisture Content [AN002] Tested: 26/9/2022

PARAMETER	UOM	LOR	LC1 SOIL - 19/9/22 14:00 SE236869.001	LC2 SOIL - 19/9/22 14:00 SE236869.002	LC3 SOIL - 19/9/22 14:00 SE236869.003	LC4 SOIL - 19/9/22 14:00 SE236869.004	LC5 SOIL - 19/9/22 14:00 SE236869.005
% Moisture	%w/w	1	25.5	26.9	29.2	34.2	44.7

PARAMETER	UOM	LOR	LC6 SOIL - 19/9/22 14:00 SE236869.006	LC7 SOIL - 19/9/22 14:00 SE236869.007	LC8 SOIL - 19/9/22 14:00 SE236869.008	LC9 SOIL - 19/9/22 14:00 SE236869.009	LC10 SOIL - 19/9/22 14:00 SE236869.010
% Moisture	%w/w	1	33.0	31.0	24.8	32.3	26.7

PARAMETER	UOM	LOR	LC11 SOIL - 19/9/22 14:00 SE236869.011	LC12 SOIL - 19/9/22 14:00 SE236869.012	LC13 SOIL - 19/9/22 14:00 SE236869.013	DA3 SOIL - 19/9/22 14:00 SE236869.014
% Moisture	%w/w	1	27.0	33.7	37.4	32.7

METHOD SUMMARY

SE236869 R0

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.

FOOTNOTES

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

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:

a. 1 Bq is equivalent to 27 pCi
b. 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.

STATEMENT OF QA/QC PERFORMANCE

SE236869 R0

CLIENT DETAILS

Contact	Felipe Canavez
Client	ENVIROWEST CONSULTING PTY LIMITED
Address	PO BOX 8158 NSW 2800
Telephone	61 2 63614954
Facsimile	(Not specified)
Email	felipe@envirowest.net.au
Project	**14064-3**
Order Number	**14064-3**
Samples	14

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE236869 R0**
Date Received	20 Sep 2022
Date Reported	04 Oct 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:

Analysis Date	Moisture Content	4 items

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	14 Soil
Date documentation received	20/9/2022	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	Yes
Sample temperature upon receipt	12.2°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

HOLDING TIME SUMMARY

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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)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
LC1	SE236869.001	LB259241	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	04 Oct 2022†
LC2	SE236869.002	LB259241	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	04 Oct 2022†
LC3	SE236869.003	LB259241	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	04 Oct 2022†
LC4	SE236869.004	LB259241	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	04 Oct 2022†
LC5	SE236869.005	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC6	SE236869.006	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC7	SE236869.007	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC8	SE236869.008	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC9	SE236869.009	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC10	SE236869.010	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC11	SE236869.011	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC12	SE236869.012	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
LC13	SE236869.013	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022
DA3	SE236869.014	LB259242	19 Sep 2022	20 Sep 2022	03 Oct 2022	26 Sep 2022	01 Oct 2022	28 Sep 2022

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES — Method: ME-(AU)-[ENV]AN040/AN320

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
LC1	SE236869.001	LB259238	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	04 Oct 2022
LC2	SE236869.002	LB259238	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	04 Oct 2022
LC3	SE236869.003	LB259238	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	04 Oct 2022
LC4	SE236869.004	LB259238	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	04 Oct 2022
LC5	SE236869.005	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC6	SE236869.006	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC7	SE236869.007	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC8	SE236869.008	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC9	SE236869.009	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC10	SE236869.010	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC11	SE236869.011	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC12	SE236869.012	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
LC13	SE236869.013	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 2022
DA3	SE236869.014	LB259239	19 Sep 2022	20 Sep 2022	18 Mar 2023	26 Sep 2022	18 Mar 2023	28 Sep 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 identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

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.

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES — **Method: ME-(AU)-[ENV]AN040/AN320**

Sample Number	Parameter	Units	LOR	Result
LB259238.001	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
LB259239.001	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 = | OriginalResult - ReplicateResult | x 100 / 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 x SDL / Mean + 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 identifer 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)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE236751A.009	LB259242.021	% Moisture	%w/w	1	21.1	21.1	35	0
SE236868.010	LB259241.011	% Moisture	%w/w	1	27.4	25.8	34	6
SE236869.004	LB259241.022	% Moisture	%w/w	1	34.2	36.1	33	5
SE236869.014	LB259242.011	% Moisture	%w/w	1	32.7	35.8	33	9

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 %
SE236751A.009	LB259239.024	Arsenic, As	mg/kg	1	9	9	42	2
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.5	18	18	33	1
		Copper, Cu	mg/kg	0.5	16	18	33	12
		Nickel, Ni	mg/kg	0.5	3.7	3.5	44	5
		Lead, Pb	mg/kg	1	17	16	36	6
		Zinc, Zn	mg/kg	2	30	31	37	4
SE236868.010	LB259238.014	Arsenic, As	mg/kg	1	2	2	83	36
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.5	2.6	2.5	50	2
		Copper, Cu	mg/kg	0.5	1.5	1.3	65	9
		Nickel, Ni	mg/kg	0.5	1.1	1.1	75	6
		Lead, Pb	mg/kg	1	7	7	44	9
		Zinc, Zn	mg/kg	2	5	5	70	1
SE236869.014	LB259239.014	Arsenic, As	mg/kg	1	2	2	88	5
		Cadmium, Cd	mg/kg	0.3	<0.3	<0.3	200	0
		Chromium, Cr	mg/kg	0.5	3.1	3.3	46	6
		Copper, Cu	mg/kg	0.5	3.2	3.4	45	4
		Nickel, Ni	mg/kg	0.5	1.8	2.0	56	8
		Lead, Pb	mg/kg	1	10	11	39	10
		Zinc, Zn	mg/kg	2	11	11	48	0

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.

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 %
LB259238.002	Arsenic, As	mg/kg	1	350	318.22	80 - 120	110
	Cadmium, Cd	mg/kg	0.3	4.4	4.81	70 - 130	92
	Chromium, Cr	mg/kg	0.5	40	38.31	80 - 120	104
	Copper, Cu	mg/kg	0.5	310	290	80 - 120	108
	Nickel, Ni	mg/kg	0.5	190	187	80 - 120	102
	Lead, Pb	mg/kg	1	92	89.9	80 - 120	102
	Zinc, Zn	mg/kg	2	280	273	80 - 120	102
LB259239.002	Arsenic, As	mg/kg	1	350	318.22	80 - 120	110
	Cadmium, Cd	mg/kg	0.3	4.2	4.81	70 - 130	87
	Chromium, Cr	mg/kg	0.5	43	38.31	80 - 120	112
	Copper, Cu	mg/kg	0.5	330	290	80 - 120	112
	Nickel, Ni	mg/kg	0.5	200	187	80 - 120	105
	Lead, Pb	mg/kg	1	94	89.9	80 - 120	104
	Zinc, Zn	mg/kg	2	300	273	80 - 120	108

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 identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

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%
SE236868.001	LB259238.004	Arsenic, As	mg/kg	1	53	2	50	100
		Cadmium, Cd	mg/kg	0.3	49	<0.3	50	97
		Chromium, Cr	mg/kg	0.5	54	4.9	50	98
		Copper, Cu	mg/kg	0.5	54	2.6	50	102
		Nickel, Ni	mg/kg	0.5	52	2.9	50	98
		Lead, Pb	mg/kg	1	55	8	50	94
		Zinc, Zn	mg/kg	2	56	8	50	97
SE236869.005	LB259239.004	Arsenic, As	mg/kg	1	45	3	50	85
		Cadmium, Cd	mg/kg	0.3	43	<0.3	50	85
		Chromium, Cr	mg/kg	0.5	47	3.6	50	86
		Copper, Cu	mg/kg	0.5	47	3.5	50	88
		Nickel, Ni	mg/kg	0.5	45	1.4	50	87
		Lead, Pb	mg/kg	1	48	10	50	77
		Zinc, Zn	mg/kg	2	49	6	50	87

MATRIX SPIKE DUPLICATES

SE236869 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / 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 x SDL / Mean + 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 identifer 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

*	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.

Chain of Custody Form – Ref 14064-3

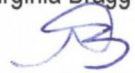
Ref:	**14064-3**		**Sample matrix**			**Sample preservation**			**Analysis**					
Investigator:	Envirowest Consulting 9 Cameron Place PO Box 8158 ORANGE NSW 2800								**SGS Method Code**					
Telephone:	(02) 6361 4954								**CL1T**					
Email:	felipe@envirowest.net.au													
Contact Person:	Felipe Canavez													
Invoice:	accounts@envirowest.net.au													
Laboratory:	SGS SYDNEY 16/33 Maddox Street ALEXANDRIA NSW 2015		Water	Soil	Sludge	Cool	HNO3/ HCl	Unpre-served	7 metals (total)					
Quotation #:	Envir_70119_2019													
Courier/CN:	Toll													
	Sample ID	**Container***	**Sampling Date/Time**											
1	LC1				X		X			X				
2	LC2				X		X			X				
3	LC3				X		X			X				
4	LC4				X		X			X				
5	LC5				X		X			X				
6	LC6				X		X			X				
7	LC7				X		X			X				
8	LC8				X		X			X				
9	LC9				X		X			X				
10	LC10				X		X			X				
11	LC11				X		X			X				
12	LC12				X		X			X				
13	LC13				X		X			X				
14	DA3				X		X			X				

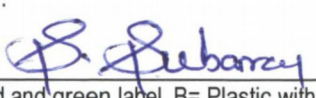
SGS EHS Sydney COC

SE236869

Investigator: I attest that the proper field sampling procedures were used during the collection of these samples.

Sampler name: Felipe Canavez
Date: 19/9/2022 Time: 14:00

Relinquished by: (print and signature) Virginia Bragg  Date: 19/9/2022 Time 1500

Received by: (print and signature)  Date 20/09/22 Time @ 7:10

Please return completed form to Envirowest Consulting, *A = Solvent rinsed glass jar with Teflon lined lid and green label, B= Plastic with green label, C= Amber with green label, D= Plastic red label, F= 40mLvial