# Preliminary contamination investigation

Lot 1 DP914028, Lidsdale NSW

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| **Client** Peter Williams<br>32 Ian Holt Drive<br>Lidsdale NSW 2790 | | | | | |
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## Summary report

### Introduction

A residential dwelling is proposed for Lot 1 DP914028, 32 Ian Holt Drive, Lidsdale NSW. The site is zoned light industrial and approval is being sought to amend the permitted use of the site. Lithgow City Council requested a preliminary contamination investigation as part of conditional approval for the proposed dwelling. An investigation of the site is required to determine the soil contamination status and suitability for residential land-use.

### Scope

The objective was to 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.

### Summary

An inspection of the site was undertaken on 23 September 2021. The site is located in a commercial/industrial zoning of Lidsdale surrounded mostly by residential dwelling to the east and south east. The site is currently pasture for the grazing of cattle and has an area of approximately 8100m$^2$. The site was previously part of a larger grazing agricultural enterprise.

Surface cover on the site comprised pastures grasses including ryegrass and red grass. No trees were present. A level building pad in the west of the site comprises imported fill material. Fill material imported to the site for a level building pad was pre classified as ENM.

No surface staining or odours were detected on the site. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities was observed on the site from the review of site history or site walkover. No use of agricultural pesticides is expected due to the low input nature of the grazing enterprise.

No evidence of the former dwelling or residual building materials was identified on the site during the site inspection. The area was well vegetated.

The soil sampling program did not detect elevated levels of the potential contaminants at the former building footprint or representative locations across the site. The levels of all substances evaluated were below the adopted thresholds for residential land-use with access to soil.

### Recommendations

The site is suitable for residential land-use.

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## 1. Introduction

A residential dwelling is proposed for Lot 1 DP914028, 32 Ian Holt Drive, Lidsdale NSW. The site is zoned light industrial and approval is being sought to amend the permitted use of the site. Lithgow City Council requested a preliminary contamination investigation as part of conditional approval for the proposed dwelling. An investigation of the site is required to determine the soil contamination status and suitability for residential land-use.

## 2. Objectives

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

## 3. Scope of work

Envirowest Consulting Pty Ltd was commissioned by Peter Williams Ltd to undertake a preliminary contamination assessment, 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 Lot 1 DP914028 Ian Holt Drive, Lidsdale NSW. The objective was to identify past potentially contaminating activities, identify potential contamination types, discuss the site condition, provide a preliminary assessment of site contamination and assess the need for further investigation or suitability for residential land-use.

## 4. Site identification

| | |
|---|---|
| Address | 32 Ian Holt Drive<br>Lidsdale NSW |
| Deposited plans | Lot 1 DP914028 |
| Latitude and longitude | -33.3887$^{o}$ 150.0817$^{o}$ |
| Geographic coordinates | 55H E786668m N6301380m |
| Client | Peter Williams |
| Owner | Peter Williams |
| Current occupier | Owner occupied |
| Area | Approximately 8100m$^{2}$ |
| Local government area | Lithgow City Council |
| Current zoning | IN1 – Light Industrial (Lithgow LEP 2014) |
| Trigger for investigation | Amend permitted use |
| Locality map | Figure 1 |

# 5. Site history

## 5.1 Land-use

The site is located in an industrial area with an existing residential dwelling to the south east. The site is currently pasture for the grazing of cattle and has an area of approximately 8100m$^2$. A dwelling and associated infrastructure was formally located in the east of the site. Fill material has been used for leveling of a house pad.

## 5.2 Summary of council records

The site is mapped in the Lithgow LEP (2014) as an area of vulnerable groundwater. The site is within the Sydney drinking water catchment and considered bushfire prone land.

## 5.3 EPA contaminated sites list

The investigation area is not listed on the NSW EPA register of contaminated sites (21 October 2021) or sites notified to the EPA (11 October 2021). No listed sites occur within 1km of the investigation area.

## 5.4 Sources of information

- Site inspections 23 September 2021 by Greg Madafiglio of Envirowest Consulting Pty Ltd
- NSW EPA records of public notices under the CLM Act 1997
- Soil and geological maps
- Historical aerial photographs – Google Earth, Nearmaps and NSW Government Historical Imagery Viewer
- NSW Planning and Environment planning viewer

## 5.5 Review of historic aerial photographs, maps and plans

| Year | Visual observations on site and surround land |
|---|---|
| 1969 | A structure presumed to be a dwelling is present in the east of the site with other infrastructure located to the south east of the site. The remainder of the site appears to be agricultural pasture. A presumed industrial complex/site is located to the south east. Ian Holt Drive is located to the east. Residential dwellings are located to the north. Agricultural land is located to the south and west. |
| 1975 | No significant changes identified. |
| 1984 | The dwelling has been removed a potential concrete slab remains. Disturbance is present to the east of the site. |
| 1991 | A series of soil stockpiles/disturbed areas are located in the central section of the site. The stockpiles form a cross country track for motorbikes. Industrial complex/site to the south east has expanded and an additional driveway to Ian Holt Drive is present. |
| 1998 | No significant on-site changes identified, former dwelling site remains visible. Original driveway at Industrial complex/site to the south east has been removed. Additional Industrial infrastructure is located to the east. |
| 2006 | The former dwelling slab and other infrastructure to the south east have been removed. The site appears vacant. A track is evident around the boundary of the site. A shed has been constructed to the south east on 32 Ian Holt Drive. The Castlereagh Highway has been constructed to the west. Industrial complex/site to the south east has expanded |
| 2014 | A disturbance possibly stockpiling is noted in the south west of the site. The disturbance was identified as motorcycle jumps during the site inspection. The remainder of the site is well vegetated. Cattle are present on the site. A dwelling and associated infrastructure has been constructed to the south east. |

| | |
|---|---|
| 2015 | The site appears sparsely vegetated possible due to dry seasonal conditions. Motorcycle jumps are present but less significant. |
| 2016 | Motorcycle jumps are present. |
| 2019 | The site appears dry due to seasonal conditions. Minor soil disturbance has occurred in the east of the site. Stockpiles are present south west of the site. |
| 2020 | The site appears dry due to seasonal conditions. Cattle are present on the site. Cattle yards and storage are present south west of the site. |
| 2021 | The site appears well vegetated. A large bare level area is located in the west of the site. Motorcycle jumps are no longer present. |

### 5.6 Chronological list of site uses

A dwelling was located on the site in the 1969 and 1975 aerial photographs. The dwelling was demolished prior to 1984, a presumed concrete slab remained onsite to the early 2000's. The site was purchased by the current owner in 2004. The current owner has used the site for the grazing of cattle. Cattle are evident in the 2014 and 2020 aerial photographs.

### 5.7 Buildings and infrastructure

No buildings are located on the site. A level building pad in located in the west of the site. A dwelling was present in the east of the site in historical aerials. Other infrastructure associated with the dwelling were located south-east of the site.

### 5.8 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.

### 5.9 Relevant complaint history

Nil

### 5.10 Previous investigations

No previous investigations are known to have been undertaken on the site. An assessment of fill material imported to the site for leveling of a house pad was undertaken and detailed below.

#### 5.10.1 Compaction and Soil Testing Services Pty Ltd (2020) ENM Classification Assessment, The Northern Road Stage 3 – Frogmore Road, Orchard Hills, NSW (Ref:1011 – E1384 – BR).

*Based on this assessment, CTST has classified the subject materials as Excavated Natural Material (ENM) in accordance with the NSW EPA Excavated Natural Material Order 2014.*

### 5.11 Historical neighbouring land-use

North – Agricultural, residential
South – Infrastructure associated with former on-site dwelling, Industrial
East – Ian Holt Drive, rural residential
West – Agricultural

Historical neighbouring land-uses are not expected to impact the site. The site is located in a mining district however no mining infrastructure or activity has been located on the site.

Ian Holt Drive was the Castlereagh Highway prior to the 1990 which is the main road to Mudgee. The site is located in the rural village of Lidsdale.

### 5.12 Contaminant sources

Potential exists for contaminating activities to have been undertaken on site which may impact on the suitability for the proposed land-use. The agricultural land-use may have resulted in application of contaminants.

Residential land-use is not a contaminating activity, other infrastructure associated with the dwelling was outside the investigation area.

Motorcycle jumps were constructed using on-site soil material and are not considered a potential contamination source.

Fill material imported to the site for a level building pad was pre classified as ENM and is not considered a potential contaminate.

### 5.13 Contaminants of concern

Based on historical activities and site inspection contaminants of concern are heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury). The heavy metals may be present use to historical disturbance, fill or residual from the former dwelling on the site.

### 5.14 Integrity assessment

The site history was obtained from site inspections 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 environment

### 6.1 Site inspection

The site was inspected by Greg Madafiglio of Envirowest Consulting Pty Ltd on 23 September 2021.

### 6.2 Land-use

The site comprised pasture for the grazing of cattle. A level house pad is located in the west from imported fill.

### 6.3 Neighbouring land-use

North – Crown land, Perma-Liner Industries Australia
South – Existing dwelling at 32 Ian Holt Drive, AC Whalan and Co Pty
East – Sheather Mechanical Repairs, Wallerawang Landscaping and Construction
West – Crown land, Castlereagh Highway

The Kerosene Vale Ash Repository is located approximately 600m east of the site. Present neighbouring land-uses are not expected to impact the site.

### 6.4 Surface cover and vegetation

Surface cover on the site comprised pastures grasses including ryegrass and red grass. No trees were located on the site. A level building pad in the west of the site comprises imported fill material.

### 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.

Fill material is located in the west of the site. Fill material imported to the site for leveling was pre classified as ENM and is not considered a potential source of contamination.

No evidence of the former dwelling or residual building materials was identified in the east of the site during the site inspection. The area was well vegetated.

Motorcycle jumps were located in the south west were constructed using onsite soil material and are not considered a potential source of contamination.

### 6.6 Topography

The site is located on an upper slope with an inclination predominately 1 to 4% to the south west. Elevation is 904 and 899 metres above sea levels, the lowest elevation occurs in the south west.

### 6.7 Soils and geology

The site is located within the Cullen Bullen Soil Landscape (NSW Government (nd)). Soil in the Cullen Bullen Soil Landscape are dominated by yellow podzolic soils and yellow earths on crests. Yellow podzolic soils, soloths and yellow leached earths on upper and mid slopes with yellow solodic soils and yellow podzolic soils on lower slopes and in narrow drainage lines. Dominate soil materials comprise dark reddish brown sandy clay loam topsoil with bright brown light to medium clay subsoil.

Parent rock comprises Illawarra Coal Measures and the Berry Formation. Illawarra Coal Measures parent rocks are shale and sandstone with conglomerate, limestone, dolomite, claystone, mudstone, coal and torbanite. The Berry Formations parent rock is grey siltstone with thin beds of limestone and sandstone.

### 6.8 Water

#### 6.8.1 Surface water

Surface water on the site is expected to flow predominately south west into a dam located south west of the site. The Coxs River is located approximately 200m south west of the site.

#### 6.8.2 Groundwater

No groundwater bores are located on the site from review of the NSW government Water NSW website (2021). Two groundwater bores are located within 500m of the site. The bores are licensed for domestic. Water bearing zones were greater than 30m in sandstone or shale. Standing water levels at the time of drilling were from 15m. A summary of bore details is given in Table 1.

**Table 1.** Groundwater bores within 500m of the site

| No. | Year drilled | Location | SWL (m) | Use | Status |
|---|---|---|---|---|---|
| GW062815 | 1983 | 500m NE | 22.9 | Domestic | Current |
| GW101461 | 1988 | 500m SE | 15 | Domestic | Current |

### 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 20 October 2021).

The site is not mapped as a geological unit with asbestos potential (NSW SEED Portal accessed 20 October 2021).

### 6.10 Environmentally sensitive features or habitats

No environmentally sensitive features or habitats were identified on the site. The site forms part of the Sydney drinking water catchment. The Coxs River is located approximately 200m south west of the site.

### 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 site which may impact on the suitability for the proposed land-use. The agricultural land-use may have resulted in application of contaminants. Residential land-use is not a contaminating activity, other infrastructure associated with the dwelling was outside the investigation area. Fill material imported to the site for a level building pad was pre classified as ENM and is not considered a potential contaminate.

### 7.2 Contaminants of concern

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

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

### 7.3 Potential receptors

The proposed land-use of the site is residential. The site is zoned light industrial and is currently used as agricultural pasture.

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, construction workers 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 vaporisation, 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 or hard surfaces constructed which will control sediment movement from the site. Contaminants from the site are unlikely to be transported to surrounding aquatic receptors.

Groundwater is not identified as a potential receptor to contamination. Groundwater in the locality is located at depths greater than 10m. Contaminants are expected to originate from the soil surface. Depth to groundwater, presence of clay subsoils and confined groundwater aquifer are expected to restrict downward movement of potential contaminants.

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

☒Potential, ☐unknown/unlikely

# 8. Data quality objectives (DQO)

## 8.1 State the problem

A residential dwelling is proposed for the site. Land-use will change from pasture to residential. The site is zoned light industrial and has historically been used as agricultural pasture which may have resulted in application of contaminants. A residential dwelling was formally located on 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 and the levels of contaminants should be less than the thresholds listed in Section 10. The decision problem is, do the levels of potential contaminants exceed the assessment criteria listed in Section 10.

## 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 Lot 1 DP914028, 32 Ian Holt Drive, Lidsdale NSW.

### 8.5 Develop a decision rule

The initial guidelines for soil were the health and ecological investigation and screening 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

Two soil samples were collected from the site on a judgemental sampling pattern and analysed for heavy metals.

## 9. Sampling analysis plan and sampling methodology

### 9.1 Sampling strategy

#### 9.1.1 Sampling design

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

#### 9.1.2 Sampling locations

Soil samples were collected from the site on a judgmental pattern. A total of two soil samples were collected for analysis. One soil sample was collected from the former miners cottage footprint and the second end the centre of the site. The samples are considered representative of the Lot as no specific areas of concern were identified.

The sampling locations are described in Figures 3.

#### 9.1.3 Sampling density

Soil samples were collected across the site on a judgmental pattern. The sampling frequency is less than the minimum recommended by NEPM (1999) but expected to be sufficient due to the historic land-use.

#### 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

Soil samples collected from the site were evaluated for arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury. Heavy metals were identified as the contaminants of concern possibly present as a result of previous activities.

### 9.3 Sampling methods

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

**Table 2.** Schedule of samples and analyses

| Sample ID | Date collected | Analysis undertaken |
|---|---|---|
| IHD1 | 23/09/2021 | Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg) |
| IHD2 | 23/09/2021 | As, Cd, Cr, Cu, Pb, Ni, Zn, Hg |

# 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.

Soil samples were collected across the site on a judgmental pattern. Sampling locations are expected to be representative of the site.

The number of sampling density is less than the recommended density in the EPA sampling guidelines but expected to be sufficient to enable characterisation due to historical land-use and preliminary nature of the investigation.

## 10.2 Field

The collection of samples was undertaken in accordance with accepted standard protocols (NEPC 1999).

Soil samples collected from the site were analysed for heavy metals.

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 4).

A single sampler was used to collect the samples using standard methods. Soil collected was a fresh sample from a 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 3.

## 10.3 Laboratory

Chemical analysis was conducted by ALS Environmental, Smithfield, 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 4.

## 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 2.

## 11. Assessment criteria

The proposed land-use is residential. The laboratory results were assessed against the proposed land-use of residential with access to the soil (*HIL A*). 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). 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 >10-15cmol(+)/kg, clay content of 20 to 25%, pH values of between 4.5 and 5 and organic carbon of 1.5 to 2% (eSPADE 2021). The proposed land-use is residential (urban residential areas). 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 4.

ESLs are dependent on land-use, soil types and are applicable to contaminants up to 2m below the surface. The appropriate ESL for the site is residential in fine soil as listed in Table 5.

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 assessment criteria – metals (mg/kg) (NEPC 1999)

| Analyte | HIL A – Residential | EIL – Urban residential and public open space |
|---|---|---|
| Arsenic | 100 | 100 |
| Cadmium | 20 | - |
| Chromium (total) | 100[1] | 550[2] |
| Copper | 6,000 | 100 |
| Lead | 300 | 1,100 |
| Nickel | 400 | 220 |
| Zinc | 7,400 | 260 |
| Mercury | 40 | - |

HIL- human investigation level, EIL- ecological investigation level.

**Table 4.** EIL Calculation sheet, residential/public open space land-use

| Analyte | Rationale | ACL (mg/kg) | ABC (mg/kg) | EIL (mg/kg) |
|---|---|---|---|---|
| Arsenic | Generic | 100 | - | 100 |
| Chromium (III) | Clay content 25%, aged | 550 | 0 | 550 |
| Copper | CEC 15cmol/kg, pH 5, organic carbon 2% | 100 | 0 | 100 |
| Lead | Generic | 1,100 | 0 | 1,100 |
| Nickel | CEC 15cmol/kg, pH 5 | 220 | 0 | 220 |
| Zinc | CEC 15cmol/kg, pH 5 | 260 | 0 | 260 |

ACL - added contaminant limit, ABC - ambient background concentration, EIL- Ecological investigation limit (ACL+ABC)

## 12. Results and discussion

The site is currently used for the grazing of cattle. The site has a land-use history of agriculture. A building on the site suspected to be a miners cottage. The dwelling was demolished prior to 1984 and the building footprint was observable until 2000. No remnants of the building remain on the site.

The site has been cleared of trees and surface cover comprised pastures grasses and broad-leaved weeds. A level building pad in the west of the site comprises imported fill material.

No surface staining or odours were detected on the site. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities on the site from the review of site history or site walkover. The use of agricultural pesticides over the area in the past is expected to be low.

No evidence of the former dwelling, building materials or soil disturbance were identified during the site inspection. All areas were vegetated except for the recently imported fill. Fill material located on the site was pre classified as ENM.

Low levels of heavy metals near environmental background levels and less than the adopted thresholds for human health and environment were detected in soil samples collected from the site (Table 5). Samples HD1 was located at the former miners cottage building location did not contain elevated levels of any analyte.

**Table 5.** Analytical results and threshold concentrations – Heavy metals (mg/kg)

| Sample ID | Arsenic | Cadmium | Chromium (total) | Copper | Lead | Nickel | Zinc | Mercury |
|---|---|---|---|---|---|---|---|---|
| IHD1 | <5 | <1 | 2 | <5 | 7 | <2 | 7 | <0.1 |
| IHD2 | <5 | <1 | 3 | <5 | 6 | <2 | 9 | <0.1 |
| ***Health Investigation Levels – Residential land-use threshold (NEPC 1999)*** | | | | | | | | |
| | *100* | *20* | *100[1]* | *6,000* | *300* | *400* | *7,400* | *40* |
| ***Ecological Investigation Levels* – Urban residential and public open space land-use threshold (NEPC 1999)** | | | | | | | | |
| | *100* | *-* | *550[2]* | *100* | *1,100* | *220* | *260* | *-* |

[1] Threshold for Chromium (VI), [2] Threshold for Chromium (III), [3] Calculated from composite sample results

## 13. Site characterisation

### 13.1 Environmental contamination

Not applicable as no contamination was detected.

### 13.2 Chemical degradation production

Not applicable as no contamination was detected.

### 13.3 Exposed population

Not applicable as no contamination was detected

# 14. Conclusions and recommendations

## 14.1 Summary

An inspection of the site was undertaken on 23 September 2021. The site is located in a commercial/industrial zoning of Lidsdale surrounded mostly by residential dwelling to the east and south east. The site is currently pasture for the grazing of cattle and has an area of approximately 8100m$^2$. The site was previously part of a larger grazing agricultural enterprise.

Surface cover on the site comprised pastures grasses including ryegrass and red grass. No trees were present. A level building pad in the west of the site comprises imported fill material. Fill material imported to the site for a level building pad was pre classified as ENM.

No surface staining or odours were detected on the site. No evidence of mines, sheep dips, mixing sheds or contaminating industrial activities was observed on the site from the review of site history or site walkover. No use of agricultural pesticides is expected due to the low input nature of the grazing enterprise.

No evidence of the former dwelling or residual building materials was identified on the site during the site inspection. The area was well vegetated.

The soil sampling program did not detect elevated levels of the potential contaminants at the former building footprint or representative locations across the site. The levels of all substances evaluated were below the adopted thresholds for residential land-use with access to soil.
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## 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.

## 14.4 Suitability for proposed use of the site

The site is suitable for residential land-use.

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

No constraints are recommended.

## 14.6 Recommendation for further work

Nil

## 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)

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

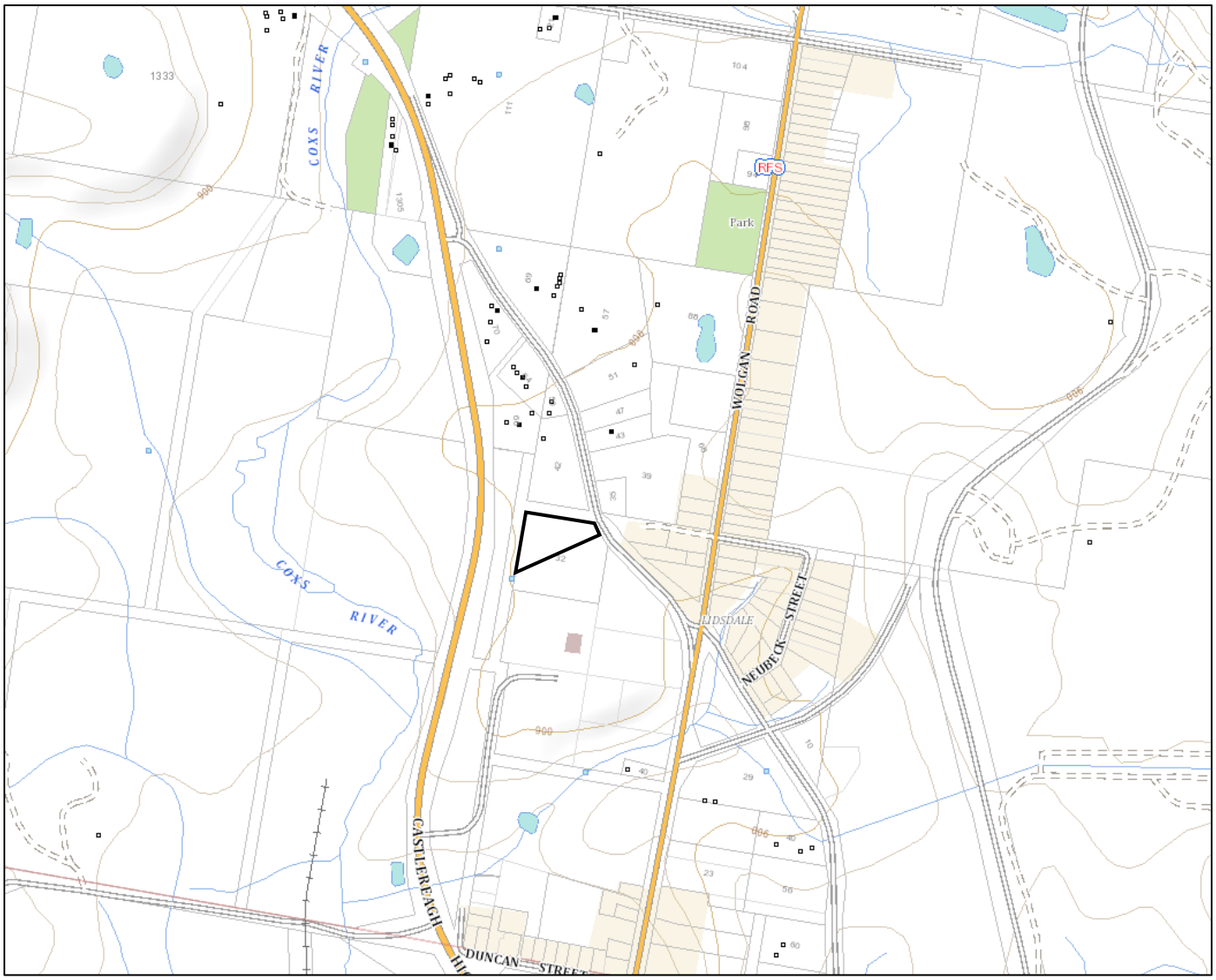
NEPC (1999 revised 2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council Service Corporation, Adelaide)

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

# Figures




**Legend**

——— Investigation area

| **Figure 1**. Locality map | | |
|---|---|---|
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

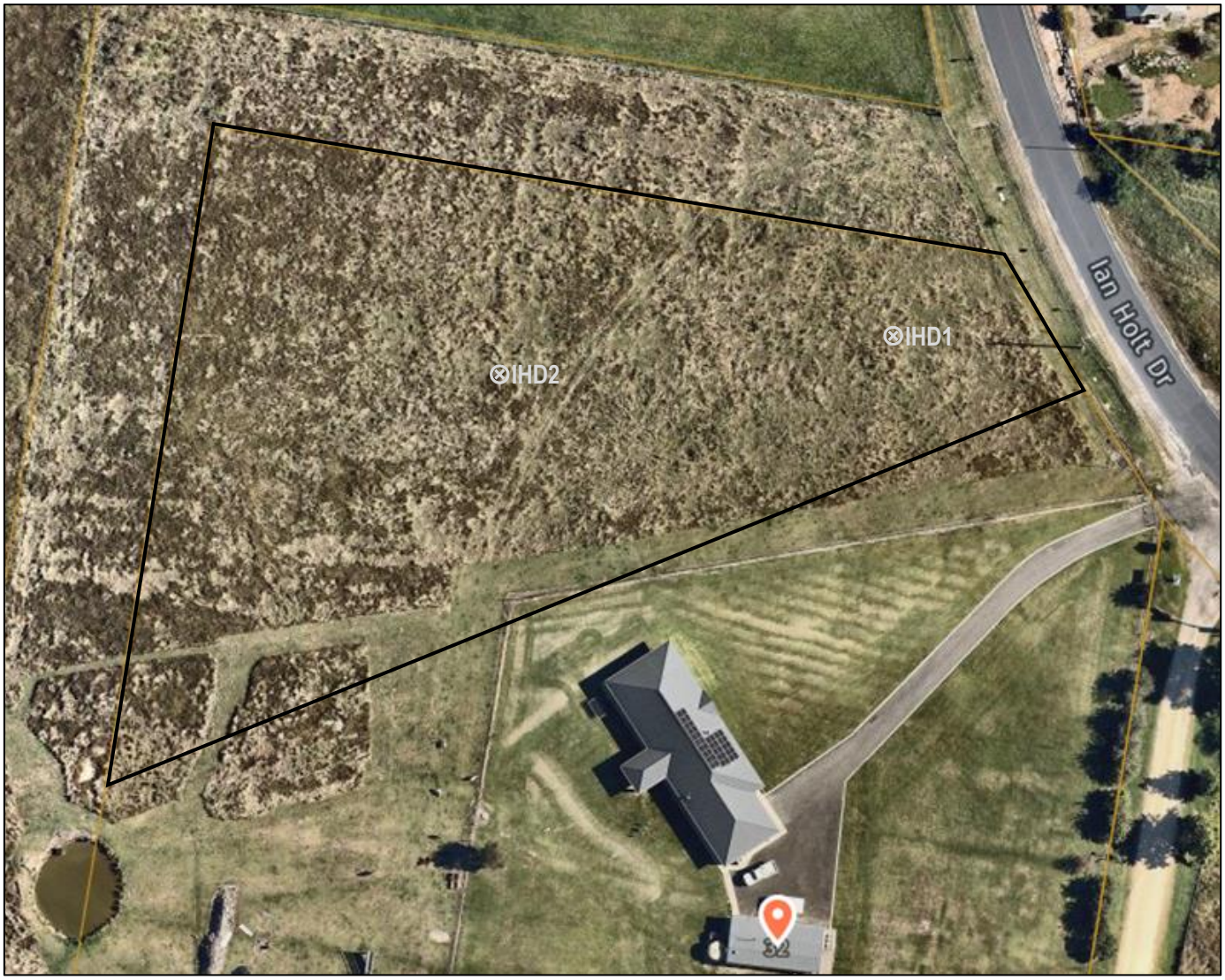

**Legend**

——— Investigation area

**Approximate Scale 1: 100**

0 10 20 40m

| | | |
|---|---|---|
| **Figure 2.** Aerial photograph and site layout | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |




**Approximate Scale 1: 100**

0 10 20 40m

**Legend**

——— Investigation area

⊗ Sample location

| | | |
|---|---|---|
| **Figure 3.** Sampling locations | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

**Figure 4.** Photographs of the site

Looking north east across eastern section of site

Looking north east across western section of site showing imported fill pad

Looking north across imported fill pad

# Appendices


| | | |
|---|---|---|
| **Appendix 1.1** 1969 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

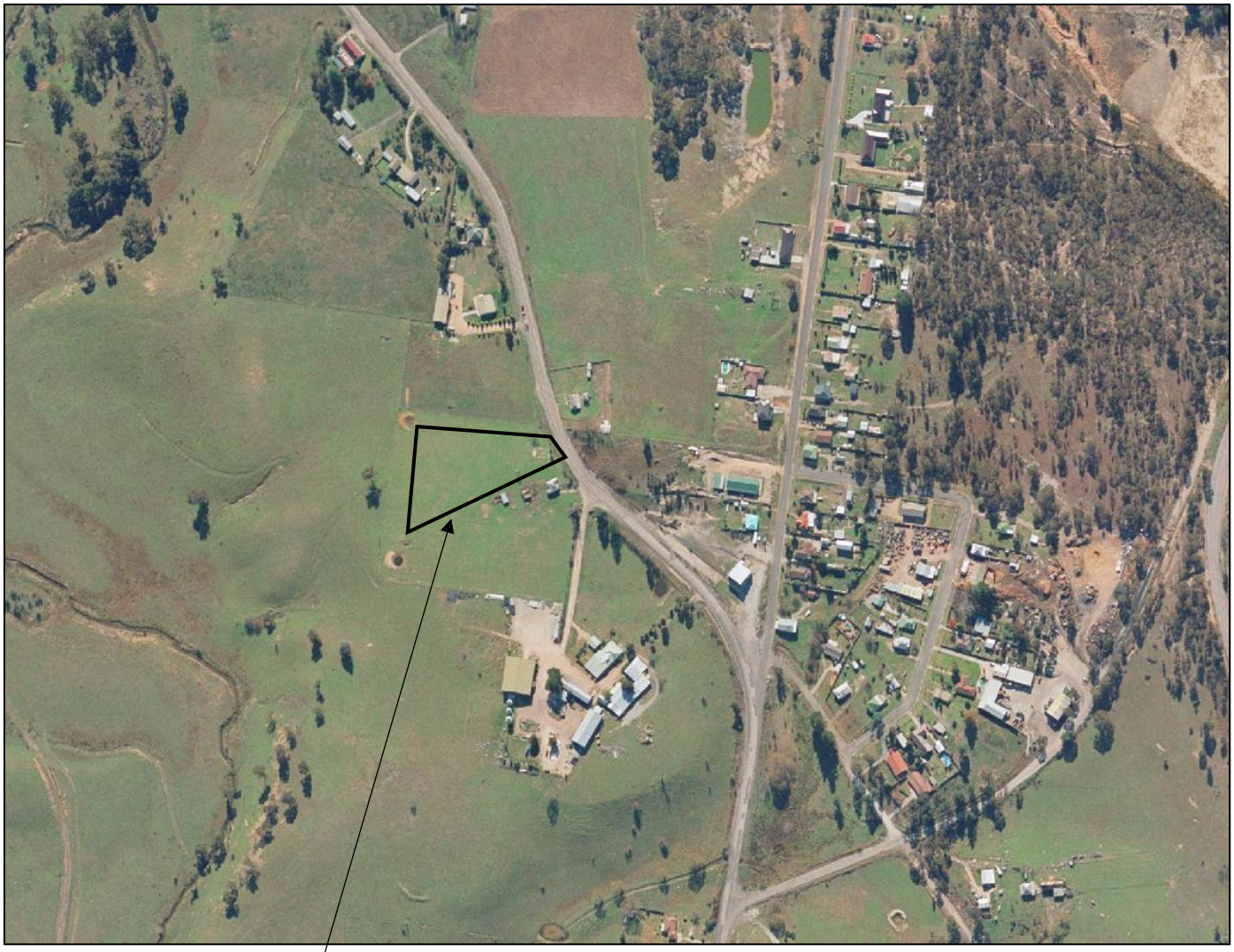
Approximate investigation area

| | | |
|---|---|---|
| **Appendix 1.2** 1975 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

Approximate investigation area

| | | |
|---|---|---|
| **Appendix 1.3** 1984 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |


| | | |
|---|---|---|
| **Appendix 1.4** 1991 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

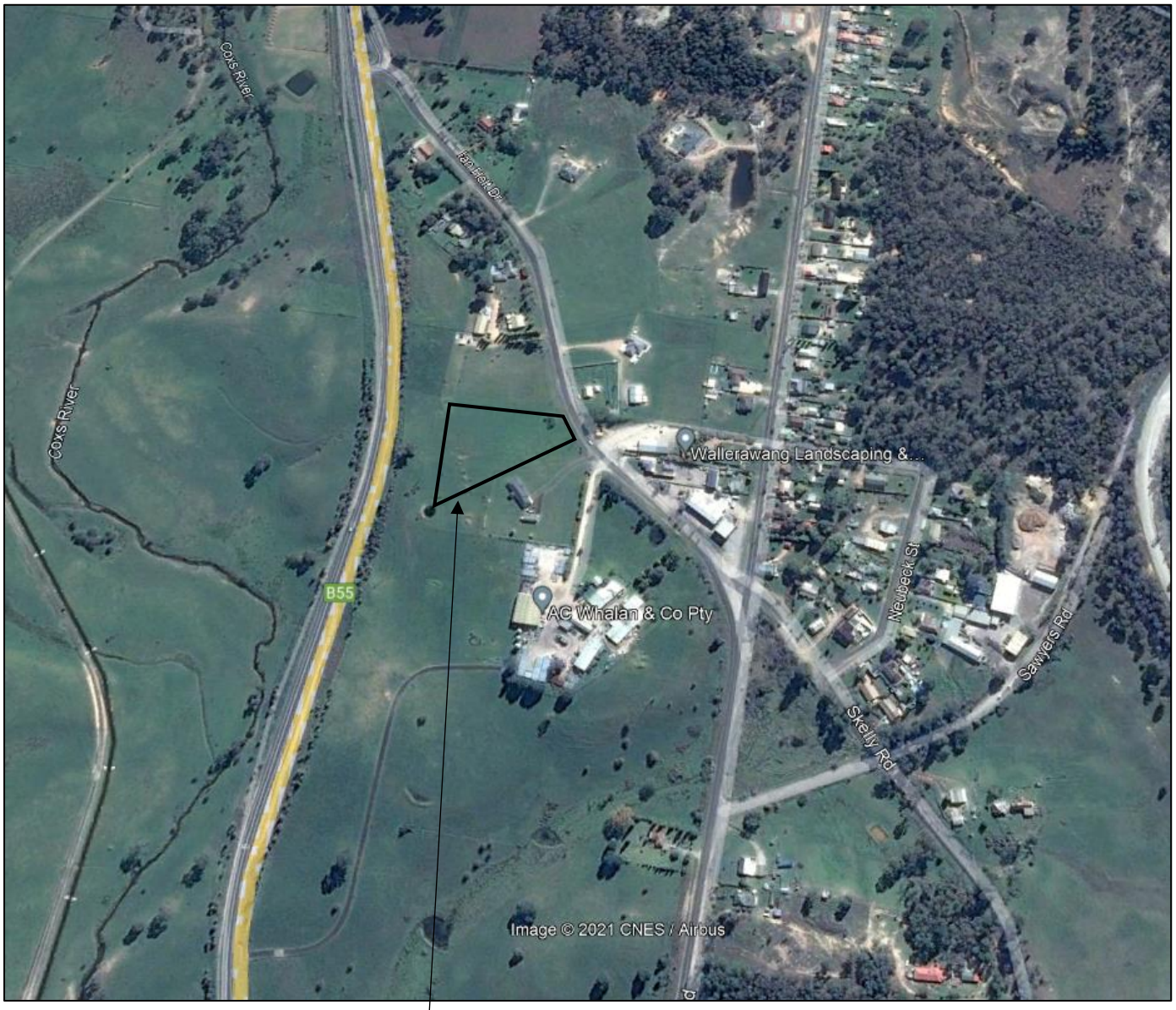


Approximate investigation area

| | | |
|---|---|---|
| **Appendix 1.5** 1998 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |


Approximate investigation area

| | | |
|---|---|---|
| **Appendix 1.6** 2006 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

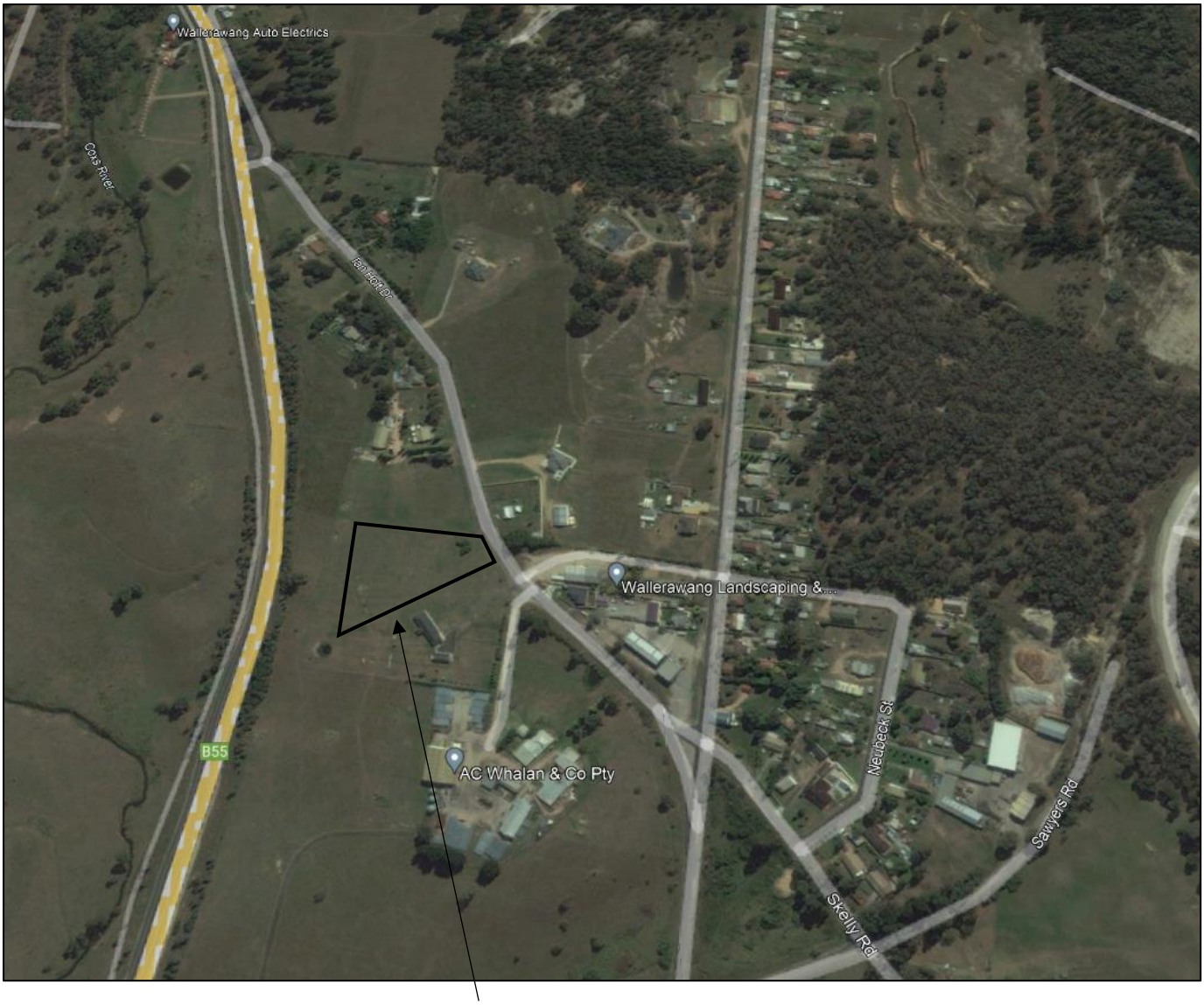



Approximate investigation area

| | | |
|---|---|---|
| **Appendix 1.7** 2014 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |


Approximate investigation area

| | | |
|---|---|---|
| **Appendix 1.8** 2015 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |




Approximate investigation area

| **Appendix 1.9** 2016 Aerial photograph | | |
|---|---|---|
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

Investigation area

| | | |
|---|---|---|
| **Appendix 1.10** 2019 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |


| | | |
|---|---|---|
| **Appendix 1.10** 2020 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |


Investigation area

| | | |
|---|---|---|
| **Appendix 1.10** 2021 Aerial photograph | | |
| Lot 1 DP 914028, 32 Ian Holt Drive, Lidsdale NSW | | |
| | Envirowest Consulting Pty Ltd | |
| Job: R13748c | Drawn by: TS | Date: 19/10/2021 |

**Appendix 2.** 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:

| Analyte | Maximum holding 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 3.** 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. |
| 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%.<br>Analysis criterion<br>60% RPD for levels greater than 10 times the PQL<br>85% RPD for levels between 5 to 10 times the PQL<br>100% RPD at levels between 2 to 5 times the PQL<br>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 23 September 2021. A total of 2 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 (NEPC 1999). Chain of custody forms accompanied transport of the samples to the laboratory.

The samples were analysed at the laboratories of ALS, Smithfield, 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 |
|---|---|---|---|---|---|---|
| IHD1, IHD2 | 2 | 1 | As, Cd, Cr, Cu, Pb, Ni, Zn, Hg | 23/09/2021 | Soil | ES2134741 |

**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 |
| TPH(C6-C9) | USPEA SW846-5030A | USPEA SW 846-8260B |
| TPH(C10-C36), PAH | Tumbler extraction of solids | USEPA SW 846-8270B |
| PCB | Tumbler extraction of solids | USEPA SW 846-8270B |
| OC Pesticides | Tumbler extraction of solids | USEPA SW 846-8270B |
| BTEX | Tumbler extraction of solids | USEPA SW 846-8260B |

## 3. Field quality assurance and quality control

One intra laboratory duplicate samples were collected for the investigation. The frequency was 12% which is higher than the recommended frequency. 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 |
|---|---|---|---|---|---|---|
| IHD1, IHD2 | 2 | 1 | 50 | 23/9/2021 | Soil | ES2134741 |

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

| | SR3C, SRDA | |
|---|---|---|
| | Relative difference (%) | Pass/Fail |
| Arsenic | NA | - |
| Cadmium | NA | - |
| Chromium | 0 | Pass |
| Copper | NA | - |
| Lead | 0 | Pass |
| Nickel | NA | - |
| Zinc | 13 | Pass |
| Mercury | NA | - |

NA – relative difference unable to be calculated as results are less than laboratory detection limit, * results less than 5 times laboratory detection limits

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

| Analyte | Maximum holding time |
|---|---|
| Metals, cyanide | 6 months |
| OCP, TRH, BTEXN, PAH | 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 significant outliers exist for the sampling batches. 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) analysis

## 5.1 Completeness

A measure of the amount of usable data for a data collection activity (total to be greater than 95%).

The data set was found to be complete based on the scope of work. No critical areas of contamination were omitted from the data set.

### 5.1.1 Field

| Consideration | Accepted | Comment |
|---|---|---|
| Locations to be sampled | Yes | In accordance with sampling methodology, described in the report. Sampling locations described in figures. |
| Depth to be sampled | Yes | In accordance with sampling methodology |
| SOP appropriate and compiled | Yes | In accordance with sampling methodology<br>Sampled with a stainless-steel push corer and hand spade into lab prepared containers, decontamination between samples, latex gloves worn by sampler |
| Experienced sampler | Yes | Same soil sampler, environmental scientist |
| Documentation correct | Yes | Sampling log completed<br>Chain of custody completed |

### 5.1.2 Laboratory

| Consideration | Accepted | Comment |
|---|---|---|
| Samples analysed | Yes | All critical samples analysed in accordance with chain of custody and analysis plan |
| Analytes | Yes | All analytes 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 report for each batch |
| Sample holding times | Yes | Metals less than 6 months. OCP, PAH, BTEXN, TRH 14 days. |

## 5.2 Comparability

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

The data sets were found to be acceptable.

### 5.2.1 Field

| Consideration | Accepted | Comment |
|---|---|---|
| SOP | Yes | Same sampling procedures used and sampled on one date |
| Experienced sampler | Yes | Experienced scientist |
| Climatic conditions | Yes | Described in field sampling log |
| Samples collected | Yes | Suitable size, storage and transport |

### 5.2.2 Laboratory

| Consideration | Accepted | Comment |
|---|---|---|
| Analytical methods | Yes | Same methods all samples, in accordance with NEPC (1999) or USEPA |
| PQL | Yes | Suitable for analytes |
| Same laboratory | Yes | ALS is NATA accredited for the tests undertaken |
| Same units | Yes | - |

## 5.3 Representativeness

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

The data sets were found to be acceptable.

### 5.3.1 Field

| Consideration | Accepted | Comment |
|---|---|---|
| Appropriate media sampled | Yes | Sampled according to sampling and quality plan |
| All media identified | Yes | Soil<br>Sampling media identified in the sampling and quality plan |

### 5.3.2 Laboratory

| Consideration | Accepted | Comment |
|---|---|---|
| Samples analysed | Yes | Undertaken in NATA accredited laboratory. No blanks analysed. 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).

The data sets were found to be acceptable.

### 5.4.1 Field

| Consideration | Accepted | Comment |
|---|---|---|
| SOP | Yes | Complied |
| Field duplicates | Yes | Collected |

### 5.4.2 Laboratory

| Consideration | Accepted | Comment |
|---|---|---|
| Laboratory and inter lab duplicates | NA | Not collected due to the preliminary nature of the investigation |
| Field duplicates | Yes | Frequency of 5%, results to be within +/-40% or discussion required. |
| Laboratory prepared volatile trip spikes | NA | Not collected due to the preliminary nature of the investigation. |

## 5.5 Accuracy

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

The data sets were found to be acceptable.

### 5.5.1 Field

| Consideration | Accepted | Comment |
|---|---|---|
| SOP | Yes | Complied |
| Field blanks | NA | Frequency of 5%, <5 times the PQL, PQL may be adjusted |
| Rinsate blanks | NA | Frequency of 5%, <5 times the PQL, PQL may be adjusted |

### 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 4.** Field sampling log

**Sampling log**

| | |
|---|---|
| Client | Peter Williams |
| Contact | - |
| Job number | 13748 |
| Location | 32 Ian Holt Drive, Lidsdale NSW |
| Date | 23 September 2021 |
| Investigator | Greg Madafiglio |
| Weather conditions | Sunny, cool |

| Sample ID | Matrix | Date | Analysis required | Observations/comments |
|---|---|---|---|---|
| IHD1 | Soil | 23/09/2021 | Arsenic (As), cadmium (Ca), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), zinc (Zn), mercury (Hg) | |
| IHD2 | Soil | 23/09/2021 | As, Cd, Cr, Cu, Pb, Ni, Zn, Hg | |
| IHD-DA | Soil | 23/09/2021 | As, Cd, Cr, Cu, Pb, Ni, Zn, Hg | Duplicate IHD1 |
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**Appendix 5.** Soil analysis results – ALS report numbers ES2134741 and chain of custody forms

ALS Environmental

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2134741** | Page | : 1 of 2 |
| Client | : **ENVIROWEST CONSULTING** | Laboratory | : Environmental Division Sydney |
| Contact | : MR GREG MADAFIGLIO | Contact | : Customer Services ES |
| Address | : 9 CAMERON PLACE PO BOX 8158<br>ORANGE NSW, AUSTRALIA 2800 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : +61 63614954 | Telephone | : +61-2-8784 8555 |
| Project | : 13748 | Date Samples Received | : 27-Sep-2021 07:45 |
| Order number | : 13748 | Date Analysis Commenced | : 28-Sep-2021 |
| C-O-C number | : 13748 | Issue Date | : 05-Oct-2021 15:55 |
| Sampler | : GREG MADAFIGLIO | | |
| Site | : 13748 | | |
| Quote number | : EN/222 | | |
| No. of samples received | : 3 | | |
| No. of samples analysed | : 3 | | |

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

## *Signatories*

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

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Ivan Taylor | Analyst | Sydney Inorganics, Smithfield, NSW |

## General Comments

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

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

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

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

## Analytical Results

| Sub-Matrix: SOIL (Matrix: SOIL) | | | Sample ID | IHD1 | IHD2 | IHD.DA | ---- | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Sampling date / time | 23-Sep-2021 00:00 | 23-Sep-2021 00:00 | 23-Sep-2021 00:00 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | ES2134741-001 | ES2134741-002 | ES2134741-003 | -------- | -------- |
| | | | | Result | Result | Result | ---- | ---- |
| **EA055: Moisture Content (Dried @ 105-110°C)** | | | | | | | | |
| **Moisture Content** | ---- | 1.0 | % | **7.8** | **10.3** | **8.3** | **----** | **----** |
| **EG005(ED093)T: Total Metals by ICP-AES** | | | | | | | | |
| **Arsenic** | 7440-38-2 | 5 | mg/kg | <5 | <5 | <5 | **----** | **----** |
| **Cadmium** | 7440-43-9 | 1 | mg/kg | <1 | <1 | <1 | **----** | **----** |
| **Chromium** | 7440-47-3 | 2 | mg/kg | **2** | **3** | **2** | **----** | **----** |
| **Copper** | 7440-50-8 | 5 | mg/kg | <5 | <5 | <5 | **----** | **----** |
| **Lead** | 7439-92-1 | 5 | mg/kg | **7** | **6** | **7** | **----** | **----** |
| **Nickel** | 7440-02-0 | 2 | mg/kg | <2 | <2 | <2 | **----** | **----** |
| **Zinc** | 7440-66-6 | 5 | mg/kg | **7** | **9** | **8** | **----** | **----** |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | |
| **Mercury** | 7439-97-6 | 0.1 | mg/kg | <0.1 | <0.1 | <0.1 | **----** | **----** |

# Chain of Custody Form – Ref 13748



| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ref:** | **13748** | **Sample matrix** | | | **Sample preservation** | | | **Analysis** | | | | | |
| Investigator: | Envirowest Consulting<br>9 Cameron Place<br>PO Box 8158<br>ORANGE NSW 2800 | | | | | | | **Method Code** | | | | | |
| Telephone: | (02) 6361 4954 | | | | | | | **S-2** | | | | | |
| **Email:** | greg@envirowest.net.au | | | | | | | | | | | | |
| Contact Person: | Greg Madafiglio | | | | | | | | | | | | |
| Invoice: | accounts@envirowest.net.au | | | | | | | | | | | | |
| **Laboratory:** | Australian Laboratory Services<br>277 Woodpark Road<br>SMITHFIELD NSW 2164 | Water | Soil | Sludge | Cool | HNO3/HCl | Unpre-served | 8 metals | | | | | |
| **Quotation #:**<br>**Courier/CN:** | **Grants Express** | | | | | | | | | | | | |

| | Sample ID | Container* | Sampling Date/Time | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | IHD1 | A | 23/09/2021 | | X | | X | | X | X | | | | |
| 2 | IHD2 | A | 23/09/2021 | | X | | X | | | X | | | | |
| 3 | IHD.DA | A | 23/09/2021 | | X | | X | | | X | | | | |
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Environmental Division Sydney
Work Order Reference
ES2134741

Telephone : +61-2-8784 8555

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

Sampler name: Greg Madafiglio
Date: 23/09/2021 Time: 16:00

Relinquished by: (print and signature) Virginia Bragg Date 24/09/2021 Time 16:00

Received by: (print and signature) A. Nasrin Date 27/9/21 Time 7:45 am

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= Vial with white label, E= Plastic with red label

# QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2134741** | Page | : 1 of 3 |
| Client | : **ENVIROWEST CONSULTING** | Laboratory | : Environmental Division Sydney |
| Contact | : MR GREG MADAFIGLIO | Contact | : Customer Services ES |
| Address | : 9 CAMERON PLACE PO BOX 8158 ORANGE NSW, AUSTRALIA 2800 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone | : +61 63614954 | Telephone | : +61-2-8784 8555 |
| Project | : 13748 | Date Samples Received | : 27-Sep-2021 |
| Order number | : 13748 | Date Analysis Commenced | : 28-Sep-2021 |
| C-O-C number | : 13748 | Issue Date | : 05-Oct-2021 |
| Sampler | : GREG MADAFIGLIO | | |
| Site | : 13748 | | |
| Quote number | : EN/222 | | |
| No. of samples received | : 3 | | |
| No. of samples analysed | : 3 | | |

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

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

This Quality Control Report contains the following information:

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

## *Signatories*

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

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Ivan Taylor | Analyst | Sydney Inorganics, Smithfield, NSW |

## General Comments

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

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

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

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

## Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

| | | | | Laboratory Duplicate (DUP) Report | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Laboratory sample ID | Sample ID | Method: Compound | CAS Number | LOR | Unit | Original Result | Duplicate Result | RPD (%) | Acceptable RPD (%) |
| **EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3927545)** | | | | | | | | | |
| ES2134740-008 | Anonymous | EG005T: Cadmium | 7440-43-9 | 1 | mg/kg | <1 | <1 | 0.0 | No Limit |
| | | EG005T: Nickel | 7440-02-0 | 2 | mg/kg | 16 | 21 | 28.7 | 0% - 50% |
| | | EG005T: Arsenic | 7440-38-2 | 5 | mg/kg | <5 | <5 | 0.0 | No Limit |
| | | EG005T: Copper | 7440-50-8 | 5 | mg/kg | 24 | 25 | 6.3 | No Limit |
| | | EG005T: Lead | 7439-92-1 | 5 | mg/kg | 13 | 11 | 20.9 | No Limit |
| | | EG005T: Zinc | 7440-66-6 | 5 | mg/kg | 34 | 48 | 34.2 | No Limit |
| ES2134740-018 | Anonymous | EG005T: Cadmium | 7440-43-9 | 1 | mg/kg | <1 | <1 | 0.0 | No Limit |
| | | EG005T: Chromium | 7440-47-3 | 2 | mg/kg | 75 | 72 | 4.4 | 0% - 20% |
| | | EG005T: Nickel | 7440-02-0 | 2 | mg/kg | 6 | 6 | 0.0 | No Limit |
| | | EG005T: Arsenic | 7440-38-2 | 5 | mg/kg | <5 | <5 | 0.0 | No Limit |
| | | EG005T: Copper | 7440-50-8 | 5 | mg/kg | 11 | 16 | 35.6 | No Limit |
| | | EG005T: Lead | 7439-92-1 | 5 | mg/kg | 11 | 11 | 0.0 | No Limit |
| | | EG005T: Zinc | 7440-66-6 | 5 | mg/kg | 20 | 20 | 0.0 | No Limit |
| **EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3927548)** | | | | | | | | | |
| ES2134740-022 | Anonymous | EA055: Moisture Content | ---- | 0.1 | % | 5.0 | 4.6 | 7.6 | No Limit |
| **EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3927546)** | | | | | | | | | |
| ES2134740-008 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.1 | mg/kg | <0.1 | <0.1 | 0.0 | No Limit |
| ES2134740-018 | Anonymous | EG035T: Mercury | 7439-97-6 | 0.1 | mg/kg | <0.1 | <0.1 | 0.0 | No Limit |

## Method Blank (MB) and Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **SOIL**

| | | | | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Spike | Spike Recovery (%) | Acceptable Limits (%) | |
| Method: Compound | CAS Number | LOR | Unit | Result | Concentration | LCS | Low | High |
| **EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3927545)** | | | | | | | | |
| EG005T: Arsenic | 7440-38-2 | 5 | mg/kg | <5 | 121.1 mg/kg | 89.9 | 88.0 | 113 |
| EG005T: Cadmium | 7440-43-9 | 1 | mg/kg | <1 | 0.74 mg/kg | 84.6 | 70.0 | 130 |
| EG005T: Chromium | 7440-47-3 | 2 | mg/kg | <2 | 19.6 mg/kg | 100 | 68.0 | 132 |
| EG005T: Copper | 7440-50-8 | 5 | mg/kg | <5 | 52.9 mg/kg | 110 | 89.0 | 111 |
| EG005T: Lead | 7439-92-1 | 5 | mg/kg | <5 | 60.8 mg/kg | 88.3 | 82.0 | 119 |
| EG005T: Nickel | 7440-02-0 | 2 | mg/kg | <2 | 15.3 mg/kg | 92.2 | 80.0 | 120 |
| EG005T: Zinc | 7440-66-6 | 5 | mg/kg | <5 | 139.3 mg/kg | 84.8 | 66.0 | 133 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3927546)** | | | | | | | | |
| EG035T: Mercury | 7439-97-6 | 0.1 | mg/kg | <0.1 | 0.087 mg/kg | 100 | 70.0 | 125 |

## Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

| | | | | Matrix Spike (MS) Report | | | |
|---|---|---|---|---|---|---|---|
| | | | | Spike | SpikeRecovery(%) | Acceptable Limits (%) | |
| Laboratory sample ID | Sample ID | Method: Compound | CAS Number | Concentration | MS | Low | High |
| **EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3927545)** | | | | | | | |
| ES2134740-008 | Anonymous | EG005T: Arsenic | 7440-38-2 | 50 mg/kg | 95.9 | 70.0 | 130 |
| | | EG005T: Cadmium | 7440-43-9 | 50 mg/kg | 103 | 70.0 | 130 |
| | | EG005T: Chromium | 7440-47-3 | 50 mg/kg | 101 | 68.0 | 132 |
| | | EG005T: Copper | 7440-50-8 | 250 mg/kg | 101 | 70.0 | 130 |
| | | EG005T: Lead | 7439-92-1 | 250 mg/kg | 103 | 70.0 | 130 |
| | | EG005T: Nickel | 7440-02-0 | 50 mg/kg | 102 | 70.0 | 130 |
| | | EG005T: Zinc | 7440-66-6 | 250 mg/kg | 99.2 | 66.0 | 133 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3927546)** | | | | | | | |
| ES2134740-008 | Anonymous | EG035T: Mercury | 7439-97-6 | 5 mg/kg | 114 | 70.0 | 130 |

ALS Environmental

# QA/QC Compliance Assessment to assist with Quality Review

| | | | |
|---|---|---|---|
| **Work Order** | : **ES2134741** | Page | : 1 of 4 |
| Client | : **ENVIROWEST CONSULTING** | Laboratory | : Environmental Division Sydney |
| Contact | : MR GREG MADAFIGLIO | Telephone | : +61-2-8784 8555 |
| Project | : 13748 | Date Samples Received | : 27-Sep-2021 |
| Site | : 13748 | Issue Date | : 05-Oct-2021 |
| Sampler | : GREG MADAFIGLIO | No. of samples received | : 3 |
| Order number | : 13748 | No. of samples analysed | : 3 |

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

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

## Summary of Outliers

### Outliers : Quality Control Samples

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

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

### Outliers : Analysis Holding Time Compliance

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

### Outliers : Frequency of Quality Control Samples

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

# Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EA055: Moisture Content (Dried @ 105-110°C)** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EA055)** | | | | | | | |
| IHD1, IHD2, IHD.DA | **23-Sep-2021** | **----** | ---- | ---- | **28-Sep-2021** | 07-Oct-2021 | ✓ |
| **EG005(ED093)T: Total Metals by ICP-AES** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EG005T)** | | | | | | | |
| IHD1, IHD2, IHD.DA | **23-Sep-2021** | **29-Sep-2021** | 22-Mar-2022 | ✓ | **01-Oct-2021** | 22-Mar-2022 | ✓ |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EG035T)** | | | | | | | |
| IHD1, IHD2, IHD.DA | **23-Sep-2021** | **29-Sep-2021** | 21-Oct-2021 | ✓ | **02-Oct-2021** | 21-Oct-2021 | ✓ |

# Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| Laboratory Duplicates (DUP) | | | | | | | |
| Moisture Content | EA055 | 1 | 8 | **12.50** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Mercury by FIMS | EG035T | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Metals by ICP-AES | EG005T | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Laboratory Control Samples (LCS) | | | | | | | |
| Total Mercury by FIMS | EG035T | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Metals by ICP-AES | EG005T | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Method Blanks (MB) | | | | | | | |
| Total Mercury by FIMS | EG035T | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Metals by ICP-AES | EG005T | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Matrix Spikes (MS) | | | | | | | |
| Total Mercury by FIMS | EG035T | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Metals by ICP-AES | EG005T | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |

## Brief Method Summaries

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

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Moisture Content | EA055 | SOIL | In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3). |
| Total Metals by ICP-AES | EG005T | SOIL | In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3) |
| Total Mercury by FIMS | EG035T | SOIL | In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3) |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Hot Block Digest for metals in soils sediments and sludges | EN69 | SOIL | In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3). |