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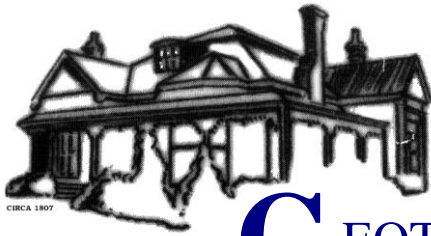
ABN 64 002 841 063



SITE CONTAMINATION ASSESSMENT

**GOOGONG TOWNSHIP RESIDENTIAL DEVELOPMENT
NEIGHBOURHOOD (NH) 3, NH4 & NH5
OLD COOMA ROAD, GOOGONG**

REPORT NO 14328/2-AA SEPTEMBER 2021



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ABN 64 002 841 063



Job No: 14328/2
Our Ref: 14328/2-AA
September 2021

Googong Township Pty Ltd (GTPL)
c/ Peet Limited
GPO Box 1000
CIVIC SQUARE ACT 2608
E-mail: Katherine.Hurley@peet.com.au

Attention: Ms Katherine Hurley

Dear Madam

re: **Googong Township Residential Development
Neighbourhood (NH) 3, NH4 & NH5 – Old Cooma Road, Googong
Site Contamination Assessment**

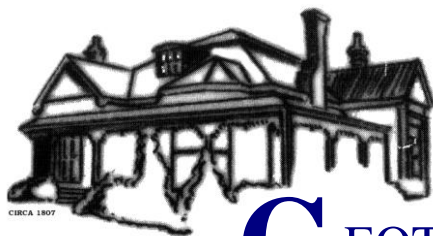
Please find herewith our *Site Contamination Assessment* report for the above site. It is understood that the site is proposed for residential (with garden / accessible soil) land use.

A brief of the outcome of the assessment is summarised in the Executive Summary.

If you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

JOHN XU
Senior Associate
BE, MEngSc, MEAust



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EXECUTIVE SUMMARY

A site contamination assessment (SCA) was carried out at the site known as Neighbourhood (NH) 3, NH4 & NH5, located at Old Cooma Road, Googong, in the Local Government Area (LGA) of Queanbeyan Palerang Regional Council (QPRC).

The report for the SCA was commissioned by Googong Township Pty Ltd (GTPL) and undertaken in accordance with fee proposal (our Ref. Q14328-2 dated 20 November 2020) prepared by Geotechnique Pty Ltd (Geotechnique). It is understood that the site is proposed for residential (with gardens / accessible soil) land use.

The objectives of the SCA are to assess and comment on the suitability of the site for the proposed development from a contamination prospective, and to provide recommendations with regard to future works.

In order to achieve the objectives of this assessment, the scope of work included review of site historical data presented in the relevant reports, site inspection, as well as soil sampling and laboratory testing.

The findings of this assessment are summarised as follows:

- Following demolition and removal of 5 aboveground storage tanks (AST) and associated infrastructure, as well as all the other site features such as the sheds, sheep yards, etc. and any hard stands, contamination assessment of residual soil is required at and in the vicinity of the footprints of AST, associated infrastructure, other features and hard stands in Area of Environmental Concern (AEC) 5, AEC6 and farm shed with drums.
- Contaminated soil / material were identified in Area 1 to Area 3 (refer to Drawing 14328/2-AA4).
For landfill disposal purposes, the contaminated soil / material to be removed from Area 1, Area 2 and Area 3 within the site are classified as **“General Solid Waste (Non-putrescible)”**, **“Restricted Solid Waste”** and **“General Solid Waste (Putrescible)”** respectively.
- Potential off-site impacts of contaminants on groundwater and waterbodies are considered to be low.
- Remediation and validation of the site are required.

Based on this assessment, it is our opinion that the site can be made suitable for the proposed redevelopment into residential (with garden / accessible soil) land use, subject to implementation of the following recommendations, prior to earth works / site preparation:

1. Assessment (by sampling and testing) of soil in the footprints of site features such as shearing shed, sheep & cattle yards, concrete slabs, hard stands, AST, farm shed with drums, etc., will be required after complete demolition and removal. In the event of contamination, detailed assessment, remediation and validation will be required.
2. A remedial action plan (RAP) is to be prepared to devise strategies for remediation / management of the contaminated soil / material in Area 1 to Area 3 as indicated on Drawing No 14328/2-AA4.
3. Site validation is to be carried out following the remediation of the contaminated areas.

If suspect materials (identified by unusual staining, odour, discolouration or inclusions such as building rubble, asbestos sheets / pieces / pipes, livestock carcasses, ash material, imported fill materials [which are different to those encountered during the previous assessments and this assessment], etc.) are encountered during any stage of future demolition / remediation / earthworks / site preparation, we recommend that this office is contacted for assessment and an unexpected finds management protocol in Appendix D of this report be implemented.

Reference should be made to Section 16.0 for details of the recommendations regarding any materials to be excavated and removed from the site, and any fill to be imported to the site.

Reference should be made to Section 17.0 for the limitations of this report.

PROJECT OVERVIEW

Googong Township is a 25 year project being developed in partnership by Peet and Mirvac, operating as Googong Township Pty Ltd (GTPL). The emerging township is located in Southern NSW, 8 kilometres (km) from Queanbeyan and 15km from Canberra. The Googong master plan is embedded in Queanbeyan-Palerang Regional Council's (QPRC) Googong Development Control Plan and provides the overarching structure for the township. It has been planned and is being developed as a freestanding township with five neighbourhoods, around 6,600 dwellings and a population of over 18,000 people over 25 years.

Neighbourhood's 1 and 2 (also known as Googong North and Googong Central) have completed Structure plans and DAs. Neighbourhood 2 is currently under staged construction.

The next 3 Neighbourhoods to be developed, under the next Development Application, are

- Neighbourhood 3 (including the Hamson land) – also known as Googong West
- Neighbourhood 4 – also known as Googong South
- Neighbourhood 5 – also known as Googong East

Neighbourhood's 3, 4 and 5 (NH345) is 235 hectares (ha) in size and is bounded by Old Cooma Road to the west, Neighbourhood 2 and Neighbourhood 1B to the north, the Googong Dam foreshore and Pink Tail Worm-Lizard Conservation Area to the east and rural land to the south.

The area around Googong is characterised by rural uses, while NH345 itself is characterised as former agricultural land.

PROJECT OBJECTIVE

GTPL are seeking to submit a Development Application (DA) with QPRC for the subdivision of the land within Neighbourhoods 3, 4 & 5 (NH345).

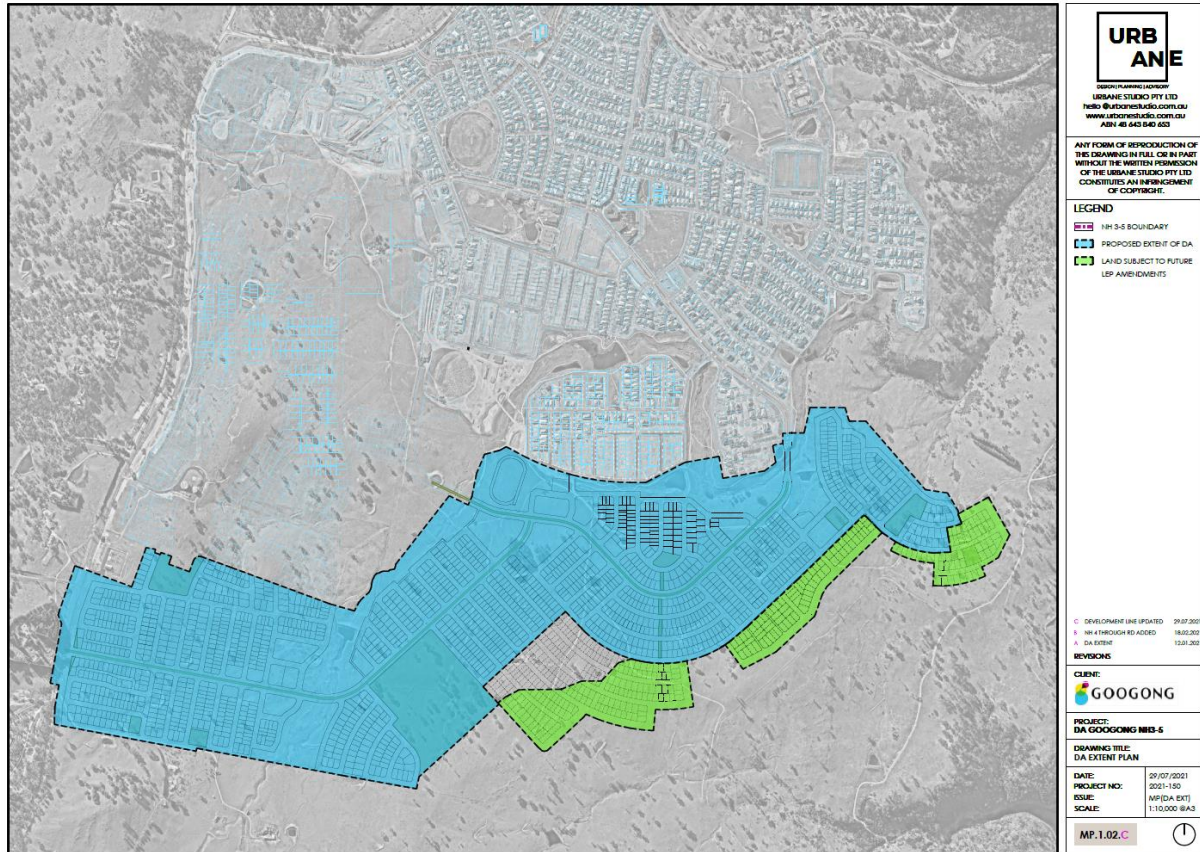
The DA proposal seeks approval for:

- Torrens title subdivision of Neighbourhoods 3, 4 and 5 to create:
 - 1476 residential lots
 - 20 lots for future subdivision of higher density housing and other uses including the Neighbourhood Centre sites, to accommodate approximately 320 dwellings
 - public reserves including, local parks, a sports fields and Googong Common
 - public roads and drainage reserves.
- All subdivision works to prepare the land for the future development comprising site preparation and grading, stormwater and drainage works, road construction, tree removal, public domain landscaping and structures and utilities provision.

The subdivision of the higher density super lots and the construction of all buildings (housing and schools) as well as the Neighbourhood Centre sites will be subject of future applications.

The DA proposal will apply to the area shown in blue on the following plan.

14328/2-AA
Report Opening Continued



PURPOSE OF THIS REPORT

The purpose of this report is for the submission and approval of a DA to QPRC for Googong NH3 to NH5 from a contamination prospective. It should be noted that the site boundary of the SCA Area for NH3 to NH5 (the site) inclusive of the DA extent, as well as additional land to the east and south as shown on the figure above.

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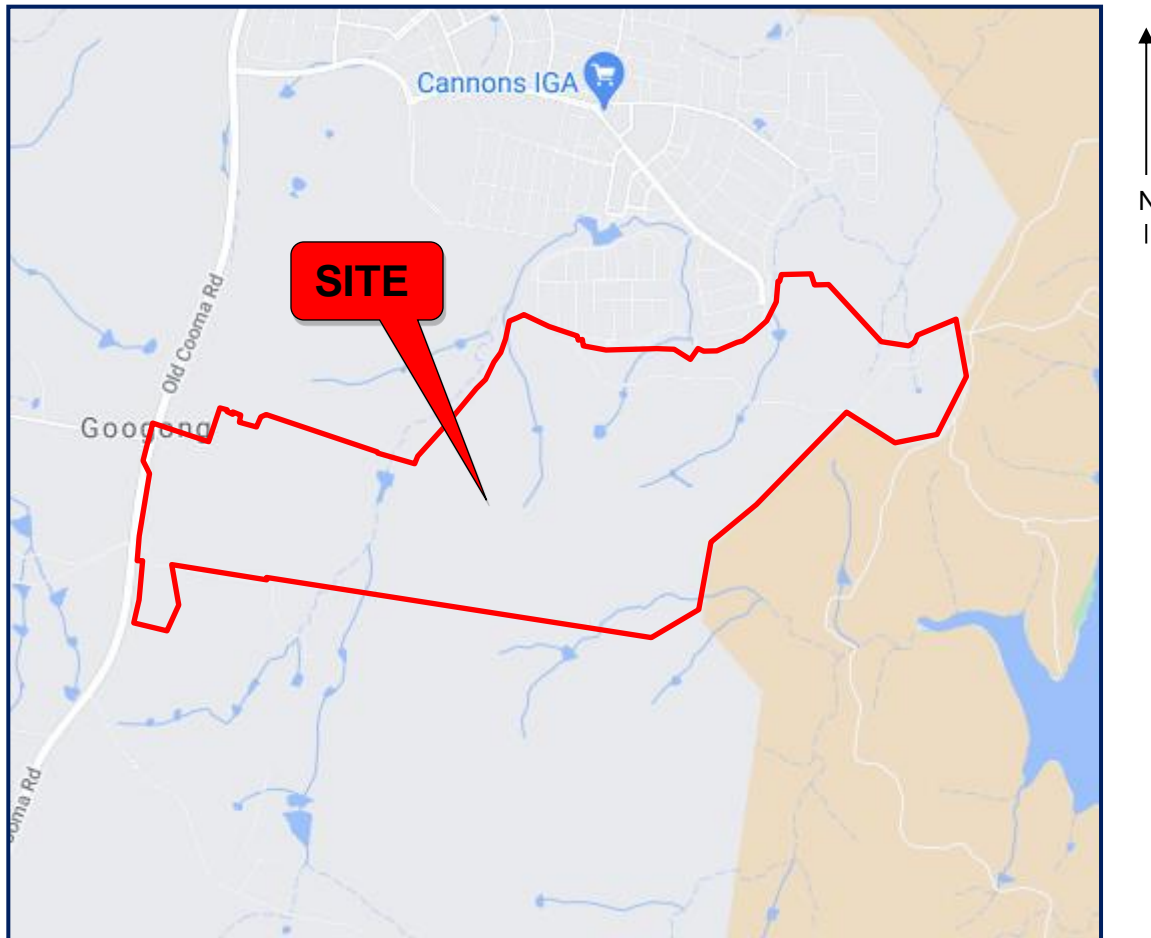
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NH3, NH4 & NH5 – Old Cooma Road, Googong

1.0 INTRODUCTION

This report, commissioned by Googong Township Pty Ltd (GTPL) and undertaken in accordance with fee proposal (our Ref. Q14328-2 dated 20 November 2020) prepared by Geotechnique Pty Ltd (Geotechnique), presents the results of a site contamination assessment (SCA) at the site known as Neighbourhood (NH) 3, NH4 & NH5, located at Old Cooma Road, Googong, as indicated on Figure 1 below.

FIGURE 1



Map Data ©2021 Google

It is understood that the site is proposed for standard residential (with garden / accessible soil) land use.

This assessment was based on site historical data presented in the following reports prepared by Geotechnique Pty Ltd (Geotechnique):

- *Supplementary Sampling, Analysis and Quality Plan & Remedial Works Plan* (Our Ref: 12675/2-L1 dated 22 August 2014) for Neighbourhood 1B.
- *Detailed Contamination Assessment Report* (Our Ref: 12675/2-AA dated 12 September 2014) for Neighbourhood 1B.
- *Contamination Assessment / Validation Report* (Our Ref: 12675/3-AAR1 dated 30 November 2015) for NH1B Stage 1 to Stage 8.

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- *Groundwater Contamination Assessment* Report (Our Ref: 12675/3-AB dated 2 September 2016) for AEC5 in Neighbourhood 1B.
- *Contamination Assessment* Report (Our Ref: 12675/4-AA dated 31 May 2016) for NH1A Stage 7 and NH2.
- *Draft Detailed Contamination Assessment* Report (Our Ref: 14328/1-AA dated 25 June 2019) for NH3 to NH5 prepared by Geotechnique.

The objectives of the SCA are to assess and comment on the suitability of the site for the proposed development from a contamination prospective, and to provide recommendations with regard to future demolition and remediation works.

2.0 SCOPE OF WORK

In order to achieve the objectives of the assessment, the following scope of work was carried out:

- Review of the previous reports.
- A thorough inspection of the site by our Environmental Scientists from Geotechnique to identify the current site conditions and any visible or olfactory indicators of potential contamination, which are different to those identified during the previous assessments.
- Recovery of soil samples at and in the vicinity of the previous sample location J2 for laboratory test for delineation of contamination extents.
- Implementation of standard quality assurance (QA) and quality control (QC) measures.
- Chemical analysis by National Association of Testing Authorities (NATA) accredited laboratories, in accordance with Chains of Custody (COC) prepared by Geotechnique.
- Assessment of the laboratory analytical results.
- Assessment of field and laboratory QA and QC.
- Assessment of the contamination status of the site.

3.0 SITE DESCRIPTION

The site is located to the east of Old Cooma Road, Googong, in the Local Government Area (LGA) of Queanbeyan Palerang Regional Council (QPRC) and within the boundary of the wider Googong Township Development.

The site, as indicated on Drawing No 14328/2-AA1, is irregular in shape and covers an area of approximately 239 hectares (ha). It should be noted that the site boundary of the SCA Area for NH3 to NH5 (the site) inclusive of the DA extent, as well as additional land to the east and south as shown on the figure in the Project Objective.

The site comprises a parcel of land (10 lots) including;

- Lot 7 in DP1246784;
- Lot 11 in DP754881 (part);
- Lot 42 in DP754881;
- Lot 10 in DP754881;
- Lot 1 in DP867223 (part);
- Lot 3 in DP1149329;

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NH3, NH4 & NH5 – Old Cooma Road, Googong

- Lot 1605 in DP1266000;
- Lots 12 & 13 in DP1266001; and
- Lot 2 in DP1231713.

4.0 SITE HISTORY & SUMMARY OF PREVIOUS CONTAMINATION ASSESSMENTS

The site was once part of a larger grazing property that has been operating since the mid to late 1800s, and had typically been used for sheep and cattle grazing.

As shown on Drawing No 14328/2-AA1, contamination assessments had been conducted within the site in various stages and documented in reports 12675/2-AA, 12675/2-L1, 12675/3-AAR1, 12675/3-AB and 12675/4-AA and 14328/1-AA.

4.1 12675/2-AA, 12675/2-L1 & 12675/3-AB Reports

Geotechnique conducted contamination assessment of the identified three Areas of Environmental Concern (AEC), namely AEC5 (a sheep spray facility associated with sheep yards and shearing shed), AEC6 (consisting of 5 scattered aboveground storage tanks [AST]) and farm shed with drums, together with other AEC for NH1B in 2014.

Reference should be made to Section 5.1.1 for brief descriptions of each AEC.

There had been shallow soil contaminated with arsenic (As) within the vicinity of former sheep spray yard in AEC5. One area labelled as Area 1 (refer to the Drawing No 12675/2-AA6) requiring remediation was identified. As such, some form of remediation is required.

It was our opinion that remediation by excavation of the contaminated soil in Area 1 and disposal at an appropriately licensed landfill facility was considered appropriate and could be carried out in conjunction with the demolition and removal of the site features in AEC5. A remedial works plan was prepared to provide details for remediation and validation of the contaminated areas including the Area 1 in AEC5.

Following demolition and removal of 5 AST and associated infrastructure, as well as all the other site features such as the sheds, sheep yards, etc. and any hard stands, contamination assessment of residual soil is required at and in the vicinity of the footprints of AST, associated infrastructure, other features and hard stands in AEC5, AEC6 and farm shed with drums.

The objectives of contamination assessment are to provide data on the status of the residual soil in the AEC5, AEC6 and farm shed with drum and to make recommendations with regard to any future remedial works if required.

Reference should be made to the Reports 12675/2-AA and 12675/2-L1 for details.

Based on the Reports 12675/2-AA and 12675/2-L1, the following additional works are required to further address the AEC5, AEC6 and farm shed with drums, prior to site preparation and earthworks:

1. Assessment (by sampling and testing) of soil in the footprints of site features such as shearing shed, sheep & cattle yards, concrete slabs, hard stands, AST, farm shed with drums, etc., will be required after complete demolition and removal. In the event of contamination, detailed assessment, remediation and validation will be required.
2. Following remediation of Area 1 in AEC5, in accordance with the remedial working plan presented in the Report 12675/2-L1, validation is to be undertaken to ensure the success of remediation.

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NH3, NH4 & NH5 – Old Cooma Road, Googong

A groundwater contamination assessment was undertaken in AEC5 by Geotechnique in 2016. The findings of the groundwater assessment are summarised as follows:

- The depth of groundwater table in the groundwater monitoring well was about 8.4m and 8.0m below the EGS measured on 4 and 17 November 2015 respectively.
- The Googong Reservoir is situated approximately 1.5 kilometres to the east of the site.
- There was no indication of contamination of groundwater from the former sheep dip activities within the site.
- The contaminants in the groundwater, in general, would not impact on the Googong Reservoir and water for short-term (up to 20 years) irrigation and recreational purposes.

It was our opinion that no further assessment or remediation of groundwater is necessary.

Reference should be made to the Report 12675/3-AB for details.

4.2 12675/3-AAR1 Report

Geotechnique carried out a contamination assessment / validation at the land (known as NH 1B Stage 1 through to Stage 8) including part of the site (northern portion of Lot 13 in DP1266001) (refer to Drawing No 14328/2-AA1) in October and November 2015.

Based on assessment / validation presented in the 12675/3-AAR1 report, NH1B Stage 1 through to Stage 8 including part of the site was suitable for the proposed residential and open space land use.

Reference should be made to the Report 12675/3-AAR1 for details.

4.3 12675/4-AA Report

Geotechnique conducted a contamination assessment at the land known as Nh1 Stage 7A and NH2 including part of the site (Lot 7 in DP1246784, Lot 10 in DP754881 & part Lot 11 in DP754881, refer to Drawing No 14328/2-AA1) in April and May 2016.

Based on the assessment, there is no AEC / PAEC and soil contamination identified within that part of the site mentioned above.

Reference should be made to the Report 12675/4-AA for details.

4.4 14328/1-AA Report

Geotechnique carried out a detailed contamination assessment (DCA) at the land known as NH3, NH4 & NH5 including majority of the site (refer to Drawing Nos 14328/1-AA1 and 14328/2-AA1) in May and June 2019.

The objectives of contamination assessment were to provide data on the contamination status of the surface soil within the site, to determine the suitability of the site for the proposed residential (with gardens / accessible soil) land use, and to make recommendations with regard to any future remedial works if required.

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NH3, NH4 & NH5 – Old Cooma Road, Googong

In order to achieve the objectives of this assessment, the scope of work included review of site historical data presented in the relevant reports and documents, site inspection, as well as soil sampling and laboratory testing.

As discussed in Section 14.0 of the report, most of the laboratory test results satisfied the criteria for stating that the analytes selected were either not present (i.e. concentrations less than laboratory limits of reporting) or present in the sampled soils at concentrations that do not pose a risk of hazard to human health or the environment, for the proposed residential (with garden / accessible soil) land use.

However, the results of sampling and testing for this assessment identified soil contamination at one isolated sample location J2 in fire pit containing elevated concentrations of metals (refer to Drawing No 14328/1-AA4).

The findings of the assessment are summarised as follows:

- Several AEC / PAEC (surface soil due to former grazing activities, fill material, stockpile, a metal bath and a pit with burial livestock carcasses) had been identified on the subject land.
- Soil contaminated with metals was identified at one location J2. Elevated concentrations of the metals would present or potentially present a risk of harm to human health and / or environment. Subsequently, further investigation was required to delineate the extent of contamination.
- Potential off-site impacts of contaminants on groundwater and waterbodies were considered to be low.
- Remediation and validation of the land are required.

Based on the assessment, it was our opinion that the site could be made suitable for the proposed redevelopment into residential (with garden / accessible soil) land use, subject to implementation of the following recommendations, prior to earth works / site preparation:

1. Removal of livestock carcasses and disposal at an appropriate landfill facility, followed by contamination assessment of residual soil at and in the vicinity of the pit after removal of the carcasses.
2. Soil contaminated with metals was identified at location J2 (refer to Drawing No 14328/1-AA4). A further assessment was recommended in order to delineate the extent of soil contamination.
3. Remediation of the contaminated area, followed by site validation should be carried out.
4. A supplemental SAQP and remedial works plan is to be prepared by Geotechnique to outline the abovementioned further assessment, remediation, validation and groundwater investigation, which is to be approved by the Site Auditor.

Reference should be made to the Report 14328/1-AA for details.

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NH3, NH4 & NH5 – Old Cooma Road, Googong

5.0 SITE CONDITION AND SURROUNDING ENVIRONMENT

5.1 Site Condition

As shown on Drawing No 14328/2-AA1, contamination assessments had been conducted within the site in various stages and documented in reports 12675/2-AA, 12675/3-AAR1, 12675/4-AA and 14328/1-AA.

5.1.1 Site Inspection in 2014

As detailed in the Report 12675/2-AA, the contamination assessment of AEC5, AEC6, and galvanised iron (GI) farm shed with drums was undertaken together with other AEC for NH1B by Geotechnique in 2014.

Brief descriptions of each AEC are provided as follows:

- AEC5 was identified by Coffey as a sheep spray facility associated with sheep yards and shearing shed.

At the time of inspection by our Environmental Engineer from Geotechnique on 15 and 16 April 2014, the following observations were made (refer to Drawing No 12675/2-AA2);

- The area was occupied by a GI shearing shed associated with sheep yard and dipping area. The dipping area was concrete covered and consisted of a GI cylinder for spraying purposes and a fenced dry-out area. The sheep yard was uncapped and fenced with timber. Drums and a water tank were observed within the sheep yard.
- The shearing shed was mainly built with GI sheet and timber. A concrete floored workshop area for storage of chemicals (pesticides, oil and small amounts of fuel) was located within the shed.
- Outcrops were noted throughout the area.

At the time of undertaking the site inspection, AEC 5 was surrounded by grass covered vacant land and a dirt driveway.

- AEC6 was identified by Coffey as 5 scattered aboveground storage tanks (AST).

At the time of inspection by our Environmental Engineer from Geotechnique on 15 April 2014, the following observations were made (refer to Drawing No 12675/2-AA3);

- Five metals AST were observed lying on the ground within the area. Residual (possible) engine oil was noted in some of the tanks.
- The slope of the area was generally downward from southwest to northeast.

At the time of undertaking the site inspection, AEC 6 was surrounded by grass covered vacant land.

- Farm shed with drums were identified during the site inspection for NH1B by Geotechnique in 2014.

At the time of inspection by our Environmental Engineer from Geotechnique on 15 April 2014, the following observations were made (refer to Drawing No 12675/2-AA5):

- The area was occupied by a GI shed supported by concrete columns. The shed contained farming equipment and shearing tools.
- Three drums were observed underneath the southeast corner of the shed.

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At the time of undertaking the site inspection, the shed was surrounded by grass and a dirt driveway.

5.1.2 Site Inspection in 2016

Geotechnique conducted a contamination assessment at the land known as Nh1 Stage 7A and NH2 including part of the site (Lot 7 in DP1246784, Lot 10 in DP754881 & part Lot 11 in DP754881, refer to Drawing No 14328/2-AA1).

At the time of inspection by our Environmental Engineer and Environmental Scientist from Geotechnique on 11 to 13 April 2016, no obvious site features of environmental concern were identified within the abovementioned lots.

5.1.3 Site Inspection in 2019

At the time of inspection by our Environmental Scientists from Geotechnique from 20, 21 & 22 May and 5 June 2019 and as indicated on Drawing No 14328/1-AA2, the land (majority of the current site) was grazing land, with rock outcrops and sparsely distributed trees throughout.

The land can be divided into two portions based on two separate boundaries, i.e. one smaller portion to the west of the site fronting Old Cooma Road and comprising Lot 42 in DP754881 and one larger portion to the east of the site, which is fronted by a new subdivision area NH1B to the north, and surrounded by Googong Foreshore to the east and by grazing land to the south, and west.

The salient points to be noted were as follows:

One smaller portion to the west of the site (Lot 42 in DP754881)

Site features (refer to Drawing No 14328/1-AA2) within this portion of the site include;

- Power lines along the western bound area
- An embankment to break the slope in the western portion and another in the north eastern portion.
- Scattered wire fencing over the ground surface in the southern portion.
- Metal bath tub with visible corrosion used as a water trough.
- Small soil stockpile in the southern portion.
- Two dams; one in the central portion, the other in the north eastern portion.
- Scattered car tyres in the central portion.
- A fire pit with scrap timber, metal, concrete and bricks, with fill material surrounding the pit. The size and appearance of the material appear to match the pit.

The ground surface of this portion of the site generally slopes towards the east.

One larger portion to the east of the site

Site features (refer to Drawing No 14328/1-AA2) within this portion of the site include;

- An area with cut trees piled together, some soil attached to tree roots forming a small stockpile. Interview with land owner suggest the trees were all cut down from within the property.
- Eight dams scattered throughout the site.

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- A large burial pit with livestock carcasses, with soil stockpiles surrounding the pit. The size and appearance of the material appear to match the pit, and interview with landowner confirmed the origin of the stockpiles is from the pit.
- A small stockpile within AEC5 area that appears to be formed from the installation of an underground effluent system. At the time of inspection the system was still not yet installed with pipes visible within the trench.
- Several small stockpiles adjacent to one of the dams in the centre of the site, appearing to have been formed from soil excavated to form the dam.
- A dried creek line was in the eastern portion of the area, running from the centre of the site to the northern most corner of the site.
- A small embankment on the south eastern portion of the site.

No obvious changes to AEC6 and shed with drums were noted.

This portion of the site has multiple hills and multiple creek lines within the site. In general, towards the centre of the site, the slope direction is towards the creeks. The site also slopes towards the west, within the western portion and towards the north in the northern portion.

5.1.4 Site Inspection in 2021

A follow up inspection was carried out on 23 and 24 February 2021 within the site (NH3 and NH5) to identify any changes to the site condition since the previous inspection. The following new features (refer to Drawing No 14328/2-AA2) were noted:

Lot 42 DP754881

- A shipping container on the southern portion.
- A fill area within the south western portion.
- A stockpile (28m x 2m x 0.5m) consisting of local natural appearing material within the southern portion.

Former Lot 6 DP1246784 (now Lot 1605 DP1266000)

- Large stockpile (75m x 3.5m x 1m) consisting of natural material on the north eastern portion.

Lot 2 DP1231713

- Timber telegraph pole lying on the ground in the northern portion of the area (near AEC6).
- Scrap metal, metal frames / general metal storage and firewood storage in the northern portion of the lot near the previously identified dam.

Former Lot 901 DP1242930 (now Lot 13 DP1266001)

- Concrete rubble stockpile (25m x 1m x 0.3m) identified in the northern portion (near AEC5).

Lot 7 DP1246784 and Lot 10 & Part Lot 11 DP754881

No obvious change appears since previous site inspection in 2016.

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AEC5 within Lot 13:

- GI silos and 3 new shipping containers found within the vicinity.
- The stockpile identified within the vicinity in 2019 however now appears absent.

AEC6 within lot 2 and farm shed with drum within lot 13

No obvious change appears since previous site inspection in 2019.

Part Lot 1 DP867223 & Lot 3 DP1149329

There areas were not covered in the previous assessments. No obvious features of concern were observed during the inspection for this assessment.

5.2 Surrounding Environment

At the time of field work, the neighbouring properties were as follows:

To the north: Googong Township Neighbourhood 2 and Neighbourhood 1B
To the south: Rural / Grazing Land
To the east: Googong Dam Foreshore and Pink Tail Worm-Lizard Conservation Area
To the west: Old Cooma Road

There were no air emissions emanating from the site and the neighbouring properties.

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6.0 GEOLOGY AND HYDROGEOLOGY

The ground surface of the site was undulating, sloping generally to the east.

The Geological Map of Canberra (Geological Series Sheet 8727, Scale 1:100,000, 1992), published by the Bureau of Mineral Resources, indicates that the site is underlain by Colinton Volcanics of late Silurian age, comprising dark green dacitic ignimbrite and minor volcanoclastic sediments. In the west of the site there is some tuffaceous shale of the same group. A small area in the centre of the site is underlain by minor granitoid stocks of late Silurian age.

The Soil Landscape Map of Canberra (Soil Landscape Series Sheet 8727, Scale 1:100,000, 2000), published by the NSW Department of Land and Water Conservation, indicates that the majority of the site is located within the Burra Landscape area, which comprises undulating to rolling low hills and alluvial fans on Silurian volcanics. Soils within this landscape are generally shallow to moderately deep. The soils are strongly acid with low fertility and low available waterholding capacity. Subsoils have low permeability. A small area in the centre of the site is located within the Celeys Creek Landscape area, which comprises rolling low hills on granitic rock. Soils within this landscape are generally shallow to moderately deep. The soils are infertile, locally shallow and non-cohesive. Topsoils are acid and highly permeable. Subsoils are hard setting with low available waterholding capacity.

Reference should be made to test pit logs in Appendix A for descriptions of the soils encountered during sampling on 23 February 2021 for this assessment. Based on information from all test pits / sample locations the sub-surface profile is generalised as follows:

Topsoil	Silty Clay, low plasticity, brown, traces of root fibres, was encountered in test pit / sample locations D105 to D107 and D109 to D111.
Fill	Silty Clay, low plasticity, dark grey, inclusion of charcoal / ash material, and plywood & metal fragments was encountered at locations J2a, D101 to D104 and D108.
Natural Material	Silty CLAY, medium plasticity, orange.

Reference may be made to Drawing No 14328/2-AA3 for the abovementioned test pit / sample locations.

Field observations by the Environmental Scientist during sampling indicated that there were no detectable odour and no obvious staining / discolouration of the soil and fibro / asbestos-cement pieces in test pit / sample locations and recovered soil samples that would indicate potential for contamination.

There is no water body such as a creek, river or wetland close to the site. Queanbeyan River is located approximately 580m to the east of the eastern bound area of the site. There were several tributaries of the Queanbeyan River traversing the site in the north and south of the eastern bound area of the site. Obvious local depressions and several farm dams that would capture or divert stormwater run-off were observed within the site. Based on observation and site topography, surface run-off would predominantly flow to the east.

As part of investigation for preparation of the SAQP for Neighbourhood 1A, CMJA undertook a desktop review of records held by the NSW Office of Water (NOW), covering boreholes within a 2 kilometres (km) radius of the centre of land including the site and assessed the hydrogeology of the surrounding area. The search revealed many bores within this radius. However, feature information was only available for

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three bores with recorded water bearing zones at depths ranging from 0m to 75 metres (m) below the EGL and standing water levels between 20m and 31m.

A search was carried out by Geotechnique on 17 June 2019 through the website of Department of Primary Industries - Office of Water for any registered groundwater bore data within a radius of 500m of the site. The search revealed there was information on six bores available on that date. A summary of the results are presented below:

Bore	Completion Date	Authorised / Intended Purpose	AMG coordinates	Water Bearing Zone (m)	Standing Water Level (m)	Salinity (mg/L)
GW063668	1.09.1986	Domestic	700.772 _E & 6076.579 _N	11.90-14.90 & 16.80-18.30	4.90	No Details
GW064429	1.01.1919	Domestic	700.982 _E & 6076.944 _N	18.30- 27.40	No Details	No Details
GW402109	2.12.2002	Stock, Domestic	701.108 _E & 6076.288 _N	18.00-23.00	11.00	370.00
GW414415	10.09.2010	Stock, Domestic	700.849 _E & 6076.592 _N	No Details	No Details	No Details
GW400206	28.04.1997	Stock, Domestic	700.927 _E & 6076.761 _N	22.80- 24.40	4.60	No Details
GW416391	29.08.2013	Monitoring Bore	701.514 _E & 6076.550 _N	12.00-43.00	6.80	No Details

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7.0 CONCENTUAL SITE MODEL

7.1 Areas of Environmental Concern (AEC) / Potential AEC

Based on the available information and site inspection, the AEC / potential AEC (PAEC) and associated contaminants of potential concern (CoPC) have been identified and are presented in the following table.

AEC / PAEC	CoPC
Spillage of hazardous building materials from demolition works	<ul style="list-style-type: none"> ➤ Asbestos ➤ Metals ¹
Fill in footprints of site features following demolition and removal in AEC5, AEC6 & farm shed with drums	<ul style="list-style-type: none"> ➤ Metals ¹ ➤ Organochlorine Pesticides (OCP) ➤ Total Recoverable Hydrocarbons (TRH) ➤ Benzene, Toluene, Ethyl Benzene and Xylenes (BTEX) ➤ Polycyclic Aromatic Hydrocarbons (PAH) ➤ Polychlorinated Biphenyls (PCB) ➤ Asbestos
Residual soil in footprints of site features following demolition and removal in AEC5	<ul style="list-style-type: none"> ➤ Metals ¹ ➤ OCP
Residual soil in footprints of site features following demolition and removal in AEC6 & farm shed with drums	<ul style="list-style-type: none"> ➤ Metals ¹ ➤ TRH ➤ BTEX ➤ PAH
Contaminated soil in Area 1 within AEC5	<ul style="list-style-type: none"> ➤ As
Contaminated soil around J2 in fire pit	<ul style="list-style-type: none"> ➤ Metals included As, Cr, Cu & Zn
Pit with burial livestock carcasses	<ul style="list-style-type: none"> ➤ E. Coli ➤ Faecal Coliforms and ➤ Salmonella ➤ Nitrogen ➤ Ammonia ➤ Phosphorus

¹ Arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn)

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The following Table 7.2 outlines the Conceptual Site Model (CSM) presenting the potential Source, Receptor and Exposure Pathway linkages,

Table 7.2 CSM

Potential Source	Potential Receptors	Potential Exposure Pathway
<p>Potential mechanisms for contamination include:</p> <ul style="list-style-type: none"> ➤ Former possible pesticide spraying of building foundation – ‘top-down’ and spills (e.g. during normal use, application and / or improper storage); ➤ Hazardous building materials – ‘top-down’ (e.g. inadequate demolition practices resulting in impacts on surficial soil; ➤ Fill materials and / or fly tipped stockpile – importation / illegal dumping of impacted material, ‘top-down’ impacts (e.g. placement of fill, leaching of contaminants from fill / stockpiled material, etc.) or sub-surface release (e.g. impacts from buried material); and ➤ Contaminated soil / material - ‘top-down’ impacts (e.g. leaching of contaminants from the impacted soil / material). 	<p>Human receptors include workers involved in construction activities, as well as future residents (including adults and children) of the site and in the immediate vicinity, visitors and intrusive maintenance workers within the site.</p> <p>Ecological receptors include flora and fauna, water bodies close to the site and groundwater.</p>	<p>Potential exposure pathways relevant to human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, BTEX and naphthalene). The potential for exposure would typically be associated with the construction and excavation works and future use of the site.</p> <p>Exposure during future site use could occur via direct contact with soil in unpaved areas such as gardens, inhalation of airborne asbestos fibres during soil disturbance, or inhalation of vapours within enclosed space such as buildings.</p> <p>Potential exposure pathways for flora and fauna include primary contact and ingestion.</p> <p>The following have been identified as potential exposure mechanisms for site contamination:</p> <ul style="list-style-type: none"> ➤ Vapour intrusion into the buildings to be constructed (either from soil contamination or volatilisation of contaminants from groundwater); ➤ Contact (dermal, ingestion or inhalation) with exposed soil in landscaped areas and / or unpaved areas; ➤ Migration of groundwater off-site and into nearby water bodies including aquatic systems and those being used for recreation; and ➤ Migration of groundwater off-site into areas where groundwater is being utilised as a resource (i.e. for irrigation).

7.2 Potentially Contaminated Media

The historical review and site inspection identified previous and current site activities, as well as sources of AEC / PAEC, which might have impacted the historical soils.

Potentially contaminated media present at the site are considered to be surface soils and fill materials.

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Based on the potential mobility of contaminants and associated potential leachability through the soil profile, vertical migration of contaminants from the surface soils into the underlying natural soils / shale bedrock might have occurred. As a result, the natural soils and underlying shale bedrock are also considered to be potentially contaminated media.

Several tributaries of the Queanbeyan River traversing the site, obvious local depressions and farm dams within the site might capture or divert stormwater run-off. If significant chemical concentrations are detected in soil samples, there is potential for off-site impact of the contaminants on the waterbodies due to surface water run-off from the site. As a result, surface water is also considered to be a potentially contaminated medium.

Groundwater is identified as a potentially contaminated medium due to the potential for the contamination to have leached to groundwater within the contaminated area(s) if identified.

7.3 Potential for Migration

Contaminants generally migrate from site via a combination of windblown dust, rainwater infiltration, groundwater migration and surface water run-off. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid / liquid and mobility characteristics).
- The extent of the contaminants (isolated or widespread).
- The locations of the contaminants (surface soils or at depth).
- The site topography, geology, hydrology and hydrogeology.

Off-site impacts of contaminants in soil are generally governed by the transport media available and likely receptors. The most common transport medium is water, whilst receptors include initially uncontaminated soils, groundwater, surface waterbodies, humans, flora and fauna.

The potential contaminants identified as the information obtained, site inspection and field sampling were generally in a solid form (e.g. heavy metals, PAH, OCP, etc.).

The ground surface within the site was in general grass covered. The potential for migration of contaminants via wind-blown dust is considered low as a result of the exposed soils within the site. The potential for migration of contamination via surface run-off is also expected to be minor. Some migration of contaminants via surface water might still occur in the event of heavy rain.

Migration of soil contaminants to the deeper soils or groundwater regime would generally be via leaching of contaminants from the surface soil, facilitated by infiltration of surface water. Several tributaries of the Queanbeyan River traversing the site, obvious local depressions and farm dams within the site might act as a preferential pathway for contaminants in the area impacted to dissolve and migrate away from this area. Furthermore, there is a possible risk of contaminants to migrate to deeper soils or the groundwater regime.

Sensitive receptors at the site and in the immediate vicinity, under current site conditions and based on the future land use of the site, are considered to include visitors and those living and working at the site who might come into contact with potentially contaminated media. The sensitive environmental receptors that could be adversely impacted by possible contamination are considered to be surface water bodies within the site and groundwater.

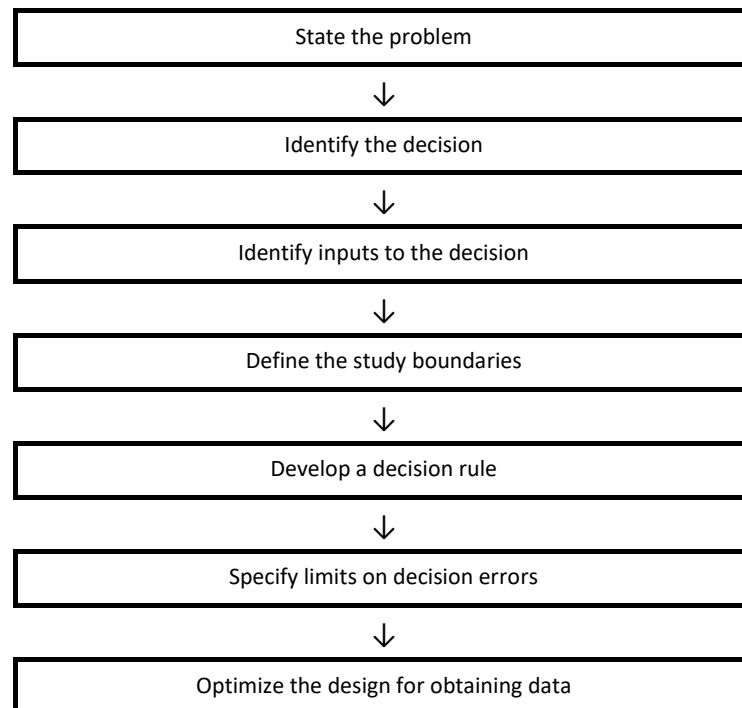
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8.0 DATA QUALITY OBJECTIVES

Data quality objectives (DQO) are qualitative and quantitative statements that specify the quality of the data required for the contamination assessment. The DQO developed for this contamination assessment was in accordance with the NSW EPA, Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd edition), as well as with the Australian Standard “*Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds*” (AS4482.1-2005) and “*Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 2: Volatile substances*” (AS4482.2-1999).

The purpose of the DQO process was to specify the type, quantity and quality of data needed to be collected for making decision on the suitability of the site for the proposed land use after remediation and validation.

The DQO process adopted consists of the following seven steps and is outlined as follows:



State the Problem

Contamination assessments had been conducted within the site in various stages and documented in a number of reports.

It is understood that the site is proposed for residential (with garden / accessible soil) land use.

The ‘problem’ as it stands is that previous and existing land uses may have given rise to potential soil contamination, which could impact on the proposed development.

A contamination study based on previous assessments and current site conditions is to be undertaken in order to provide data on the contamination status of the site and to make recommendations with regard to future demolition and remedial works.

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The ‘problem’ to be addressed is whether the site can be declared environmentally suitable for the proposed development, following completion of the demolition and remedial works, if required.

The following key professional personnel will be involved in the contamination assessment:

John Xu	Senior Associate
Justin Hofmann	Environmental Scientist

Identify the Decisions

The decisions to be made in completing the assessment are as follows:

- Is the site currently suitable for the proposed land use?
- Is further investigation required to adequately address the abovementioned decisions?
- Is further investigation required to delineate the extent of contamination / locations of concern identified?
- Does the site require remediation or management to ensure suitability for the proposed land use?

Identify Inputs to the Decisions

The inputs into the decision process are as follows:

- Results of previous contamination assessments (presented in Section 4.0).
- Site conditions and observation details (presented in Section 5.0).
- A grid and judgemental soil sampling to delineate the extent of contamination around previously identified contaminated location J2.
- Soil profile information obtained through the sampling phase.
- Develop conceptual site model (presented in Section 7.0).
- Laboratory test data on analysed samples.
- Assessment of test results against applicable soil Investigation levels and screening levels in the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (April 2013).

Define the Study Boundaries

The study boundary for this assessment is defined by coordinates for the boundaries of the site, as shown on Drawing No 14328/2-AA1, and summarised in Section 3.0 of this report.

The vertical boundary will be the depth within the soil profile to which contamination might have potentially migrated.

Develop a Decision Rule

The information obtained through this assessment will be used to characterise the subject site in terms of contamination issues and risk to human health and the environment. The decision rule in characterising the site will be as follows:

- The assessment criteria are the NSW EPA produced and / or endorsed criteria, as specified in Section 13.0 of this report.
- The soil / site will be deemed contaminated if any of the above criteria are unfulfilled or containing contamination “hot spots”. Reference should be made to NSW EPA (1995) “Contaminated Sites:

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Sampling Design Guidelines", which define what criteria determine an exceedence of a trigger value is a hot spots or not.

- Further investigation, remediation and / or management will be recommended if the site is found to be contaminated or containing contamination "hot spots".

Laboratory test results will only be accepted and considered useable for this assessment under the following conditions:

- All laboratories used are accredited by NATA for the analyses undertaken.
- All detection limits set by the laboratories fall below the assessment criteria adopted.
- Analyte concentrations in the rinsate water sample should be less than laboratory limits of reporting or should not be detected significantly.
- The differences between the reported concentrations of the analytes in the field duplicate and the corresponding original samples are within accepted limits (refer to Section 10.6).
- The differences between the reported concentrations of the analytes in the inter-laboratory duplicate (split) and the corresponding original samples are within accepted limits (refer to Section 10.7).
- The QA / QC protocols and results reported by the laboratories comply with the requirements of the NEPM 1999 (April 2013) "*Guideline on Laboratory Analysis of Potentially Contaminated Soils*".

Specify Limits on Decision Errors

The limits on decision errors for this assessment are as follows:

- Selection of sampling patterns complies with those recommended in the NSW EPA sampling design guidelines, which have risk probabilities already incorporated. Sample numbers and sampling plans are therefore considered to be adequate for site characterisation.
- The analyte selection is based on the previous site investigations, current site conditions and soil profiles. The possibility of any other potential contaminants that would be detected through field observation (odours, staining, and colouring) during sampling may need to be included. The potential for contaminants other than those analysed is considered remote.
- The assessment criteria adopted from the guidelines stated in Section 13.0 have risk probabilities already incorporated.
- The acceptable limits for field and inter-laboratory duplicate comparisons are outlined in Sections 10.6 and 10.7 of this report.
- The acceptance limits for laboratory QA / QC parameters will be assessed based on the laboratory reported acceptance limits and those stated in the NEPM 1999 (April 2013) "*Guideline on Laboratory Analysis of Potentially Contaminated Soils*".

Optimise the Design for Obtaining Data

The following measures were undertaken to ensure accurate data collection:

- The procedures adopted for the location and collection of environmental samples were developed prior to implementation, in accordance with NSW EPA guidelines and current industry practice. The sampling program was designed to ensure integrity of data collection during the assessment, including decontamination techniques, sample labelling, storage and chain of custody protocols.

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- The analytical program was developed in theory prior to undertaking the sampling (based on the previous site investigations and soil profiles) and will be refined on the basis of field observations (both surface and sub-surface) during the sampling phase. All potential contaminants have been covered.
- Only laboratories accredited by NATA for the analyses undertaken will be used for this assessment. The laboratory performance is assessed through review of statistics calculated for QA samples such as blanks, spikes, duplicates and surrogates.
- The QA / QC program incorporates preparation of traceable documentation of procedures used in the sampling and analytical program and in data validation procedures.

Data Quality Indicators

The performance of the assessment in achieving the DQO will be assessed through the application of Data Quality Indicators (DQI), defined as follows:

Precision:	A quantitative measure of the variability (or reproducibility) of data;
Accuracy:	A quantitative measure of the closeness of reported data to the “true” value;
Representativeness:	The confidence (expressed qualitatively) that data is representative of each media present on the site;
Completeness:	A measure of the amount of useable data from a data collection activity;
Comparability:	The confidence (expressed qualitatively) that data can be considered equivalent for each sampling and analytical event;
Sensitivity:	The appropriateness of the chosen laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted site assessment criteria.

An assessment of the data quality indicators is presented in Section 10.0 and Section 11.0 of this report for field procedures (soil sampling phase) and for laboratory procedures (analytical phase) respectively.

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9.0 SITE INSPECTION, SAMPLING & ANALYSIS PLAN AND SAMPLING METHODOLOGY

On 23 and 24 February 2021, our Environmental Scientist carried out site inspection across the site.

Sampling at and in the vicinity of J2 was undertaken on 23 February 2021 as shown on Drawing No 14328/2-AA3 in order to delineate the extent of contamination previously identified. A number of surface and deeper soil samples were recovered.

The sampling procedures adopted for the assessment were generally as follows:

- The test pits / sample locations were excavated using an excavator to the depth as nominated by the Environmental Scientist. The representative soil sample was recovered directly from the excavator bucket using a stainless steel trowel or single use disposable gloves.
- The stainless steel trowel was decontaminated prior to use between each sample location, in order to prevent cross contamination (refer to Section 10.2 for details of the procedures for decontamination of the trowel).
- The soil sample for laboratory analysis was immediately transferred to a labelled, laboratory supplied, 250ml glass jar and sealed with an airtight, Teflon screw top lid. The fully filled jar was then placed in a chilled container.

In order to ensure the analytical performance of the primary laboratory, duplicate and split samples were prepared for analysis. Soil samples were kept in a labelled laboratory supplied glass jar (acid-washed and solvent-rinsed) and sealed with an airtight screw Teflon top lid. The fully filled jar was placed in a chilled container.

A rinsate water sample was collected and placed in a glass bottle supplied by the laboratory. The fully filled bottle was labelled and placed in a chilled container.

The primary samples in the chilled container were forwarded under COC conditions to the primary NATA accredited laboratory, SGS Environmental Services (SGS). The split sample in the chilled container was forwarded under COC conditions to the secondary NATA accredited laboratory, Envirolab Services Pty Ltd (Envirolab).

On receipt of the samples, the laboratories returned the Sample Receipt Advice verifying the integrity of all the samples received.

The Environmental Scientist carried out sampling in locations shown on Drawing No 14328/2-AA3. The numbers of samples recovered (refer to test pit logs in Appendix A) and analysed including duplicate and split samples, are summarised below.

Area of Concern / Targeted Attribute	Sample Location & ID	Number of Samples Recovered & Analysed	Analytes	Duplicate Sample	Split Sample	Remarks
At & in the vicinity of J2	J2a, D101 to D111	14	➤ 4 metals (As, Cr, Cu & Zn)	DDS101 = D101 (0-0.1m)	DSS101 = D103 (0-0.1m)	➤ 14 samples for analysis of 4 metals (As, Cr, Cu & Zn)

Note:

4 metals including arsenic (As), chromium (Cr), copper (Cu) and zinc (Zn)

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In addition, the following samples were recovered / prepared and analysed:

- 4 topsoil, 2 fill and 2 natural soil samples selected analysis of Cation Exchange Capacity (CEC) and pH.
- 1 rinsate sample (RS101) for analysis of 4 metals.

Reference may be made to Sections 10.0 and 14.0 of this report for a summary and assessment of the laboratory test results. A copy of the laboratory analytical reports and certificates of analyses is included in Appendix B.

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10.0 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

10.1 Sampling Personnel

Geotechnique undertook all the sampling associated with this assessment. Our Environmental Scientist (Justin Hofmann) from Geotechnique located sampling positions based on the project brief prepared by the Project Manager and site conditions, logged the soil profile encountered, recovered soil samples at a frequency determined by the project brief and packaged the samples (refer to Section 9.0).

Justin Hofmann has undergone supervised training in Geotechnique procedures for sampling and logging.

10.2 Decontamination Procedures

As stated in Section 9.0 of this report, soil sampling was carried out using an excavator. A stainless steel trowel and single use disposable gloves were used to transfer the soil sample from the excavator bucket to the laboratory supplied glass jar. Decontamination of the trowel involved:

- Removal of soils adhering to the trowel by scrubbing with a brush;
- Washing the trowel thoroughly in a solution of phosphate free detergent (Decon 90) using brushes and disposable towels;
- Rinsing the trowel thoroughly with distilled water;
- Repeating the rinsing with water;
- Drying the trowel with a clean cloth.

A rinsate water sample was recovered at completion of sampling.

10.3 Log for Each Sample Collected

Reference should be made to test pit logs in Appendix A regarding logs for descriptions of the samples collected.

10.4 Chain of Custody

The primary samples in chilled container with rinsate and duplicate samples were forwarded under COC conditions to the primary testing laboratory SGS. Inter-laboratory duplicate (split) sample was forwarded under COC conditions to the secondary testing laboratory of Envirolab.

On receipt of the samples, the laboratories returned the signed COC and Sample Receipt Advice, acknowledging the receipt of samples and verifying the integrity of all the samples received.

Reference should be made to Appendix A for full identification of samples and sampling date under chain of COC conditions to the above mentioned laboratories.

10.5 Rinsate Samples

One rinsate water sample (Rinsate RS101) was recovered on completion of the field work in order to identify possible cross contamination between the sampling locations.

The rinsate water sample was analysed for metals. The test results for the rinsate water sample are summarised in Table A. A copy of the laboratory analytical report is included in Appendix B.

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As indicated in Table A, concentrations of analytes in the rinsate blank sample were less than the laboratory limits of reporting (LOR), indicating that the cleaning and decontamination processes adopted in the field were adequate.

10.6 Duplicate Sample

A duplicate sample was prepared in the field through the following processes:

- A larger than normal quantity of soil was recovered from the sample location selected for duplication.
- The sample was divided into two portions, using the decontaminated trowel.
- One portion of the sub-sample was immediately transferred into a labelled, laboratory supplied, 250ml glass jar and sealed with an airtight, Teflon screw top lid. The fully filled jar was then placed in a chilled container.
- The remaining portion was stored in the same way and labelled as the original sample.

Duplicate samples were prepared on the basis of sample numbers recovered during the field work. The duplicate sample frequency was computed using the total number of samples analysed as part of this assessment.

The duplicate frequency adopted (7% for metals) complies with Schedule B3 Guideline on Laboratory Analysis of Potentially Contaminated Soils of the NEPM 1999 (April 2013), which recommends a duplicate frequency of 5%.

The duplicate sample test results are summarised in Table B. A copy of the laboratory analytical report is included in Appendix B.

A comparison was made of the laboratory test results for the duplicate sample with the original sample, and the Relative Percentage Differences (RPD) were computed in order to assess the accuracy of the laboratory test procedures. RPD within 30% are generally considered acceptable. However, this variation can be higher for low concentrations of analytes or non-homogeneous samples.

As shown in Table D, the comparisons between the duplicate and corresponding original sample indicated generally acceptable RPD, with the exception of RPD for As (39%), which was in excess of 30%, mainly due to the non-homogeneous nature of the soil samples.

The As concentrations with RPD in excess of 30% in the duplicate pair were both above the relevant assessment criteria.

Based on the overall duplicate sample numbers and comparisons, the RPD are not considered crucial, therefore it is concluded that the test results provided by the primary laboratory SGS are of adequate accuracy and reliability for this assessment.

10.7 Split Sample

Split samples provide a check on the analytical performance of the primary laboratory. The split samples were prepared based on sample numbers recovered during the field work, in the same manner as the duplicate sample. Reference should be made to Section 10.6. The split sample was forwarded to a secondary laboratory (Envirolab) for analysis.

The split sample frequency was computed using the total number of samples analysed as part of this assessment.

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The split sample frequency adopted (7% for metals) complies with Schedule B3 of the NEPM 1999 (April 2013), which recommends a frequency of 5%.

The split sample test results are summarised in Table C. A copy of the laboratory analytical report and certificate of analysis is included in Appendix B.

Based on Schedule B3 of the NEPM 1999 (April 2013) the difference in the results between the split samples should generally be within 30% of the mean concentration determined by both laboratories, i.e., RPD should be within 30%. However, higher variations can be expected for samples with low analyte concentrations or non-homogeneous samples.

As shown in Table C the comparisons between the splits and corresponding original samples indicated generally acceptable RPD, with the exception of RPD for Cu (43%) and Zn (54%), which were in excess of 30%. This is considered to be due to the non-homogeneous nature of the soil samples.

All the analyte concentrations with RPD in excess of 30% in the split pair were either both above or both less than the relevant assessment criteria.

Based on the above, the variations are not considered critical. Based on the overall split sample numbers and comparisons, it is concluded that the test results provided by the primary laboratory can be relied upon for this assessment.

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11.0 LABORATORY QUALITY ASSESSMENT AND QUALITY CONTROL

11.1 Signed Chain of Custody Forms

Reference should be made to Appendix B for copies of signed COC Forms along with the laboratory Analytical Reports (SGS) and Certificate of Analysis (Envirolab).

11.2 Sample Holding Times

The following Table 11.1 lists the allowable holding times of soils and water, detailed in Schedule B3 of the NEPM 1999 (April 2013) and in Standard Methods for the Examination of Water and Wastewater (APHA).

Table 11.1 Sample Holding Times

ANALYTE	HOLDING TIME (SOIL)	HOLDING TIME (WATER)
Metals *	6 months	6 months
pH	7 days	-
CEC	28 days	-

* Metals include Arsenic, Chromium, Copper and Zinc

The actual holding times of the laboratories used for this assessment are shown in the laboratory analytical reports / certificates of analyses in Appendix B of this report. All analyses were in general conducted within the relevant holding times with the exception of the analysis of pH and CEC.

The extraction times for CEC and pH analysis of some soil samples by SGS (Report No SE216927A) were 29 days and 30 days respectively, which were technically 1 day and 23 days over the 'recommended' holding time for CEC and pH analysis respectively. It is our opinion that 1 day or 23 days over is insignificant for CEC and pH analysis as they were kept refrigerated the whole time in the laboratory.

11.3 Test Methods and Limits of Reporting / Practical Quantitation Limits

The test methods and LOR / Practical Quantitation Limits (PQL) adopted by the laboratories are indicated with the analytical reports / certificate of analysis in Appendix B.

All reported laboratory LOR / PQL were less than the assessment criteria adopted for each analyte or analyte group.

11.4 Method Blanks

Method blank samples are designed to monitor the introduction of incidental or accidental interferences into the analysis, which might result in a false increase in analyte concentration. The blank comprises reagents specific to each individual analytical method and is analysed in the same manner as the site sample. The reagents are carried through the preparation, extraction and digestion procedures and analysed at the beginning of every sample batch analysis, or at least 1 in 20 samples.

Reagent blank samples for soil samples were analysed by the primary and secondary laboratories for Metals.

The reagent blank samples for rinsate water sample were analysed for metals by the primary laboratory (SGS).

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All reported blank concentrations were below the LOR or PQL, as detailed in the laboratory analytical reports from SGS and certificate of analysis from Envirolab. The results complied with the acceptance criteria for each laboratory (must not be detected at the LOR / PQL).

The test results indicate that there was no interference to the analysis.

11.5 Laboratory Duplicate Samples

The laboratory prepares duplicate samples from the supplied samples (original samples) and/or laboratory spike samples, carries out preparation and testing in the same manner as the original sample. The duplicate sample provides an indication of laboratory precision and reproducibility.

The laboratory prepared duplicates were analysed for the same range of analytes as the samples submitted from the site.

SGS requires 1 duplicate analysed for every 10 samples whilst Envirolab requires 1 duplicate analysed for every 20 samples.

The comparisons between the laboratory duplicates and original samples have been reported on the laboratory test results certificates as RPD.

Maximum Allowable Difference (MAD) was suggested by SGS as RPD criteria for Lab Duplicates.

Note: $MAD = 100 \times \text{Statistical Detection Limit (SDL)} / \text{Mean} + \text{Limiting Repeatability}$

Reference may be made to SGS analytical reports in Appendix B for details of the reported duplicate sample numbers, RPD ranges, as well as acceptance criteria.

As presented in the SGS analytical reports, the duplicate sample numbers and reported RPD were in general within the acceptance criteria adopted by the laboratory with the exception of one duplicate batch sample comparisons reported RPD exceeding the laboratory accepted limit for Cr and Zn, mainly due to the heterogeneity of the soil samples.

Based on the overall duplicate sample numbers and comparisons, the RPD are not considered crucial.

The RPD acceptance for Envirolab is typically in the range of 20% to 50% (if concentrations are greater than 10 times the PQL). The acceptance RPD is higher for concentrations less than 10 times the PQL as the results approach PQL and estimated measurement uncertainty will statistically increase.

No duplicate sample was reported for Envirolab but claims to run one sample in batches of 20 samples. The results are not reported with the laboratory certificates provided to clients; however, claim to be within the laboratory acceptance criteria.

Based on the above, the duplicate sample numbers and reported RPD for SGS and Envirolab were within the acceptance criteria adopted by the laboratories.

11.6 Laboratory Control Samples

A laboratory control sample is a sample of material with known concentrations of various analytes, such as a standard reference material or control matrix. The control sample is analysed with the sample batch

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and the recorded concentrations reported as a percentage recovery of the known or expected concentration. At least one control sample is included in each run to confirm calibration validity.

The acceptance criteria for both laboratories are presented below:

SGS: 80% to 120% for metals / inorganics

Envirolab: 70% to 130% for metals / inorganics

Reference may be made to SGS analytical reports and Envirolab certificate of analyses in Appendix B for details of the reported percentage recoveries.

The control sample data presented by SGS, fall within the acceptance limits of the laboratory.

No laboratory control sample for the analytes was reported for Envirolab, but claims to run one sample in batches of 20 samples. The results are generally not reported with the laboratory certificates provided to clients; however, claim to be within the laboratory acceptance criteria.

11.7 Matrix Spike

The purpose of matrix spikes is to monitor the performance of the analytical methods used and to determine whether matrix interferences exist. Samples are spiked with identical concentrations of the target analyte before extraction or digestion. The results are reported as percentage recoveries of the known spike concentration.

The acceptance criteria for the matrix spike recoveries in soil samples for SGS and Envirolab are 70% to 130% for metals / inorganics.

The acceptance criteria for the matrix spike recoveries in water samples for SGS are 80% to 120% for metals / inorganics

The matrix spike data presented by SGS fall within the laboratory acceptance criteria.

No matrix spike for the analytes was reported for Envirolab, but claims to run one sample in batches of 20 samples. The results are generally not reported with the laboratory certificates provided to clients; however, claim to be within the laboratory acceptance criteria.

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12.0 QA / QC DATA EVALUATION

All QA and QC details are presented in Sections 10.0 and 11.0 of this report.

The following table provides a list of the DQI for the field procedures (soil sampling phase) of the assessment, and the methods adopted to ensure that the data quality indicators are met.

DATA QUALITY INDICATOR	ACHIEVEMENT
Precision and Accuracy	Use of trained and qualified field staff; Appropriate industry standard decontamination procedures adopted; Rinsate blank water, field duplicate, and inter-laboratory duplicate (split) samples recovered or prepared; Refer to the Section 10.0 for all the above.
Representativeness	Good sampling coverage of the soils of concern; Sample numbers and selection of sampling patterns complies with NSW EPA sampling design guidelines; Collection and analysis of soil samples was based on the previous assessment and in accordance with the sampling and analysis plan in Section 9.0; Representative coverage of potential contaminants, based on the previous site investigation and soil profiles.
Completeness	Grid and Judgemental soil sampling at predetermined locations, spacing and depths; All soils of concern (potential contamination) sampled; On site visual assessment of soils uncovered; Preparation of sample location plan; Records of test pit logs; Field duplicate sample numbers complying with NEPM; Inter-laboratory duplicate (split) numbers complying with NEPM; Rinsate sample recovered daily; Trip spike samples prepared and sent with sample batch; Preparation of chain of custody records.
Comparability	Using appropriate techniques for sample recovery; Using the same sampling and decontamination procedures for the fieldwork; Experienced sampler used; Using appropriate sample storage and transportation methods for sampling.

The following table provides a list of the DQI for the laboratory procedures (analytical phase) of the assessment and the methods adopted in ensuring that the data quality indicators were met.

DATA QUALITY INDICATOR	ACHIEVEMENT
Precision and Accuracy	Use of analytical laboratories experienced in the analyses undertaken, with appropriate NATA certification; NATA accreditation requires adequately trained and experienced testing staff; Rinsate blank water, field duplicate, and inter-laboratory duplicate (split) samples analysed; Acceptable concentrations in rinsate blank water sample; Acceptable RPD for duplicate comparison overall; Acceptable RPD for inter-laboratory duplicate (split) sample comparison overall; Appropriate and validated laboratory test methods used;

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DATA QUALITY INDICATOR	ACHIEVEMENT
	Adequate laboratory performance based on results of the blank, duplicate, control and matrix spike samples.
Representativeness	Representative coverage of potential contaminants, based on the previous site investigations and soil profiles; Adequate rinsate, duplicate and split sample numbers; Adequate laboratory internal quality control and quality assurance methods, complying with the NEPM.
Completeness	Analysis for all potential contaminants of concern; Laboratory sample receipt information received, confirming receipt of samples intact and appropriate chain of custody; NATA registered laboratory analytical reports / certificate of analysis provided.
Comparability	Use of NATA registered laboratories; Test methods consistent for each sample; Test methods comparable between primary and secondary laboratory; Generally acceptable RPD between original samples and field duplicates and inter-laboratory duplicate (split) samples; Some high RPD recorded mainly due to the heterogeneity of the samples.
Sensitivity	Appropriate laboratory analysis methods Appropriate laboratory LOR / PQL

As discussed in Sections 10.6 & 10.7, some of the duplicate / split sample comparisons reported RPD exceeding the generally accepted limits for As, Cu and / or Zn. These have been attributed to the heterogeneity of the samples. The results are still considered acceptable, as virtually all remaining QA / QC sample data falls within acceptance limits.

As discussed in Section 11.5, one duplicate batch sample comparisons reported RPD by SGS exceeding the generally accepted limit for Cr and Zn, mainly due to the heterogeneity of the soil samples. The results are still considered acceptable as virtually all remaining QA / QC sample data of both laboratories fall within the acceptance criteria adopted. As such, these variations are not considered to have affected the laboratory data provided.

Based on the above, it is considered that the quality assurance and quality control data quality indicators have been complied with, both in the field and in the laboratories. As such, it is concluded that the laboratory test data obtained as part of this assessment is reliable and useable.

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13.0 ASSESSMENT CRITERIA

Investigation levels and screening levels developed in the NEPM 1999 (April 2013) will be used for this assessment, as follows:

- Risk-based Health Investigation Levels (HIL) for a broad range of metals and organic substances. The HIL are applicable for assessing human health risk via all relevant pathways of exposure. The HIL as listed in Table 1A (1) of Schedule B1 “*Guideline on Investigation Levels for Soil and Groundwater*” are provided for different land uses.

The site is proposed for residential land use and as such the analytical results for the assessment will be assessed against the available HIL for *residential with garden / accessible soil* (HIL A).

- Ecological Investigation Levels (EIL), a specific type of Soil Quality Guidelines (SQG) for selected metals, Naphthalene and DDT are applicable for assessing the risk to terrestrial ecosystems. EIL listed in Table 1B(1-5) of Schedule B1 “*Guideline on Investigation Levels for Soil and Groundwater*” depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2m of soil. The EIL are calculated using 30% effect concentration (EC30) or lowest observed effect concentrations (LOEC) toxicity data.

For this assessment, the analytical results will be assessed against the available EIL for *urban residential* land use for aged contamination in soil.

For arsenic, generic EIL for urban residential is adopted for aged contaminant. For other metals, EIL are the sum of the added contaminant limit (ACL) and the ambient background concentration (ABC). Where available, EIL are calculated using the EIL calculator developed by CSIRO for NEPC.

The soil will be deemed contaminated if the above criteria are unfulfilled or containing contamination “hot spots” as defined by the NSW EPA “*Contaminated Sites: Sampling Design Guidelines*”. Further investigation, remediation and / or management will be recommended if the soil is found to be contaminated or contain contamination “hot spots”.

14.0 LABORATORY TEST RESULTS, ASSESSMENT & DISCUSSION

The test results are presented in Table D together with the assessment criteria adopted. A copy of the laboratory analytical reports is included in Appendix B. A discussion of the test results is presented below.

The average CEC and pH were adopted to calculate the relevant EIL.

With the exception of highlighted concentrations of 4 metals including As, Cr, Cu and / or Zn in surface soil samples recovered from locations D101 to D104 and D108 and deeper sample recovered from D103, the remaining concentrations of 4 metals were below the HIL A and / or EIL.

The As concentrations (ranging from 130mg/kg to 1800mg/kg) in samples recovered from locations D101 to D104 and D108 exceeded the HIL A and EIL of 100mg/kg, which might pose a risk to human health and terrestrial ecosystems.

The Cr concentrations (ranging from 150mg/kg to 620mg/kg) in samples recovered from locations D101 to D104 and D108 exceeded the HIL A of 100mg/kg for Cr (VI). The Cr concentration (620mg/kg) in sample recovered from D102 exceeded the EIL of 410mg/kg for Cr (III). The Cr concentrations in the soil might present a potential risk of harm to human health and / or pose potential risk to terrestrial ecosystems.

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The Cu concentrations (ranging from 360mg/kg to 8700mg/kg) in samples recovered from locations D101 to D104 and D108 exceeded the EIL of 230mg/kg. The Cu concentration (8700mg/kg) in sample recovered from location D104 exceeded the HIL A of 6000mg/kg. The Cu concentrations in the soil might pose potential risk to terrestrial ecosystems and / or present a risk of harm to human health.

The Zn concentrations (3600mg/kg and 3800mg/kg) in samples recovered from locations D102 and D108 exceeded the EIL of 770mg/kg; however, were well below the HIL A of 7400mg/kg, which might pose potential risk to terrestrial ecosystems, but will not present a risk of harm to human health.

Based on the laboratory test results and locations of contamination, one area (labelled as Area 2) requiring remediation was identified as shown on Drawing No 14328/2-AA4. The size and thickness are estimates only, which may be decreased or increased. This will be confirmed by validation sampling and testing.

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15.0 SITE CHARACTERISATION

Based on this assessment, contaminated soil / material at locations and areas requiring remediation are identified within the site, as indicated and tabulated on Drawing No 14328/2-AA4 and detailed below:

- Concentrations of As in the impacted soil in Area 1 would present a risk to human health and terrestrial ecosystems.
- Concentrations of As, Cr, Cu and Zn in the impacted soil in Area 2 might pose potential risk to terrestrial ecosystems and / or present a risk of harm to human health.
- A large burial pit with livestock carcasses in Area 3 would present a risk of harm to human health and pose potential risk to terrestrial ecosystems.

As such, some form of remediation and / or management process is required.

The elevated concentrations of metals of concern were encountered in the surface soil in contaminated Area 1 and Area 2. Due to the relatively impermeable nature of the soils beneath the surface soil and the slope of the land, only minor infiltration of surface waters is likely to occur. As such, the contaminants are likely to be confined primarily to the surface soil, and therefore leaching of contaminants into deeper soils is considered unlikely.

Migration of soil contaminants to the groundwater regime would generally be via leaching of contaminants from the soil, facilitated by infiltration of surface water. It is anticipated that groundwater would be within the underlying shale bedrock. Given that the naturally occurring soils beneath the site are relatively impermeable based on the regional geology information from the previous assessments for the other Neighbourhood development, the potential for recent and ongoing migration of contaminants from the site to the groundwater table below is considered low. Furthermore, the relatively impermeable clay layer and underlying shale bedrock would have minimised the potential for contaminants in the past to migrate to deeper soils or the groundwater regime. It is considered unlikely that the groundwater regime beneath the site has been impacted by contaminants in the soils.

Several tributaries of the Queanbeyan River traversing the site, obvious local depressions and farm dams within the site might capture or divert stormwater run-off.

The contaminated soil / material were identified in Area 1 to Area 3 and will be remediated at later stage.

Based on the above, potential off-site impacts of contaminants on groundwater and waterbodies are considered to be low.

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16.0 WASTE CLASSIFICATION

Waste classification is required to provide information to the nominated landfill facility regarding classification of the contaminated soil / material to be disposed.

In NSW the criteria for disposal of contaminated soils / material are generally governed by the "Waste Classification Guidelines Part 1: Classifying Waste", the NSW EPA 2014. This guideline outlines a clear, step-by-step process for classifying waste. There are six waste classes to be used:

- Special Waste, including clinical and related waste, asbestos waste, as well as waste tyres
- Liquid Waste
- Hazardous Waste
- Restricted Solid Waste
- General Solid Waste (Putrescible)
- General Solid Waste (Non-putrescible)

Each category has separate requirements in terms of licensing for transportation and landfill sites. NSW EPA consent is required for disposal, treatment and / or storage of Hazardous Waste.

Waste is classified according to Contaminant Threshold (CT) values without Toxicity Characteristics Leaching Procedure (TCLP) test or Specific Contaminant Concentration (SCC) values with the TCLP test.

Area 1

For landfill disposal purposes, the As contaminated soil in Area 1 to be removed from the site is classified as "General Solid Waste (Non-putrescible)".

Reference should be made to Table P in report 12675/2-AA for details of the waste classification.

-

Area 2

The laboratory test results are summarised in Tables W1 to W6 in Appendix C. Copies of the laboratory analytical reports / certificate of analysis are included in Appendix B.

According to the "Waste Classification Guidelines Part 1: Classifying Waste" (NSW EPA 2014), soil content, as well as the laboratory test results, the metal contaminated soil in Area 2 to be removed from the site is classified as "Restricted Solid Waste" as detailed in Table W6.

Area 3

According to the "Waste Classification Guidelines Part 1: Classifying Waste" (NSW EPA 2014), the livestock carcasses in Area 3 to be removed from the site is classified as "General Solid Waste (Putrescible)".

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The contaminated soil / material must be disposed of at an appropriately licensed landfill facility. Removal and disposal of the waste must be carried out in accordance with the requirements of the regulators, such as NSW EPA.

It should be noted that:

- If the waste material is to be disposed at a licensed waste facility in a State other than New South Wales (NSW), such as Australian Capital Territory (ACT), Victoria (VIC) or Queensland (QLD), the proximity principle for disposal might apply and should be considered. If the waste is allowed to be disposed of at a landfill facility in ACT, VIC or QLD, then the classification of the waste will need to comply with the requirements of the regulators in ACT, VIC or QLD. The waste disposal will need to comply with the cross boarder requirements of the National Environmental Protection (Movement of Controlled Waste Between States and Territories) Measure and will require the approval of the EPA in ACT, VIC or QLD.
- Prior to waste material being removed from the site, the Site Auditor is required to review the waste classification for disposal in NSW and all associated documents for disposal in ACT, VIC or QLD.
- All landfill delivery dockets and documents associated with landfill disposal shall be provided to Geotechnique for inclusion in a final validation report.

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17.0 CONCLUSION AND RECOMMENDATIONS

The data quality objectives outlined in the report have been satisfied. The findings of this assessment are summarised as follows:

- Following demolition and removal of 5 AST and associated infrastructure, as well as all the other site features such as the sheds, sheep yards, etc. and any hard stands, contamination assessment of residual soil is required at and in the vicinity of the footprints of AST, associated infrastructure, other features and hard stands in AEC5, AEC6 and farm shed with drums.
- Contaminated soil / material were identified in Area 1 to Area 3 (refer to Drawing 14328/2-AA4).
For landfill disposal purposes, the contaminated soil / material to be removed from Area 1, Area 2 and Area 3 within the site are classified as “**General Solid Waste (Non-putrescible)**”, “**Restricted Solid Waste**” and “**General Solid Waste (Putrescible)**” respectively.
- Potential off-site impacts of contaminants on groundwater and waterbodies are considered to be low.
- Remediation and validation of the site are required.

Based on this assessment, it is our opinion that the site can be made suitable for the proposed redevelopment into residential (with garden / accessible soil) land use, subject to implementation of the following recommendations, prior to earth works / site preparation:

1. Assessment (by sampling and testing) of soil in the footprints of site features such as shearing shed, sheep & cattle yards, concrete slabs, hard stands, AST, farm shed with drums, etc., will be required after complete demolition and removal. In the event of contamination, detailed assessment, remediation and validation will be required.
2. A remedial action plan (RAP) is to be prepared to devise strategies for remediation / management of the contaminated soil / material in Area 1 to Area 3 as indicated on Drawing No 14328/2-AA4.
3. Site validation is to be carried out following the remediation of the contaminated areas.

If suspect materials (identified by unusual staining, odour, discolouration or inclusions such as building rubble, asbestos sheets / pieces / pipes, livestock carcasses, ash material, imported fill materials [which are different to those encountered during the previous assessments and this assessment], etc.) are encountered during any stage of future demolition / remediation / earthworks / site preparation, we recommend that this office is contacted for assessment and an unexpected finds management protocol in Appendix D of this report be implemented.

For any materials to be excavated and removed from the site, it is recommended that waste classification of the materials, in accordance with the "Waste Classification Guidelines Part 1: Classifying Waste" NSW EPA 2014; NSW EPA resource recovery exemptions and orders under the Protection of the Environment Operations (Waste) Regulation 2014; or NSW EPA *Certification: Virgin excavated natural material* is undertaken prior to disposal at a facility that can lawfully accept the materials.

Any imported soil (fill) must be assessed by a qualified environmental consultant, prior to importation, to ensure suitability for the proposed use. In addition, the imported fill must not contain asbestos and ash, be free of unusual odour, not discoloured and not acid sulphate soil or potential acid sulphate soil. The imported fill should either be virgin excavated natural material (VENM) or excavated natural material (ENM).

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18.0 LIMITATIONS

The services performed by Geotechnique in preparing this report were conducted in a manner consistent with the level of quality and skill generally exercised by members of the profession and consulting practice.

This report has been prepared for the purposes stated within. This report can also be relied upon by Queanbeyan Palerang Regional Council for development and building application assessment processes and by Site Auditor for site auditing purposes. Any reliance on this report by other parties shall be at such parties' sole risk as the report might not contain sufficient information for other purposes.

This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval is provided by Geotechnique.

The information in this report is considered accurate at the date of issue, in accordance with current site conditions during site inspection and field sampling for this assessment (23 and 24 February 2021). Any variations to the site form or use beyond those dates could nullify the conclusion stated.

No contamination assessment can eliminate all risk; even a rigorous professional assessment might not detect all contamination within a site. Whilst the assessment conducted at the site was carried out in accordance with current NSW guidelines, the potential always exists for contaminants and contaminated soils to be present between sampled locations and in the grass covered areas.

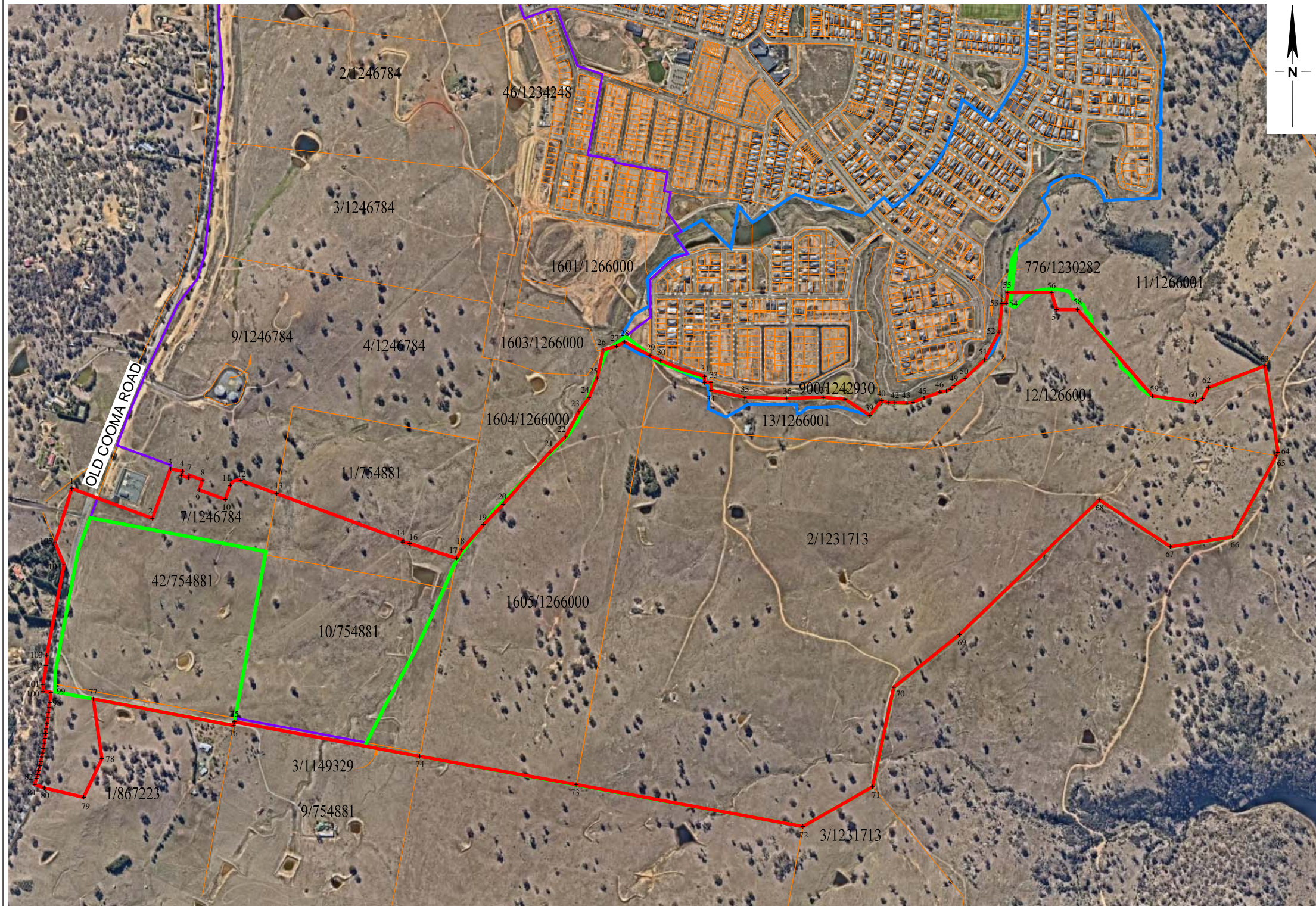
Presented in Appendix E is a document entitled "Environmental Notes", which should be read in conjunction with this report.

LIST OF REFERENCES

- Australian Standard "Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds" (AS4482.1-2005)*
- Australian Standard "Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 2: Volatile substances" (AS4482.2-1999)*
- Contaminated Land Management Act 1997*
- Contaminated Land Management Regulation 1998*
- Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites – NSW Environment Protection Authority 1997 / 2011*
- Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition) – NSW Environment Protection Authority 2017*
- Geology of Canberra 1:100,000 Sheet (8727) – Bureau of Mineral Resources, 1992*
- Googong Local Environment Study, Phase 1 Environmental Site Assessment Report (Ref. C7552/1-AC dated 4 July 2004) prepared by Coffey Geosciences Pty Ltd*
- Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land – Department of Urban Affairs and Planning / NSW Environment Protection Authority 1998*
- Contaminated Land Management Act 1997*
- National Environment Protection (Assessment of Site Contamination) Measures, 1999 (April 2013) - National Environmental Protection Council*
- Protection of the Environment Operations Act – 1997*
- Resource Recovery Order / Exemption Under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 – The Excavated Natural Material Order / Exemption 2014 NSW Environment Protection Authority*
- Soil Landscape of Canberra 1:100,000 Sheet (8727) – NSW Department of Land and Water Conservation, 2000*
- Waste Classification Guidelines Part 1: Classifying Waste – NSW EPA 2014*

DRAWINGS

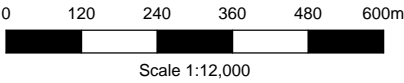
14328/2-AA1	<i>Site & Lot Layout</i>
12675/2-AA6	<i>Locations of Contamination & Area 1 to be Remediated</i>
14328/1-AA1	<i>Site & Lot Layout and Areas of Environmental Concern</i>
14328/1-AA4	<i>Locations of Contamination</i>
12675/2-AA2	<i>Site Features & Borehole Locations – AEC5</i>
12675/2-AA3	<i>Site Features & Borehole Locations – AEC6</i>
12675/2-AA5	<i>Site Features & Borehole Locations– Shed with Drums</i>
14328/1-AA2	<i>Site Features</i>
14328/2-AA2	<i>Site Features</i>
14328/2-AA3	<i>Sample Locations</i>
14328/2-AA4	<i>Locations of Contamination and Areas to be Remediated</i>



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LEGEND

- Site Boundary of Contamination Study Area for NH3 to NH5 (The Site)
- Covered under Report 14328/1-AA dated 25/06/2019 for NH3 to NH5
- Covered under Report 12675/3-AAR1 dated 30/11/2015 for NH1b Stage 1 to 8
- Covered under Report 12675/4-AA dated 31/05/2016 for NH1A Stage 7 and NH2



Point ID	Easting	Northing	Point ID	Easting	Northing
1	701206.62	6076654.47	54	703698.51	6077148.38
2	701421.44	6076575.07	55	703702.22	6077177.19
3	701470.05	6076706.59	56	703819.95	6077176.98
4	701501.76	6076700.97	57	703833.12	6077131.91
5	701499.05	6076689.87	58	703889.28	6077131.84
6	701517.52	6076683.04	59	704089.29	6076901.55
7	701519.76	6076690.26	60	704203.49	6076884.22
8	701555.46	6076677.27	61	704222.45	6076894.41
9	701546.13	6076650.87	62	704238.06	6076923.42
10	701615.64	6076625.57	63	704388.73	6076981.84
11	701629.15	6076662.68	64	704423.93	6076751.02
12	701657.35	6076675.83	65	704418.96	6076741.79
13	701752.91	6076641.05	66	704303.16	6076525.59
14	702090.12	6076516.72	67	704136.94	6076499.29
15	702089.23	6076511.48	68	703947.25	6076624.49
16	702108.08	6076507.82	69	703574.05	6076264.83
17	702232.44	6076468.77	70	703398.86	6076124.33
18	702246.84	6076490.86	71	703342.31	6075858.99
19	702304.57	6076558.26	72	703156.47	6075753.21
20	702357.21	6076612.61	73	702551.84	6075865.12
21	702482.61	6076752.42	74	702134.33	6075940.31
22	702523.47	6076792.57	75	701640.00	6076032.65
23	702559.03	6076859.48	76	701638.26	6076022.74
24	702586.03	6076896.28	77	701263.81	6076093.42
25	702607.59	6076949.33	78	701287.03	6075934.69
26	702624.03	6077024.37	79	701238.24	6075831.15
27	702659.09	6077033.64	80	701133.11	6075855.93
28	702680.63	6077045.60	81	701107.28	6075865.09
29	702748.98	6077009.15	82	701112.18	6075881.83
30	702777.05	6076996.18	83	701115.11	6075891.98
31	702893.98	6076953.30	84	701117.99	6075903.21
32	702893.98	6076937.21	85	701121.03	6075915.14
33	702911.48	6076937.21	86	701123.60	6075926.05
34	702911.48	6076916.85	87	701126.21	6075938.55
35	703001.54	6076897.80	88	701128.44	6075949.36
36	703112.75	6076894.92	89	701130.68	6075961.34
37	703210.75	6076897.69	90	701133.06	6075975.06
38	703269.09	6076892.58	91	701135.01	6075987.98
39	703335.52	6076849.26	92	701136.77	6076001.13
40	703366.81	6076889.24	93	701138.35	6076013.30
41	703384.17	6076883.43	94	701140.31	6076027.37
42	703401.88	6076883.25	95	701142.22	6076043.23
43	703434.30	6076882.13	96	701144.04	6076057.71
44	703450.24	6076884.40	97	701145.79	6076070.37
45	703479.52	6076895.96	98	701147.53	6076084.07
46	703521.98	6076911.88	99	701150.79	6076111.18
47	703539.44	6076914.50	100	701130.29	6076113.42
48	703549.34	6076919.71	101	701129.70	6076132.00
49	703560.21	6076929.56	102	701138.24	6076182.68
50	703589.03	6076948.24	103	701139.66	6076210.12
51	703640.97	6076997.54	104	701185.72	6076451.06
52	703679.88	6077071.52	105	701161.86	6076509.81
53	703687.40	6077148.11			



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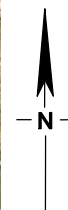
Site features are shown at approximate locations and are not to scale.

Googong Neighbourhoods 3, 4 & 5
Old Cooma Road, Googong

Site & Lot Layout

Drawing No: 14328/2-AA1
Job No: 14328/2
Drawn By: MH
Date: 16 June 2021
Checked By: JX

File No: 14328-2
Layers: 0, AA1



Sample Location	Depth (m)	Contaminant	Concentration (mg/kg)	Assessment Criteria (mg/kg)
BH205	0-0.1	arsenic (As)	370	As = 100 ^a As = 100 ^b
BH210	0.05-0.15	As	190	
BH212	0-0.1	As	390	
BH213	0-0.1	As	460	
BH214	0-0.1	As	400	
BH215	0.3-0.35	As	160	

Notes:

a : Health-based Investigation Level (HIL) A - Residential A for arsenic

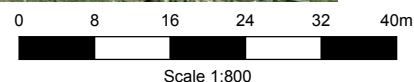
b : Ecological Investigation Level (EIL) for arsenic - urban residential land use

AREA	MATERIAL	ESTIMATED SIZE (m)	ESTIMATED THICKNESS	ESTIMATED VOLUME (cu. m)	CONTAMINANT	REMEDICATION METHOD
1	Silty clay or shale	16 x 16	Ranging from about 0.15m to 0.2m	45	arsenic	Excavation & Landfill Disposal

LEGEND

- Borehole
- Area to be Remediated

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Canberra Investment Corporation
Googong Dam Road
Googong

Locations of Contamination &
Area 1 to be Remediated

Drawing No: 12675/2-AA6
Job No: 12675/2
Drawn By: MH
Date: 15 May 2014
Checked By: JX

File No: 12675-2
Layers: 0, AA6



LEGEND

● Area of Environmental Concern (AEC)

— Site Boundary

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0120240360480600m

Scale 1:12,000

Point ID	Easting	Northing
1	701225.659	6076576.506
2	701223.948	6076490.707
3	701177.149	6076244.974
4	701163.286	6076171.491
5	701162.156	6076133.073
6	701641.984	6076042.501
7	701724.175	6076486.377
9	702225.503	6076448.770
10	702190.518	6076367.457
11	702127.117	6076230.411
12	702045.391	6076080.787
13	701992.754	6075976.982
15	702136.159	6075950.196
17	702134.322	6075940.303
19	703156.359	6075753.410
21	703342.651	6075858.858
23	703399.171	6076124.155
25	703574.316	6076264.646
27	703947.510	6076624.315
29	704137.203	6076499.161
31	704303.398	6076525.503
32	702760.737	6076998.212
33	704419.167	6076741.698
34	703098.396	6077691.518
35	704424.115	6076750.937
36	702893.977	6076948.111
37	704388.870	6076981.752
38	702911.477	6076937.216
39	704378.932	6076978.724
41	704293.883	6076944.257
43	704238.157	6076922.375
45	704220.810	6076893.101
47	704203.794	6076886.595
49	704178.986	6076886.638
51	704110.214	6076895.398
53	704079.320	6076905.508
55	704056.388	6076922.077
57	704025.032	6076961.272
59	704005.293	6076976.951
61	703994.205	6077010.634
63	703980.322	6077022.534
65	703974.371	6077043.359
67	703960.488	6077053.771
69	703953.216	6077065.977
71	703926.997	6077084.705
73	703927.050	6077101.606
75	703923.255	6077115.912
77	703912.015	6077125.907
79	703904.523	6077144.635
81	703876.692	6077161.368

Point ID	Easting	Northing
83	703867.766	6077178.722
85	703842.321	6077185.233
87	703823.125	6077187.206
89	703798.253	6077185.737
91	703773.664	6077178.973
93	703756.728	6077170.470
95	703731.201	6077148.470
97	703722.014	6077138.379
109	702761.667	6077003.290
111	702748.977	6077009.154
113	702683.796	6077060.512
115	702634.430	6077022.881
117	702579.080	6076887.535
119	702556.042	6076834.029
121	702530.383	6076796.428
123	702331.417	6076594.044
125	702238.580	6076471.408
128	702774.956	6076991.641
129	702774.956	6076991.641
130	702893.977	6076948.111
131	702983.977	6076937.216
132	702911.509	6076916.849
310	703001.571	6076897.807
311	703112.771	6076894.926
312	70321.776	6076897.688
313	703269.087	6076892.586
314	703335.518	6076849.271
315	703366.808	6076889.243
316	703384.167	6076883.436
317	703709.786	6077142.407
318	703724.766	6077284.998
319	703713.497	6077264.715
320	703699.244	6077154.040
321	703698.515	6077148.381
322	703687.403	6077148.112
323	703679.884	6077071.521
324	703640.971	6076997.549
325	703633.678	6076990.695
326	703617.678	6076975.585
327	703589.031	6076948.249
328	703560.204	6076929.566
329	703549.337	6076919.711
330	703539.434	6076914.502
331	703521.974	6076911.886
332	703479.519	6076895.961
333	703450.236	6076884.406
334	703434.298	6076882.131
335	703418.301	6076882.676
336	703401.880	6076883.255
337	703384.167	6076883.436



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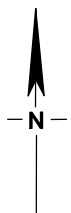
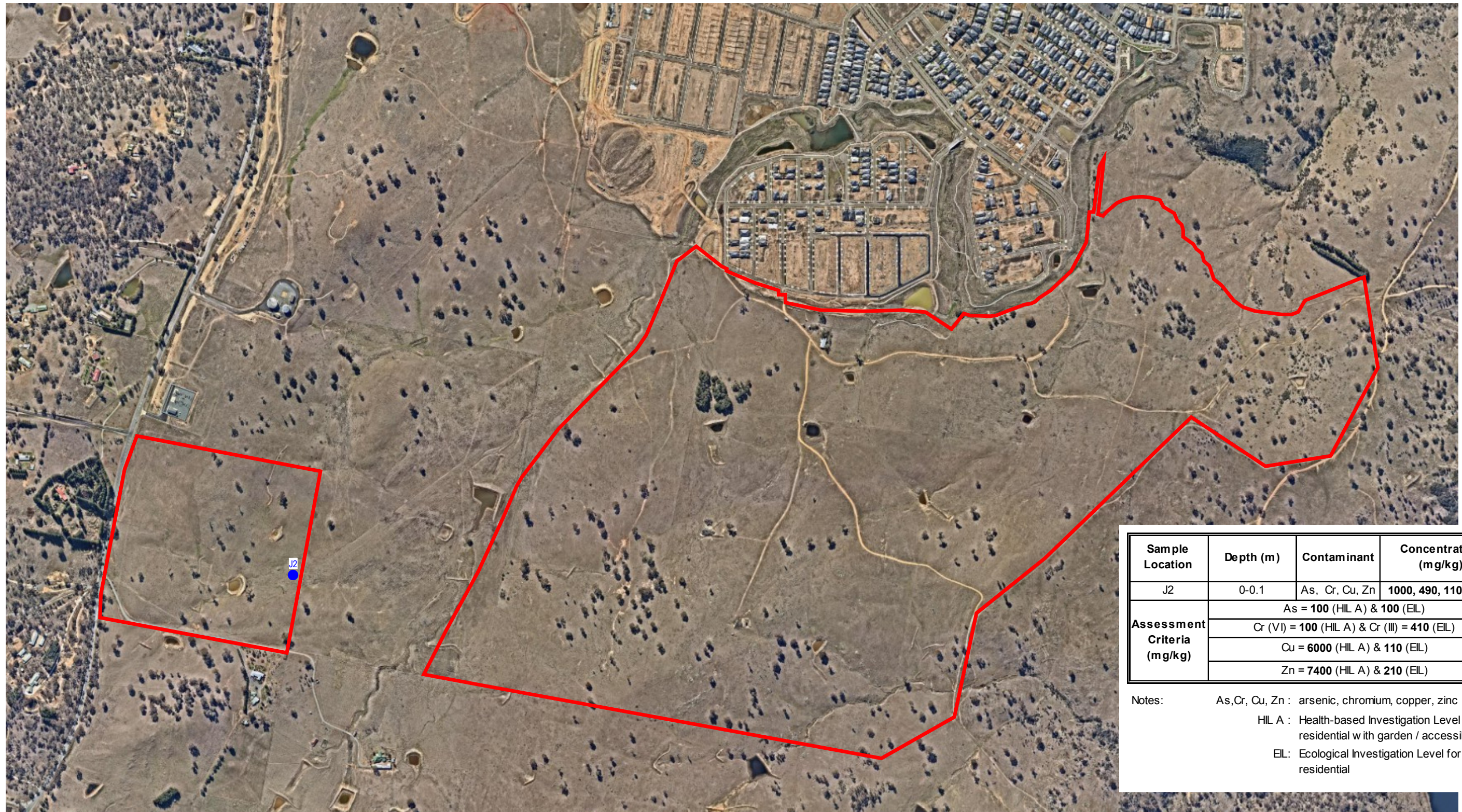
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Googong Neighbourhoods 3, 4 & 5

Site & Lot Layout and Areas of Environmental Concern

Drawing No: 14328/1-AA1
Job No: 14328/1
Drawn By: MH
Date: 25 June 2019
Checked By: JX

File No: 14328-1
Layers: 0, AA1



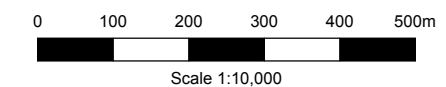
Sample Location	Depth (m)	Contaminant	Concentration (mg/kg)
J2	0-0.1	As, Cr, Cu, Zn	1000, 490, 1100, 790
Assessment Criteria (mg/kg)	As = 100 (HIL A) & 100 (EIL)		
	Cr (VI) = 100 (HIL A) & Cr (III) = 410 (EIL)		
	Cu = 6000 (HIL A) & 110 (EIL)		
	Zn = 7400 (HIL A) & 210 (EIL)		

Notes: As,Cr, Cu, Zn : arsenic, chromium, copper, zinc
HIL A : Health-based Investigation Level for residential with garden / accessible soil
EIL: Ecological Investigation Level for urban residential

LEGEND

- Sample
- Site Boundary

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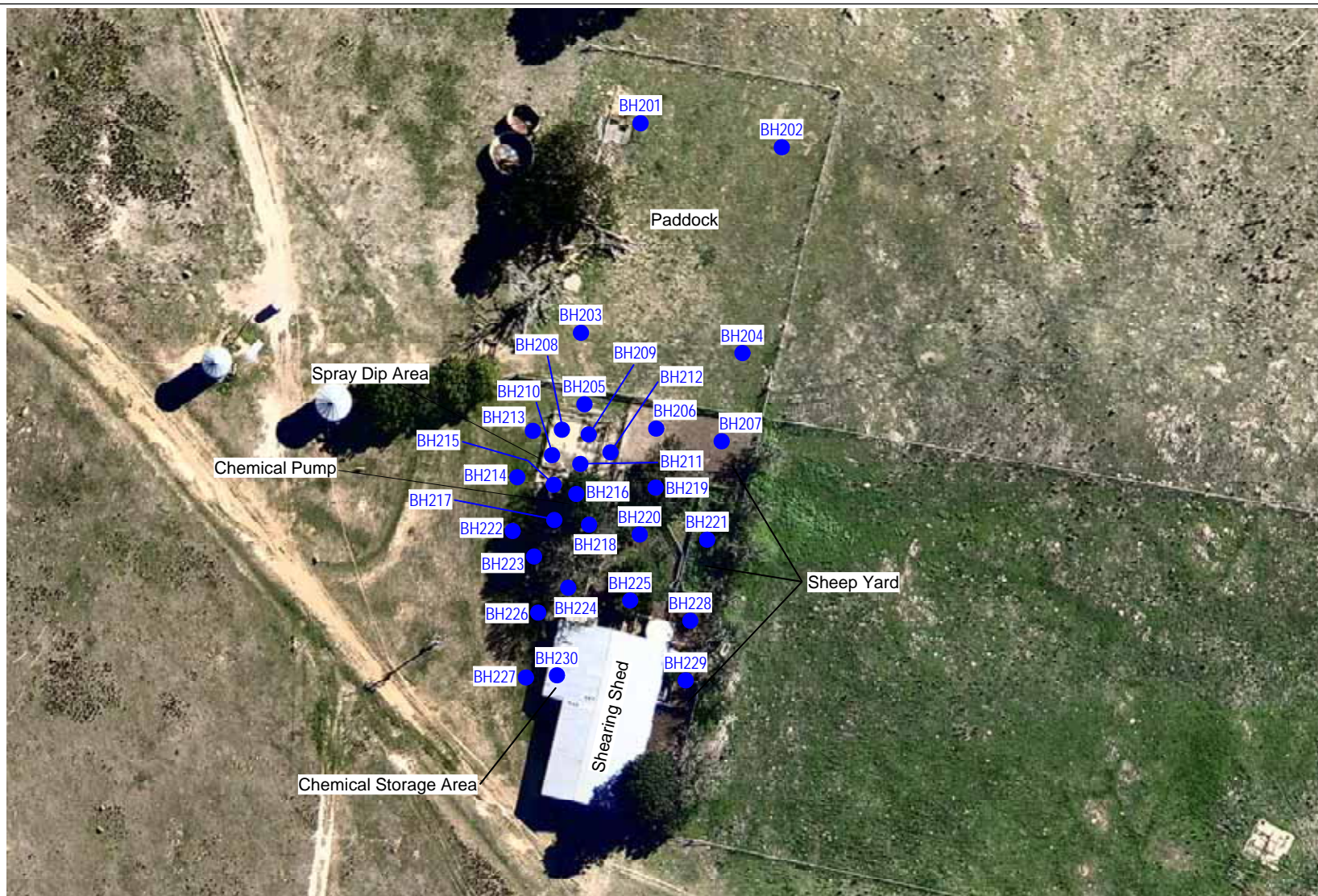
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Googong Neighbourhoods 3, 4 & 5

Locations of Contamination

Drawing No: 14328/1-AA4
Job No: 14328/1
Drawn By: MH
Date: 25 June 2019
Checked By: JX

File No: 14328-1
Layers: 0, AA3



LEGEND

● Borehole

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0 8 16 24 32 40m
Scale 1:800



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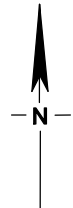
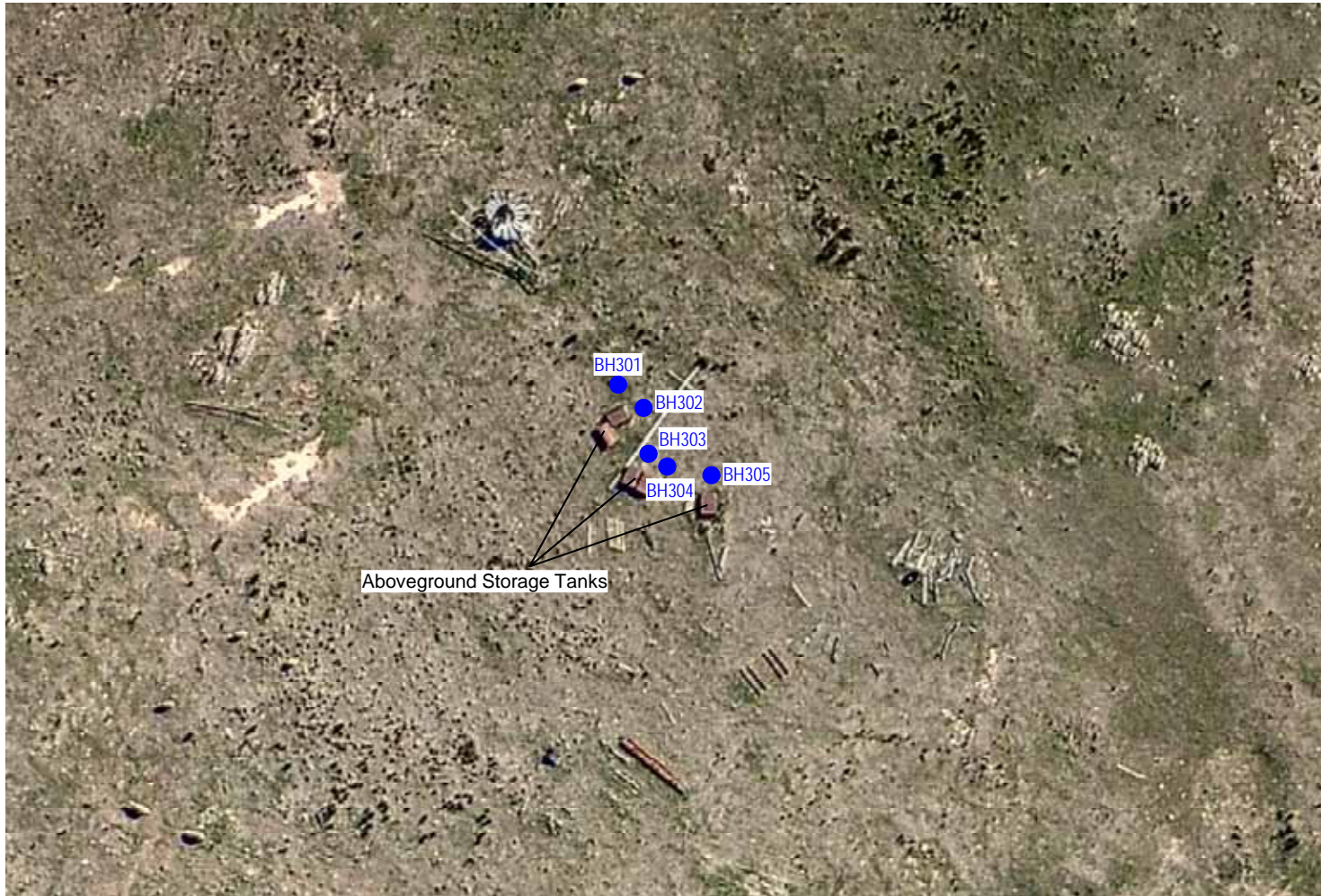
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Googong Dam Road
Googong

Site Features & Borehole Locations - AEC5

Drawing No: 12675/2-AA2
Job No: 12675/2
Drawn By: MH/LY
Date: 22 April 2014
Checked By: JX

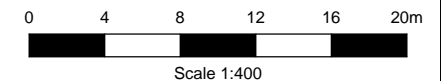
File No: 12675-2
Layers: 0, AA2



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LEGEND

● Borehole



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Googong Dam Road
Googong

Site Features & Borehole Locations - AEC6

Drawing No: 12675/2-AA3
Job No: 12675/2
Drawn By: MH/LY
Date: 22 April 2014
Checked By: JX

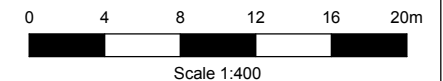
File No: 12675-2
Layers: 0, AA3



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LEGEND

● Borehole



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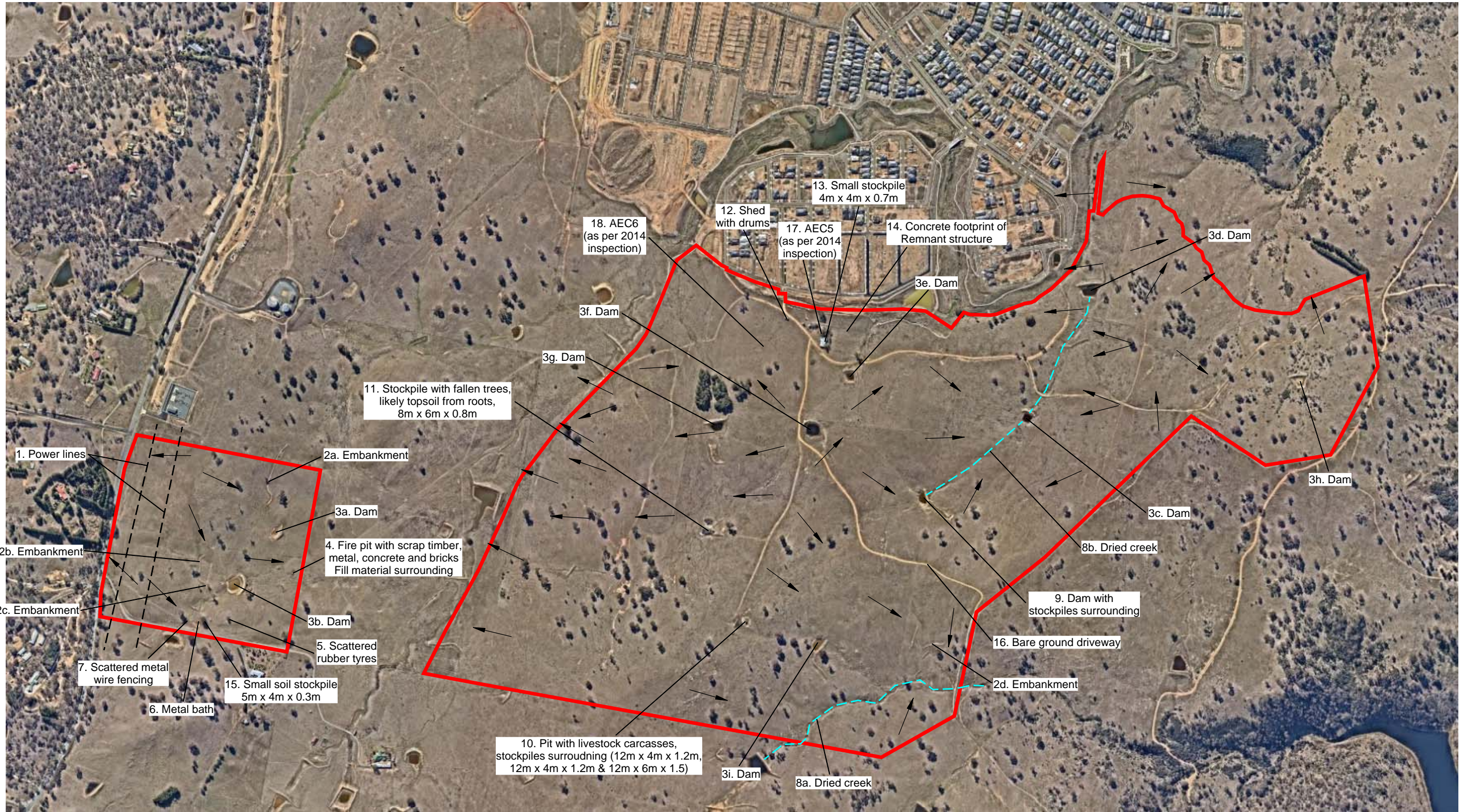
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Canberra Investment Corporation
Googong Dam Road
Googong

Site Features & Borehole Locations
Shed with Drums

Drawing No: 12675/2-AA5
Job No: 12675/2
Drawn By: MH/LY
Date: 22 April 2014
Checked By: JX

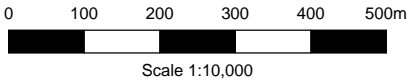
File No: 12675-2
Layers: 0, AA5



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LEGEND

- > Slope
- Site Boundary



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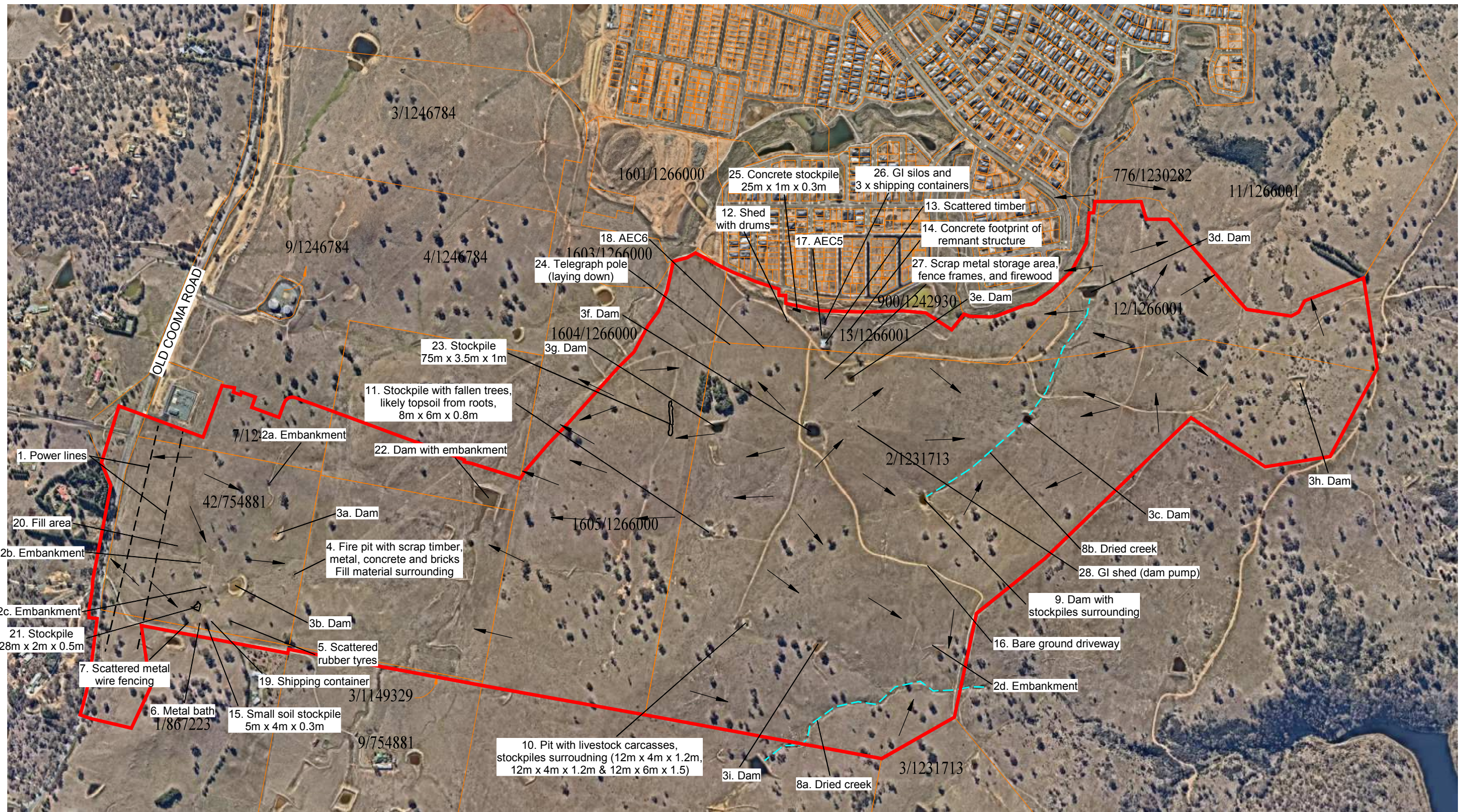
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Googong Neighbourhoods 3, 4 & 5

Site Features

Drawing No: 14328/1-AA2
Job No: 14328/1
Drawn By: MH
Date: 11 June 2019
Checked By: JX

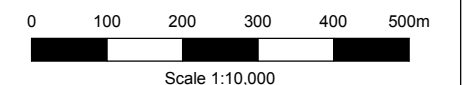
File No: 14328-1
Layers: 0, AA1



LEGEND

- Slope
- Site Boundary

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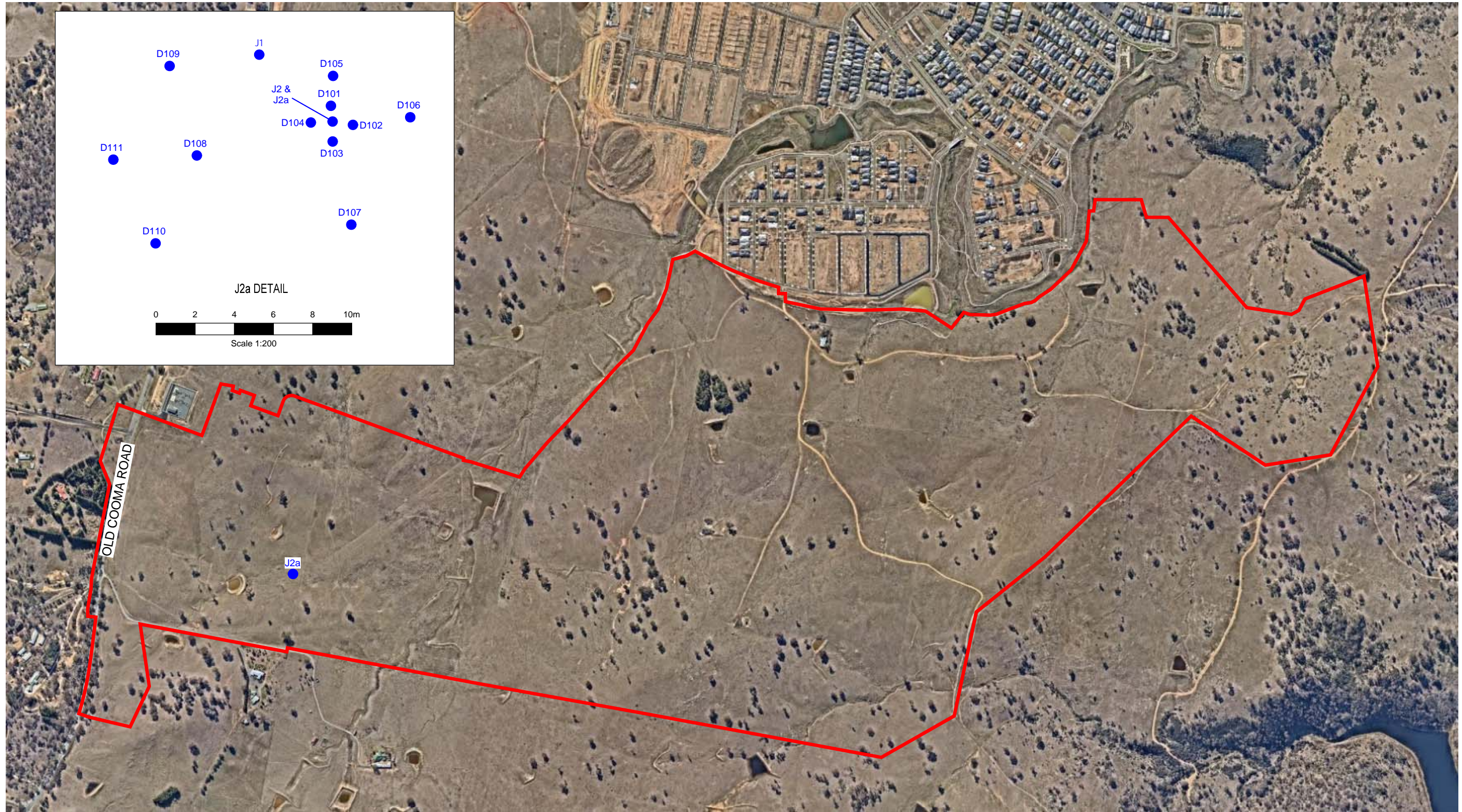
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Googong Neighbourhoods 3, 4 & 5
Old Cooma Road, Googong

Site Features

Drawing No: 14328/2-AA2
Job No: 14328/2
Drawn By: MH
Date: 16 June 2021
Checked By: JH/XZ/JX

File No: 14328-2
Layers: 0, AA1



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LEGEND

- Sample
- Site Boundary

0 100 200 300 400 500m
Scale 1:10,000



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Googong Neighbourhoods 3, 4 & 5
Old Cooma Road, Googong

Sample Locations

Drawing No: 14328/2-AA3
Job No: 14328/2
Drawn By: MH
Date: 9 July 2021
Checked By: JH/XZ/JX

File No: 14328-2
Layers: 0, AA3

File No: 14328-2
Layers: 0, AA4

LABORATORY TEST RESULTS SUMMARY TABLES

<i>Table A</i>	<i>Rinsate</i>
<i>Table B</i>	<i>Duplicate Sample</i>
<i>Table C</i>	<i>Split Sample</i>
<i>Table D</i>	<i>Metals, Cation Exchange Capacity (CEC) & pH Test Results Test Results – Discrete Samples</i>

TABLE A
RINSATE
(Ref No: 14328/2)

SAMPLE DATE		R101 23/02/2021
METAL		(mg/L)
Arsenic		<0.02
Chromium		<0.005
Copper		<0.005
Zinc		<0.01

TABLE B
DUPLICATE SAMPLE
(Ref No: 14328/2)

ANALYTE	D101 0.0-0.1 (m) mg/kg	DDS101 mg/kg	RELATIVE PERCENTAGE DIFFERENCES (RPD) %
Arsenic	520	350	39
Chromium	170	140	19
Copper	430	350	21
Zinc	550	510	8

TABLE C
SPLIT SAMPLE
(Ref No: 14328/2)

ANALYTE	D103 0.0-0.1 (m) mg/kg (SGS)	DSS101 mg/kg (ENVIROLAB)	RELATIVE PERCENTAGE DIFFERENCES (RPD) %
Arsenic	130	150	14
Chromium	64	85	28
Copper	110	170	43
Zinc	450	260	54

TABLE D
METAL, CATION EXCHANGE CAPACITY (CEC) & pH TEST RESULTS
DISCRETE SAMPLES
(Ref No: 14328/2)

		METAL (mg/kg)				CEC (cmol _c /kg)	pH
		ARSENIC	CHROMIUM (Total)	COPPER	ZINC		
Sample Location	Depth (m)						
J1	0.0-0.1	17	13	31	120	17	6.2
J2	0.0-0.1	290	140	310	300	-	-
J2	0.0-0.1	-	<0.5 ^c	-	-	-	-
J2a	0.35-0.45	7	14	11	30	9.8	6.4
D101	0.0-0.1	520	170	430	550	33	7.2
D101	0.45-0.55	24	21	16	43	-	-
D102	0.0-0.1	1800	620	1800	3600	-	-
D103	0.0-0.1	130	64	110	450	-	-
D103	0.45-0.55	750	200	8700	680	23	7.2
D104	0.0-0.1	1000	280	520	710	34	7
D105	0.0-0.1	42	27	39	55	-	-
D106	0.0-0.1	6	21	14	33	7.9	7.2
D107	0.0-0.1	5	16	10	32	-	-
D108	0.0-0.1	630	150	360	3800	31	6.9
D109	0.0-0.1	46	28	32	50	14	5.9
D110	0.0-0.1	27	24	21	120	16	6.7
D111	0.0-0.1	5	14	9.3	37	-	-
SGS Lab Duplicate LB175907.023 = DDS6=J2 (0.0-0.1)		1000	490	1100	790	-	-
Limit of Reporting (LOR)		1	0.5	0.5	2	0.02	0.1
NATIONAL ENVIRONMENT PROTECTION AMENDMENT MEASURE (2013)							
Health-based Investigation Levels (HIL) ^a A - Residential A		100	100 ^c	6000	7400		
Ecological Investigation Levels (EIL) ^b - Urban residential		100 ^e	410 ^f	230	770		

- Notes:
- a: Residential with garden / accessible soil (home grown produce <10% fruit and vegetable intake (no poultry)), also includes childcare centres, preschools and primary schools.
 - b: EIL of aged chromium (III), copper, nickel & zinc were derived from calculation spreadsheet developed by CSIRO for NEPC; Old Suburb with Low Traffic; the average CEC=20.6 cmol_c/kg & pH=6.7; the assumed clay content=10 % were selected for derivation of EIL.
 - c: Chromium (VI)
 - d: Methyl Mercury
 - e: Generic EIL for aged arsenic
 - f: Chromium (III)
 - g: Generic added contaminant limit for aged lead + ambient background concentration; Old Suburb with Low Traffic.

APPENDIX A

TABLE 1 – TEST PIT LOGS

Project	Neighbourhood (NH) 3, NH 4 & NH 5	Job No	14328/2
Location	Old Cooma Road, Googong	Refer to Drawing No	14328/2-AA3
		Logged & Sampled by	JH

TABLE 1

Page 1 of 2

Test Pit / Sample	Depth (m)	Sample Depth (m)	Date	Material Description	Remarks*
J2a	0-0.3	0-0.1	23/2/2021	Fill: Silty Clay, low plasticity, dark grey with charcoal/ ash material with weathered plywood fragments and metal fragments	
	0.3-0.5	0.35-0.45		(Cl) Silty CLAY, medium plasticity, orange	
D101	0-0.4	0-0.1	23/2/2021	Fill: Silty Clay, low plasticity, dark grey with charcoal/ ash material with weathered plywood fragments and metal fragments	
	0.4-0.6	0.45-0.55		(Cl) Silty CLAY, medium plasticity, orange	
D102	0-0.3	0-0.1	23/2/2021	Fill: Silty Clay, low plasticity, dark grey with charcoal/ ash material	
	0.3-0.5	NS		(Cl) Silty CLAY, medium plasticity, orange	
D103	0-0.4	0-0.1	23/2/2021	Fill: Silty Clay, low plasticity, dark grey with charcoal/ ash material with weathered plywood fragments and metal fragments	
	0.4-0.6	0.45-0.55		(Cl) Silty CLAY, medium plasticity, orange	
D104	0-0.3	0-0.1	23/2/2021	Fill: Silty Clay, low plasticity, dark grey with charcoal/ ash material	
	0.3-0.5	NS		(Cl) Silty CLAY, medium plasticity, orange	
D105	0-0.2	0-0.1	23/2/2021	Topsoil: Silty Clay, low plasticity, brown, trace of root fibres	
	0.2			Termination due to refusal	
D106	0-0.2	0-0.1	23/2/2021	Topsoil: Silty Clay, low plasticity, brown, trace of root fibres	
	0.2			Termination due to refusal	
D107	0-0.2	0-0.1	23/2/2021	Topsoil: Silty Clay, low plasticity, brown, trace of root fibres	
	0.2			Termination due to refusal	

NS = No Sample

*Odour (O), Discolouration (D), Petroleum Hydrocarbon Staining (PHS), Asbestos Containing Material (ACM), Ash Material (ASHM), Demolition Waste (DW), Groundwater (GW), Perched Water (PW) PID reading etc.

Project	Neighbourhood (NH) 3, NH 4 & NH 5	Job No	14328/2
Location	Old Cooma Road, Googong	Refer to Drawing No	14328/2-AA3
		Logged & Sampled by	JH

TABLE 1

Page 2 of 2

Test Pit / Sample	Depth (m)	Sample Depth (m)	Date	Material Description	Remarks*
D108	0-0.3	0-0.1	23/2/2021	Fill: Silty Clay, low plasticity, dark grey with charcoal/ ash material with weathered plywood fragments and metal fragments	
	0.3-0.5	NS		(Cl) Silty CLAY, medium plasticity, orange	
D109	0-0.2	0-0.1	23/2/2021	Topsoil: Silty Clay, low plasticity, brown, trace of root fibres	
	0.2			Termination due to refusal	
D110	0-0.2	0-0.1	23/2/2021	Topsoil: Silty Clay, low plasticity, brown, trace of root fibres	
	0.2			Termination due to refusal	
D111	0-0.2	0-0.1	23/2/2021	Topsoil: Silty Clay, low plasticity, brown, trace of root fibres	
	0.2			Termination due to refusal	

NS = No Sample

*Odour (O), Discolouration (D), Petroleum Hydrocarbon Staining (PHS), Asbestos Containing Material (ACM), Ash Material (ASHM), Demolition Waste (DW), Groundwater (GW), Perched Water (PW) PID reading etc.

APPENDIX B

**SGS ENVIRONMENTAL SERVICES ANALYTICAL REPORTS
AND
ENVIROLAB SERVICES CERTIFICATE OF ANALYSIS**

CLIENT DETAILS

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Project 14328/2 Googong
Order Number (Not specified)
Samples 17

LABORATORY DETAILS

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SGS Reference SE216927 R0
Date Received 25/2/2021
Date Reported 3/3/2021

COMMENTS

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

SIGNATORIES



Bennet LO
 Senior Organic Chemist/Metals Chemist



Dong LIANG
 Metals/Inorganics Team Leader



Kamrul AHSAN
 Senior Chemist



Shane MCDERMOTT
 Inorganic/Metals Chemist

pH in soil (1:5) [AN101] Tested: 2/3/2021

			D101	D104
			CLAY	CLAY
			0.0-0.1	0.0-0.1
			23/2/2021	23/2/2021
			SE216927.003	SE216927.008
PARAMETER	UOM	LOR		
pH	pH Units	0.1	7.2	7.0

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 3/3/2021

PARAMETER	UOM	LOR	D101	D104
			CLAY 0.0-0.1 23/2/2021 SE216927.003	CLAY 0.0-0.1 23/2/2021 SE216927.008
Exchangeable Sodium, Na	mg/kg	2	48	47
Exchangeable Sodium, Na	meq/100g	0.01	0.21	0.21
Exchangeable Sodium Percentage*	%	0.1	0.6	0.6
Exchangeable Potassium, K	mg/kg	2	420	470
Exchangeable Potassium, K	meq/100g	0.01	1.1	1.2
Exchangeable Potassium Percentage*	%	0.1	3.3	3.6
Exchangeable Calcium, Ca	mg/kg	2	5800	6100
Exchangeable Calcium, Ca	meq/100g	0.01	29	31
Exchangeable Calcium Percentage*	%	0.1	88.5	90.9
Exchangeable Magnesium, Mg	mg/kg	2	300	200
Exchangeable Magnesium, Mg	meq/100g	0.02	2.5	1.7
Exchangeable Magnesium Percentage*	%	0.1	7.5	4.9
Cation Exchange Capacity	meq/100g	0.02	33	34

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 2/3/2021

PARAMETER	UOM	LOR	J2a	D101	D102	D103	D104
			CLAY 0.35-0.45 23/2/2021 SE216927.002	CLAY 0.0-0.1 23/2/2021 SE216927.003	CLAY 0.0-0.1 23/2/2021 SE216927.005	CLAY 0.0-0.1 23/2/2021 SE216927.006	CLAY 0.0-0.1 23/2/2021 SE216927.008
Arsenic, As	mg/kg	1	7	520	1800	130	1000
Chromium, Cr	mg/kg	0.5	14	170	620	64	280
Copper, Cu	mg/kg	0.5	11	430	1800	110	520
Zinc, Zn	mg/kg	2	30	550	3600	450	710

PARAMETER	UOM	LOR	DDS101
			CLAY - 23/2/2021 SE216927.016
Arsenic, As	mg/kg	1	350
Chromium, Cr	mg/kg	0.5	140
Copper, Cu	mg/kg	0.5	350
Zinc, Zn	mg/kg	2	510

Moisture Content [AN002] Tested: 1/3/2021

			J2a	D101	D102	D103	D104
			CLAY	CLAY	CLAY	CLAY	CLAY
			0.35-0.45	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1
			23/2/2021	23/2/2021	23/2/2021	23/2/2021	23/2/2021
PARAMETER	UOM	LOR	SE216927.002	SE216927.003	SE216927.005	SE216927.006	SE216927.008
% Moisture	%w/w	1	18.6	30.7	43.8	23.5	38.4

			DDS101
			CLAY
			-
			23/2/2021
PARAMETER	UOM	LOR	SE216927.016
% Moisture	%w/w	1	29.7

TCLP (Toxicity Characteristic Leaching Procedure) for Metals [AN006] Tested: 26/2/2021

			J2a
			CLAY
			0.0-0.1
			23/2/2021
			SE216927.001
PARAMETER	UOM	LOR	
pH 1:20	pH Units	-	6.6
pH 1:20 plus HCL	pH Units	-	2.5
Extraction Solution Used	No unit	-	1
Mass of Sample Used*	g	-	13
Volume of ExtractionSolution Used*	mL	-	250
pH TCLP after 18 hours	pH Units	-	5.1



ANALYTICAL RESULTS

SE216927 R0

Metals in TCLP Extract by ICPOES [AN320] Tested: 3/3/2021

			J2a
			CLAY
			0.0-0.1
			23/2/2021
PARAMETER	UOM	LOR	SE216927.001
Arsenic, As	mg/L	0.02	0.16
Chromium, Cr	mg/L	0.005	0.007

Metals in Water (Dissolved) by ICPOES [AN320] Tested: 26/2/2021

			R101
			WATER
			-
			23/2/2021
PARAMETER	UOM	LOR	SE216927.017
Arsenic, As	mg/L	0.02	<0.02
Chromium, Cr	mg/L	0.005	<0.005
Copper, Cu	mg/L	0.005	<0.005
Zinc, Zn	mg/L	0.01	<0.01

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.

AN006

Contaminants of interest in a waste material are leached out of the waste with a selected leaching solution under controlled conditions. The ratio of sample to extraction fluid is 100g to 2L (1 to 20 by mass). The concentration of each contaminant of interest is determined in the leachate by appropriate methods after separation from the sample by filtering. Base on USEPA 1311.

AN006

Extraction Fluid #1: This fluid is made by combining 128.6mL of dilute sodium hydroxide solution and 11.5mL glacial acetic acid with water and diluting to a volume of 2 litres. The pH of this fluid should be 4.93 ± 0.05 .

AN006

Extraction Fluid #2: This fluid is made by diluting 5.7mL glacial acetic acid with water to a volume of 1 litre. The pH of this fluid should be 2.88 ± 0.05 .

AN020

Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.

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.

AN101

pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl₂) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.

AN122

Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.

AN122

The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100.
ESP can be used to categorise the sodicity of the soil as below:

ESP < 6%	non-sodic
ESP 6-15%	sodic
ESP >15%	strongly sodic

Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-

AN320

Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.

AN320

Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

FOOTNOTES

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

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

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

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

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

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

Note that in terms of units of radioactivity:

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

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

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

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STATEMENT OF QA/QC PERFORMANCE

SE216927 R0

CLIENT DETAILS

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Project **14328/2 Googong**
Order Number (Not specified)
Samples 17

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SGS Reference **SE216927 R0**
Date Received 25 Feb 2021
Date Reported 03 Mar 2021

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 (within the SGS Alexandria Environmental laboratory).

SAMPLE SUMMARY

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 sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D101	SE216927.003	LB219813	23 Feb 2021	25 Feb 2021	23 Mar 2021	03 Mar 2021	23 Mar 2021	03 Mar 2021
D104	SE216927.008	LB219813	23 Feb 2021	25 Feb 2021	23 Mar 2021	03 Mar 2021	23 Mar 2021	03 Mar 2021

Metals in TCLP Extract by ICPOES

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
J2a	SE216927.001	LB219797	23 Feb 2021	25 Feb 2021	22 Aug 2021	03 Mar 2021	22 Aug 2021	03 Mar 2021

Metals in Water (Dissolved) by ICPOES

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
R101	SE216927.017	LB219475	23 Feb 2021	25 Feb 2021	22 Aug 2021	26 Feb 2021	22 Aug 2021	26 Feb 2021

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
J2a	SE216927.002	LB219642	23 Feb 2021	25 Feb 2021	09 Mar 2021	01 Mar 2021	06 Mar 2021	03 Mar 2021
D101	SE216927.003	LB219642	23 Feb 2021	25 Feb 2021	09 Mar 2021	01 Mar 2021	06 Mar 2021	03 Mar 2021
D102	SE216927.005	LB219642	23 Feb 2021	25 Feb 2021	09 Mar 2021	01 Mar 2021	06 Mar 2021	03 Mar 2021
D103	SE216927.006	LB219642	23 Feb 2021	25 Feb 2021	09 Mar 2021	01 Mar 2021	06 Mar 2021	03 Mar 2021
D104	SE216927.008	LB219642	23 Feb 2021	25 Feb 2021	09 Mar 2021	01 Mar 2021	06 Mar 2021	03 Mar 2021
DDS101	SE216927.016	LB219642	23 Feb 2021	25 Feb 2021	09 Mar 2021	01 Mar 2021	06 Mar 2021	03 Mar 2021

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D101	SE216927.003	LB219735	23 Feb 2021	25 Feb 2021	02 Mar 2021	02 Mar 2021	03 Mar 2021	02 Mar 2021
D104	SE216927.008	LB219735	23 Feb 2021	25 Feb 2021	02 Mar 2021	02 Mar 2021	03 Mar 2021	02 Mar 2021

TCLP (Toxicity Characteristic Leaching Procedure) for Metals

Method: ME-(AU)-[ENV]AN006

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
J2a	SE216927.001	LB219514	23 Feb 2021	25 Feb 2021	22 Aug 2021	26 Feb 2021	22 Aug 2021	03 Mar 2021

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
J2a	SE216927.002	LB219762	23 Feb 2021	25 Feb 2021	22 Aug 2021	02 Mar 2021	22 Aug 2021	03 Mar 2021
D101	SE216927.003	LB219762	23 Feb 2021	25 Feb 2021	22 Aug 2021	02 Mar 2021	22 Aug 2021	03 Mar 2021
D102	SE216927.005	LB219762	23 Feb 2021	25 Feb 2021	22 Aug 2021	02 Mar 2021	22 Aug 2021	03 Mar 2021
D103	SE216927.006	LB219762	23 Feb 2021	25 Feb 2021	22 Aug 2021	02 Mar 2021	22 Aug 2021	03 Mar 2021
D104	SE216927.008	LB219762	23 Feb 2021	25 Feb 2021	22 Aug 2021	02 Mar 2021	22 Aug 2021	03 Mar 2021
DDS101	SE216927.016	LB219762	23 Feb 2021	25 Feb 2021	22 Aug 2021	02 Mar 2021	22 Aug 2021	03 Mar 2021

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

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

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.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result
LB219813.001	Exchangeable Sodium, Na	mg/kg	2	0
	Exchangeable Potassium, K	mg/kg	2	0
	Exchangeable Calcium, Ca	mg/kg	2	0
	Exchangeable Magnesium, Mg	mg/kg	2	0

Metals in TCLP Extract by ICPOES

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

Sample Number	Parameter	Units	LOR	Result
LB219797.001	Arsenic, As	mg/L	0.02	<0.02
	Chromium, Cr	mg/L	0.005	<0.005

Metals in Water (Dissolved) by ICPOES

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

Sample Number	Parameter	Units	LOR	Result
LB219475.001	Arsenic, As	mg/L	0.02	<0.02
	Chromium, Cr	mg/L	0.005	<0.005
	Copper, Cu	mg/L	0.005	<0.005
	Zinc, Zn	mg/L	0.01	<0.01

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

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

Sample Number	Parameter	Units	LOR	Result
LB219762.001	Arsenic, As	mg/kg	1	<1
	Chromium, Cr	mg/kg	0.5	<0.5
	Copper, Cu	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	2	<2

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

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

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

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

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

Metals in Water (Dissolved) by ICPOES

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE216927.017	LB219475.007	Arsenic, As	mg/L	0.02	<0.02	<0.02	200	0
		Chromium, Cr	mg/L	0.005	<0.005	<0.005	200	0
		Copper, Cu	mg/L	0.005	<0.005	<0.005	200	0
		Zinc, Zn	mg/L	0.01	<0.01	<0.01	200	0

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE216986.001	LB219642.011	% Moisture	%w/w	1	4.3	5.5	50	25
SE216989.001	LB219642.019	% Moisture	%w/w	1	31.9	33.2	33	4

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 %
SE216927.006	LB219762.014	Arsenic, As	mg/kg	1	130	150	31	18
		Chromium, Cr	mg/kg	0.5	64	79	31	21
		Copper, Cu	mg/kg	0.5	110	130	30	18
		Zinc, Zn	mg/kg	2	450	360	30	22
SE217009.011	LB219762.024	Arsenic, As	mg/kg	1	6	5	49	21
		Chromium, Cr	mg/kg	0.5	9.0	7.3	36	21
		Copper, Cu	mg/kg	0.5	23	19	32	21
		Zinc, Zn	mg/kg	2	45	38	35	17

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.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB219813.002	Exchangeable Sodium, Na	meq/100g	0.01	0.21	0.194	80 - 120	107
	Exchangeable Potassium, K	meq/100g	0.01	0.72	0.63	80 - 120	115
	Exchangeable Calcium, Ca	meq/100g	0.01	6.5	6.3	80 - 120	104
	Exchangeable Magnesium, Mg	meq/100g	0.02	1.1	1.11	80 - 120	102

Metals in TCLP Extract by ICPOES

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB219797.002	Arsenic, As	mg/L	0.02	0.50	0.5	80 - 120	101
	Chromium, Cr	mg/L	0.005	0.51	0.5	80 - 120	102

Metals in Water (Dissolved) by ICPOES

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB219475.002	Arsenic, As	mg/L	0.02	0.52	0.5	80 - 120	104
	Chromium, Cr	mg/L	0.005	0.51	0.5	80 - 120	101
	Copper, Cu	mg/L	0.005	0.52	0.5	80 - 120	103
	Zinc, Zn	mg/L	0.01	0.50	0.5	80 - 120	101

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB219735.003	pH	pH Units	0.1	7.4	7.415	98 - 102	99

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 %
LB219762.002	Arsenic, As	mg/kg	1	330	318.22	80 - 120	103
	Chromium, Cr	mg/kg	0.5	36	38.31	80 - 120	94
	Copper, Cu	mg/kg	0.5	300	290	80 - 120	102
	Zinc, Zn	mg/kg	2	270	273	80 - 120	98

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

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

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%
SE216922.020	LB219762.004	Arsenic, As	mg/kg	1	51	5.73855582524	50	90
		Chromium, Cr	mg/kg	0.5	58	12.63087985436	50	90
		Copper, Cu	mg/kg	0.5	70	25.55630764563	50	88
		Zinc, Zn	mg/kg	2	70	27.34264563106	50	85

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

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

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

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

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

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.

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1 LEMKO PLACE PENRITH NSW 2750

CHAIN OF CUSTODY

Results Required By: **Normal Turnaround 4 days**
Except pH Results Required By -

Date: **Wednesday, 3 March 2021**

Date:

Your Reference No.:

TO: SGS UNIT 16, 33 MADDOX STREET ALEXANDRIA NSW 2015								Sampled By: JH														Ref No: 14328/2				Project Manager: JOHN XU			
								Location: Googong																					
Location	Depth (m)	Date	Soil	Water	Material	Metals As Cd Cr Cu Pb Hg Ni Zn	pH	CEC	CL8 TRH BTEX PAH	CL10 Metals* TRH BTEX PAH	CL16 Metals* TRH BTEX PAH OC PCB	As Cr Cu Zn	TCLP for As Cr	Asbestos 0.001% w/w	Asbestos	BTEX	TRH & BTEX	PAH	OCF	OCF & PCB	Phenol	Cyanide	VOC	OCF OPP & PCB					
1 J2a	0.0-0.1	23/02/2021	G		Clay								✓																
2 J2a	0.35-0.45	23/02/2021	G		Clay							✓																	
3 D101	0.0-0.1	23/02/2021	G		Clay		✓	✓				✓																	
4 D101	0.45-0.55	23/02/2021	G		Clay																								
5 D102	0.0-0.1	23/02/2021	G		Clay							✓																	
6 D103	0.0-0.1	23/02/2021	G		Clay							✓																	
7 D103	0.45-0.55	23/02/2021	G		Clay																								
8 D104	0.0-0.1	23/02/2021	G		Clay		✓	✓				✓																	
9 D105	0.0-0.1	23/02/2021	G		Clay																								
10 D106	0.0-0.1	23/02/2021	G		Clay																								
11 D107	0.0-0.1	23/02/2021	G		Clay																								
12 D108	0.0-0.1	23/02/2021	G		Clay																								
13 D109	0.0-0.1	23/02/2021	G		Clay																								
14 D110	0.0-0.1	23/02/2021	G		Clay																								
15 D111	0.0-0.1	23/02/2021	G		Clay																								
16 DDS101	-	23/02/2021	G		Clay							✓																	
17 R101	-	23/02/2021		WG								✓																	
Relinquished by								Received by																					
Name		Signature		Date		Name		Signature		Date																			
JOHN XU		JX		25/02/2021		Suba		S. Suba		25/02/21 @ 2.~																			
WG: Water sample (glass bottle)								FCP Fibro Cement Piece (plastic bag)								*: As,Cd,Cr,Cu,Pb,Hg,Ni & Zn (8 metals)													
WP: Water sample (plastic bottle)								✓ Test required																					

SGS EHS Sydney COC
SE216927





SAMPLE RECEIPT ADVICE

SE216927

CLIENT DETAILS

Contact John Xu
Client Geotechnique
Address P.O. Box 880
NSW 2751

Telephone 02 4722 2700
Facsimile 02 4722 6161
Email john.xu@geotech.com.au

Project **14328/2 Googong**
Order Number (Not specified)
Samples 17

LABORATORY DETAILS

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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

Samples Received Thu 25/2/2021
Report Due Wed 3/3/2021
SGS Reference **SE216927**

SUBMISSION DETAILS

This is to confirm that 17 samples were received on Thursday 25/2/2021. Results are expected to be ready by COB Wednesday 3/3/2021. Please quote SGS reference SE216927 when making enquiries. Refer below for details relating to sample integrity upon receipt.

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	7 Clay, 1 Water
Date documentation received	25/2/2021	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	13.3°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

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CLIENT DETAILS

Client **Geotechnique**

Project **14328/2 Googong**

SUMMARY OF ANALYSIS

No.	Sample ID	Exchangeable Cations and Cation Exchange Capacity	Metals in Water (Dissolved) by ICPOES	Moisture Content	pH in soil (1:5)	TCLP (Toxicity Characteristic Leaching	Total Recoverable Elements in Soil/Waste
001	J2a 0.0-0.1	-	-	1	-	6	-
002	J2a 0.35-0.45	-	-	1	-	-	4
003	D101 0.0-0.1	13	-	1	1	-	4
005	D102 0.0-0.1	-	-	1	-	-	4
006	D103 0.0-0.1	-	-	1	-	-	4
008	D104 0.0-0.1	13	-	1	1	-	4
016	DDS101	-	-	1	-	-	4
017	R101	-	4	-	-	-	-

CONTINUED OVERLEAF

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .



SAMPLE RECEIPT ADVICE

SE216927

CLIENT DETAILS

Client **Geotechnique**

Project **14328/2 Googong**

SUMMARY OF ANALYSIS

No.	Sample ID	Metals in TCLP Extract by ICPOES
001	J2a 0.0-0.1	2

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

CLIENT DETAILS

Contact John Xu
Client Geotechnique
Address P.O. Box 880
 NSW 2751

Telephone 02 4722 2700
Facsimile 02 4722 6161
Email john.xu@geotech.com.au
Project **14328/2 Googong - Additional**
Order Number (Not specified)
Samples 17

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 **SE216927A R0**
Date Received 3/3/2021
Date Reported 25/3/2021

COMMENTS

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

SIGNATORIES



Bennet LO
 Senior Organic Chemist/Metals Chemist



Shane MCDERMOTT
 Inorganic/Metals Chemist

pH in soil (1:5) [AN101] Tested: 25/3/2021

			J2a	D103	D106	D108	D109
			CLAY 0.35-0.45 23/2/2021	CLAY 0.45-0.55 23/2/2021	CLAY 0.0-0.1 23/2/2021	CLAY 0.0-0.1 23/2/2021	CLAY 0.0-0.1 23/2/2021
PARAMETER	UOM	LOR	SE216927A.002	SE216927A.007	SE216927A.010	SE216927A.012	SE216927A.013
pH	pH Units	0.1	6.4	7.2	7.2	6.9	5.9

			D110
			CLAY 0.0-0.1 23/2/2021
PARAMETER	UOM	LOR	SE216927A.014
pH	pH Units	0.1	6.7

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 24/3/2021

PARAMETER	UOM	LOR	J2a	D103	D106	D108	D109
			CLAY 0.35-0.45 23/2/2021 SE216927A.002	CLAY 0.45-0.55 23/2/2021 SE216927A.007	CLAY 0.0-0.1 23/2/2021 SE216927A.010	CLAY 0.0-0.1 23/2/2021 SE216927A.012	CLAY 0.0-0.1 23/2/2021 SE216927A.013
Exchangeable Sodium, Na	mg/kg	2	38	45	62	38	17
Exchangeable Sodium, Na	meq/100g	0.01	0.16	0.19	0.27	0.17	0.07
Exchangeable Sodium Percentage*	%	0.1	1.7	0.8	3.4	0.5	0.5
Exchangeable Potassium, K	mg/kg	2	240	480	150	340	400
Exchangeable Potassium, K	meq/100g	0.01	0.62	1.2	0.38	0.86	1.0
Exchangeable Potassium Percentage*	%	0.1	6.3	5.3	4.8	2.8	7.2
Exchangeable Calcium, Ca	mg/kg	2	1300	3600	980	5400	2000
Exchangeable Calcium, Ca	meq/100g	0.01	6.3	18	4.9	27	10
Exchangeable Calcium Percentage*	%	0.1	64.2	77.7	62.3	88.4	71.5
Exchangeable Magnesium, Mg	mg/kg	2	330	450	280	310	360
Exchangeable Magnesium, Mg	meq/100g	0.02	2.7	3.7	2.3	2.5	3.0
Exchangeable Magnesium Percentage*	%	0.1	27.8	16.1	29.5	8.3	20.7
Cation Exchange Capacity	meq/100g	0.02	9.8	23	7.9	31	14

PARAMETER	UOM	LOR	D110
			CLAY 0.0-0.1 23/2/2021 SE216927A.014
Exchangeable Sodium, Na	mg/kg	2	34
Exchangeable Sodium, Na	meq/100g	0.01	0.15
Exchangeable Sodium Percentage*	%	0.1	0.9
Exchangeable Potassium, K	mg/kg	2	480
Exchangeable Potassium, K	meq/100g	0.01	1.2
Exchangeable Potassium Percentage*	%	0.1	7.7
Exchangeable Calcium, Ca	mg/kg	2	2300
Exchangeable Calcium, Ca	meq/100g	0.01	12
Exchangeable Calcium Percentage*	%	0.1	73.6
Exchangeable Magnesium, Mg	mg/kg	2	340
Exchangeable Magnesium, Mg	meq/100g	0.02	2.8
Exchangeable Magnesium Percentage*	%	0.1	17.8
Cation Exchange Capacity	meq/100g	0.02	16

Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES [AN040/AN320] Tested: 24/3/2021

PARAMETER	UOM	LOR	D101	D103	D105	D106	D107
			CLAY 0.45-0.55 23/2/2021 SE216927A.004	CLAY 0.45-0.55 23/2/2021 SE216927A.007	CLAY 0.0-0.1 23/2/2021 SE216927A.009	CLAY 0.0-0.1 23/2/2021 SE216927A.010	CLAY 0.0-0.1 23/2/2021 SE216927A.011
Arsenic, As	mg/kg	1	24	750	42	6	5
Chromium, Cr	mg/kg	0.5	21	200	27	21	16
Copper, Cu	mg/kg	0.5	16	8700	39	14	10
Zinc, Zn	mg/kg	2	43	680	55	33	32

PARAMETER	UOM	LOR	D108	D109	D110	D111
			CLAY 0.0-0.1 23/2/2021 SE216927A.012	CLAY 0.0-0.1 23/2/2021 SE216927A.013	CLAY 0.0-0.1 23/2/2021 SE216927A.014	CLAY 0.0-0.1 23/2/2021 SE216927A.015
Arsenic, As	mg/kg	1	630	46	27	5
Chromium, Cr	mg/kg	0.5	150	28	24	14
Copper, Cu	mg/kg	0.5	360	32	21	9.3
Zinc, Zn	mg/kg	2	3800	50	120	37

Moisture Content [AN002] Tested: 24/3/2021

PARAMETER	UOM	LOR	D101	D103	D105	D106	D107
			CLAY	CLAY	CLAY	CLAY	CLAY
			0.45-0.55	0.45-0.55	0.0-0.1	0.0-0.1	0.0-0.1
			23/2/2021	23/2/2021	23/2/2021	23/2/2021	23/2/2021
			SE216927A.004	SE216927A.007	SE216927A.009	SE216927A.010	SE216927A.011
% Moisture	%w/w	1	21.9	33.0	8.1	2.9	4.4

PARAMETER	UOM	LOR	D108	D109	D110	D111
			CLAY	CLAY	CLAY	CLAY
			0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1
			23/2/2021	23/2/2021	23/2/2021	23/2/2021
			SE216927A.012	SE216927A.013	SE216927A.014	SE216927A.015
% Moisture	%w/w	1	40.9	18.1	13.1	13.3

TCLP (Toxicity Characteristic Leaching Procedure) for Metals [AN006] Tested: 24/3/2021

PARAMETER	UOM	LOR	D101	D102
			CLAY 0.0-0.1 23/2/2021 SE216927A.003	CLAY 0.0-0.1 23/2/2021 SE216927A.005
pH 1:20	pH Units	-	6.9	6.9
pH 1:20 plus HCL	pH Units	-	2.2	2.4
Extraction Solution Used	No unit	-	1	1
Mass of Sample Used*	g	-	13	13
Volume of ExtractionSolution Used*	mL	-	250	250
pH TCLP after 18 hours	pH Units	-	5.4	6.0

Metals in TCLP Extract by ICPOES [AN320] Tested: 25/3/2021

PARAMETER	UOM	LOR	D101	D102
			CLAY 0.0-0.1 23/2/2021 SE216927A.003	CLAY 0.0-0.1 23/2/2021 SE216927A.005
Arsenic, As	mg/L	0.02	0.51	1.1
Chromium, Cr	mg/L	0.005	0.023	0.069

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.

AN006

Contaminants of interest in a waste material are leached out of the waste with a selected leaching solution under controlled conditions. The ratio of sample to extraction fluid is 100g to 2L (1 to 20 by mass). The concentration of each contaminant of interest is determined in the leachate by appropriate methods after separation from the sample by filtering. Base on USEPA 1311.

AN006

Extraction Fluid #1: This fluid is made by combining 128.6mL of dilute sodium hydroxide solution and 11.5mL glacial acetic acid with water and diluting to a volume of 2 litres. The pH of this fluid should be 4.93 ± 0.05 .

AN006

Extraction Fluid #2: This fluid is made by diluting 5.7mL glacial acetic acid with water to a volume of 1 litre. The pH of this fluid should be 2.88 ± 0.05 .

AN020

Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.

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.

AN101

pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl₂) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.

AN122

Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.

AN122

The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100.
ESP can be used to categorise the sodicity of the soil as below:

ESP < 6%	non-sodic
ESP 6-15%	sodic
ESP >15%	strongly sodic

Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-

AN320

Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.

AN320

Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

FOOTNOTES

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

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

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

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

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

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

Note that in terms of units of radioactivity:

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

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

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

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STATEMENT OF QA/QC PERFORMANCE

SE216927A R0

CLIENT DETAILS

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Facsimile 02 4722 6161
Email john.xu@geotech.com.au

Project **14328/2 Googong - Additional**
Order Number (Not specified)
Samples 17

LABORATORY DETAILS

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Alexandria NSW 2015

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Email au.environmental.sydney@sgs.com

SGS Reference **SE216927A R0**
Date Received 03 Mar 2021
Date Reported 25 Mar 2021

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:

Extraction Date	Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)	6 items
	Moisture Content	9 items
	pH in soil (1:5)	6 items
Analysis Date	Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)	6 items
Duplicate	Total Recoverable Elements in Soil/Waste Solids/Materials by ICPOES	2 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	12 Clay
Date documentation received	3/3/2021@4:35PM	Type of documentation received	Email
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	13.3°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

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

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

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
J2a	SE216927A.002	LB221374	23 Feb 2021	03 Mar 2021	23 Mar 2021	24 Mar 2021†	23 Mar 2021	25 Mar 2021†
D103	SE216927A.007	LB221374	23 Feb 2021	03 Mar 2021	23 Mar 2021	24 Mar 2021†	23 Mar 2021	25 Mar 2021†
D106	SE216927A.010	LB221374	23 Feb 2021	03 Mar 2021	23 Mar 2021	24 Mar 2021†	23 Mar 2021	25 Mar 2021†
D108	SE216927A.012	LB221374	23 Feb 2021	03 Mar 2021	23 Mar 2021	24 Mar 2021†	23 Mar 2021	25 Mar 2021†
D109	SE216927A.013	LB221374	23 Feb 2021	03 Mar 2021	23 Mar 2021	24 Mar 2021†	23 Mar 2021	25 Mar 2021†
D110	SE216927A.014	LB221374	23 Feb 2021	03 Mar 2021	23 Mar 2021	24 Mar 2021†	23 Mar 2021	25 Mar 2021†

Metals in TCLP Extract by ICPOES

Method: ME-(AU)-[ENV]AN302

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D101	SE216927A.003	LB221407	23 Feb 2021	03 Mar 2021	22 Aug 2021	25 Mar 2021	22 Aug 2021	25 Mar 2021
D102	SE216927A.005	LB221407	23 Feb 2021	03 Mar 2021	22 Aug 2021	25 Mar 2021	22 Aug 2021	25 Mar 2021

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D101	SE216927A.004	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D103	SE216927A.007	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D105	SE216927A.009	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D106	SE216927A.010	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D107	SE216927A.011	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D108	SE216927A.012	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D109	SE216927A.013	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D110	SE216927A.014	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021
D111	SE216927A.015	LB221366	23 Feb 2021	03 Mar 2021	09 Mar 2021	24 Mar 2021†	29 Mar 2021	25 Mar 2021

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
J2a	SE216927A.002	LB221420	23 Feb 2021	03 Mar 2021	02 Mar 2021	25 Mar 2021†	26 Mar 2021	25 Mar 2021
D103	SE216927A.007	LB221420	23 Feb 2021	03 Mar 2021	02 Mar 2021	25 Mar 2021†	26 Mar 2021	25 Mar 2021
D106	SE216927A.010	LB221420	23 Feb 2021	03 Mar 2021	02 Mar 2021	25 Mar 2021†	26 Mar 2021	25 Mar 2021
D108	SE216927A.012	LB221420	23 Feb 2021	03 Mar 2021	02 Mar 2021	25 Mar 2021†	26 Mar 2021	25 Mar 2021
D109	SE216927A.013	LB221420	23 Feb 2021	03 Mar 2021	02 Mar 2021	25 Mar 2021†	26 Mar 2021	25 Mar 2021
D110	SE216927A.014	LB221420	23 Feb 2021	03 Mar 2021	02 Mar 2021	25 Mar 2021†	26 Mar 2021	25 Mar 2021

TCLP (Toxicity Characteristic Leaching Procedure) for Metals

Method: ME-(AU)-[ENV]AN006

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D101	SE216927A.003	LB221362	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D102	SE216927A.005	LB221362	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021

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

Method: ME-(AU)-[ENV]AN040/AN302

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D101	SE216927A.004	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D103	SE216927A.007	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D105	SE216927A.009	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D106	SE216927A.010	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D107	SE216927A.011	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D108	SE216927A.012	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D109	SE216927A.013	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D110	SE216927A.014	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021
D111	SE216927A.015	LB221354	23 Feb 2021	03 Mar 2021	22 Aug 2021	24 Mar 2021	22 Aug 2021	25 Mar 2021

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

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

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.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result
LB221374.001	Exchangeable Sodium, Na	mg/kg	2	0
	Exchangeable Potassium, K	mg/kg	2	0
	Exchangeable Calcium, Ca	mg/kg	2	0
	Exchangeable Magnesium, Mg	mg/kg	2	0

Metals in TCLP Extract by ICPOES

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

Sample Number	Parameter	Units	LOR	Result
LB221407.001	Arsenic, As	mg/L	0.02	<0.02
	Chromium, Cr	mg/L	0.005	<0.005

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

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

Sample Number	Parameter	Units	LOR	Result
LB221354.001	Arsenic, As	mg/kg	1	<1
	Chromium, Cr	mg/kg	0.5	<0.5
	Copper, Cu	mg/kg	0.5	<0.5
	Zinc, Zn	mg/kg	2	<2

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

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

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

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

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

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE217964.009	LB221366.021	% Moisture	%w/w	1	15.9	15.9	36	0
SE217968.001	LB221366.011	% Moisture	%w/w	1	39.6	40.0	33	1

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE217313B.023	LB221420.014	pH	pH Units	0.1	10.1	10.1	31	0
SE217964.005	LB221420.022	pH	pH Units	0.1	8.0	8.1	31	1

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 %
SE217964.001	LB221354.014	Arsenic, As	mg/kg	1	2	2	72	0
		Chromium, Cr	mg/kg	0.5	7.0	13	35	60 @
		Copper, Cu	mg/kg	0.5	21	20	32	5
		Zinc, Zn	mg/kg	2	25	40	36	48 @
SE217964.009	LB221354.021	Copper, Cu	mg/kg	0.5	5.8	8.1	37	34

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.

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB221374.002	Exchangeable Sodium, Na	meq/100g	0.01	0.22	0.194	80 - 120	113
	Exchangeable Potassium, K	meq/100g	0.01	0.69	0.63	80 - 120	110
	Exchangeable Calcium, Ca	meq/100g	0.01	7.4	6.3	80 - 120	118
	Exchangeable Magnesium, Mg	meq/100g	0.02	1.2	1.11	80 - 120	109

Metals in TCLP Extract by ICPOES

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB221407.002	Arsenic, As	mg/L	0.02	0.50	0.5	80 - 120	100
	Chromium, Cr	mg/L	0.005	0.49	0.5	80 - 120	98

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB221420.003	pH	pH Units	0.1	7.5	7.415	98 - 102	101

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 %
LB221354.002	Arsenic, As	mg/kg	1	350	318.22	80 - 120	109
	Chromium, Cr	mg/kg	0.5	41	38.31	80 - 120	106
	Copper, Cu	mg/kg	0.5	320	290	80 - 120	109
	Zinc, Zn	mg/kg	2	290	273	80 - 120	104

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

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

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%
SE216927A.00 4	LB221354.004	Arsenic, As	mg/kg	1	60	24	50	71
		Chromium, Cr	mg/kg	0.5	61	21	50	82
		Copper, Cu	mg/kg	0.5	57	16	50	83
		Zinc, Zn	mg/kg	2	78	43	50	71

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

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

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

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

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

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.

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1 LEMKO PLACE PENRITH NSW 2750

CHAIN OF CUSTODY

Results Required By: **Normal Turnaround 4 days**
Except pH Results Required By -

Date: **Wednesday, 10 March 2021**

Date:

Your Reference No.: **SE216927**

TO: SGS UNIT 16, 33 MADDOX STREET ALEXANDRIA NSW 2015						Sampled By: JH		Ref No: 14328/2		Project Manager: JOHN XU														
						Location: Googong																		
Location	Depth (m)	Date	Soil	Water	Material	Metals As Cd Cr Cu Pb Hg Ni Zn	pH	CEC	CL8 TRH BTEX PAH	CL10 Metals* TRH BTEX PAH	CL16 Metals* TRH BTEX PAH OC PCB	As Cr Cu Zn	TCLP for As Cr	Asbestos 0.001% w/w	Asbestos	BTEX	TRH & BTEX	PAH	OC	OC & PCB	Phenol	Cyanide	VOC	OC OPP & PCB
J2a	0.0-0.1	23/02/2021	G		Clay																			
J2a	0.35-0.45	23/02/2021	G		Clay		✓	✓																
D101	0.0-0.1	23/02/2021	G		Clay								✓											
D101	0.45-0.55	23/02/2021	G		Clay							✓												
D102	0.0-0.1	23/02/2021	G		Clay								✓											
D103	0.0-0.1	23/02/2021	G		Clay																			
D103	0.45-0.55	23/02/2021	G		Clay		✓	✓				✓												
D104	0.0-0.1	23/02/2021	G		Clay																			
D105	0.0-0.1	23/02/2021	G		Clay							✓												
D106	0.0-0.1	23/02/2021	G		Clay		✓	✓				✓												
D107	0.0-0.1	23/02/2021	G		Clay							✓												
D108	0.0-0.1	23/02/2021	G		Clay		✓	✓				✓												
D109	0.0-0.1	23/02/2021	G		Clay		✓	✓				✓												
D110	0.0-0.1	23/02/2021	G		Clay		✓	✓				✓												
D111	0.0-0.1	23/02/2021	G		Clay							✓												
DDS101	-	23/02/2021	G		Clay																			
R101	-	23/02/2021		WG																				
Relinquished by						Received by																		
Name		Signature		Date		Name		Signature		Date														
JOHN XU		JX		3/03/2021		[Signature]		[Signature]		3/3/21 4.35														
WG: Water sample (glass bottle)						FCP Fibro Cement Piece (plastic bag)						*: As,Cd,Cr,Cu,Pb,Hg,Ni & Zn (8 metals)												
WP: Water sample (plastic bottle)						✓ Test required																		

SGS EHS Alexandria Laboratory


SE216927A COC

Received: 03-Mar-2021



SAMPLE RECEIPT ADVICE

SE216927A

CLIENT DETAILS

Contact John Xu
Client Geotechnique
Address P.O. Box 880
NSW 2751

Telephone 02 4722 2700
Facsimile 02 4722 6161
Email john.xu@geotech.com.au

Project **14328/2 Googong - Additional**
Order Number (Not specified)
Samples 17

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

Samples Received Wed 3/3/2021
Report Due Thu 25/3/2021
SGS Reference **SE216927A**

SUBMISSION DETAILS

This is to confirm that 17 samples were received on Wednesday 3/3/2021. Results are expected to be ready by COB Thursday 25/3/2021. Please quote SGS reference SE216927A when making enquiries. Refer below for details relating to sample integrity upon receipt.

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	12 Clay
Date documentation received	3/3/2021@4:35PM	Type of documentation received	Email
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	13.3°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

This document is issued by the Company under its General Conditions of Service accessible at www.sgs.com/en/Terms-and-Conditions.aspx. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

CLIENT DETAILS

Client **Geotechnique**

Project **14328/2 Googong - Additional**

SUMMARY OF ANALYSIS

No.	Sample ID	Exchangeable Cations and Cation Exchange Capacity	Metals in TCLP Extract by ICPOES	Moisture Content	pH in soil (1:5)	TCLP (Toxicity Characteristic Leaching)	Total Recoverable Elements in Soil/Waste
002	J2a 0.35-0.45	13	-	-	1	-	-
003	D101 0.0-0.1	-	2	-	-	6	-
004	D101 0.45-0.55	-	-	1	-	-	4
005	D102 0.0-0.1	-	2	-	-	6	-
007	D103 0.45-0.55	13	-	1	1	-	4
009	D105 0.0-0.1	-	-	1	-	-	4
010	D106 0.0-0.1	13	-	1	1	-	4
011	D107 0.0-0.1	-	-	1	-	-	4
012	D108 0.0-0.1	13	-	1	1	-	4
013	D109 0.0-0.1	13	-	1	1	-	4
014	D110 0.0-0.1	13	-	1	1	-	4
015	D111 0.0-0.1	-	-	1	-	-	4

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document. The numbers shown in the table indicate the number of results requested in each package. Please indicate as soon as possible should your request differ from these details . Testing as per this table shall commence immediately unless the client intervenes with a correction .

CLIENT DETAILS

Contact John Xu
Client Geotechnique
Address P.O. Box 880
 NSW 2751

Telephone 02 4722 2700
Facsimile 02 4722 6161
Email john.xu@geotech.com.au
Project **14328/2 Googong - Additional**
Order Number (Not specified)
Samples 17

LABORATORY DETAILS

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Laboratory SGS Alexandria Environmental
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 Alexandria NSW 2015

Telephone +61 2 8594 0400
Facsimile +61 2 8594 0499
Email au.environmental.sydney@sgs.com
SGS Reference **SE216927B R0**
Date Received 25/3/2021
Date Reported 29/3/2021

COMMENTS

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

SIGNATORIES



Dong LIANG
 Metals/Inorganics Team Leader



Shane MCDERMOTT
 Inorganic/Metals Chemist

TCLP (Toxicity Characteristic Leaching Procedure) for Metals [AN006] Tested: 26/3/2021

PARAMETER	UOM	LOR	D103	D108
			CLAY 0.45-0.55 23/2/2021 SE216927B.007	CLAY 0.0-0.1 23/2/2021 SE216927B.012
pH 1:20	pH Units	-	7.5	6.9
pH 1:20 plus HCL	pH Units	-	2.3	2.4
Extraction Solution Used	No unit	-	1	1
Mass of Sample Used*	g	-	13	13
Volume of ExtractionSolution Used*	mL	-	250	250
pH TCLP after 18 hours	pH Units	-	5.0	5.1



ANALYTICAL RESULTS

SE216927B R0

Metals in TCLP Extract by ICPOES [AN320] Tested: 29/3/2021

			D103	D108
			CLAY 0.45-0.55 23/2/2021 SE216927B.007	CLAY 0.0-0.1 23/2/2021 SE216927B.012
PARAMETER	UOM	LOR		
Arsenic, As	mg/L	0.02	0.29	0.67
Chromium, Cr	mg/L	0.005	0.008	0.012

METHOD

METHODOLOGY SUMMARY

AN006

Contaminants of interest in a waste material are leached out of the waste with a selected leaching solution under controlled conditions. The ratio of sample to extraction fluid is 100g to 2L (1 to 20 by mass). The concentration of each contaminant of interest is determined in the leachate by appropriate methods after separation from the sample by filtering. Base on USEPA 1311.

AN006

Extraction Fluid #1: This fluid is made by combining 128.6mL of dilute sodium hydroxide solution and 11.5mL glacial acetic acid with water and diluting to a volume of 2 litres. The pH of this fluid should be 4.93 ± 0.05 .

AN006

Extraction Fluid #2: This fluid is made by diluting 5.7mL glacial acetic acid with water to a volume of 1 litre. The pH of this fluid should be 2.88 ± 0.05 .

AN020

Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.

AN320

Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components.

AN320

Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements. Reference APHA 3120 B.

FOOTNOTES

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

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

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

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

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

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

Note that in terms of units of radioactivity:

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

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

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

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STATEMENT OF QA/QC PERFORMANCE

SE216927B R0

CLIENT DETAILS

Contact John Xu
Client Geotechnique
Address P.O. Box 880
NSW 2751

Telephone 02 4722 2700
Facsimile 02 4722 6161
Email john.xu@geotech.com.au

Project **14328/2 Googong - Additional**
Order Number (Not specified)
Samples 17

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 **SE216927B R0**
Date Received 25 Mar 2021
Date Reported 29 Mar 2021

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 (within the SGS Alexandria Environmental laboratory).

SAMPLE SUMMARY

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 sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Metals in TCLP Extract by ICPOES

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D103	SE216927B.007	LB221577	23 Feb 2021	25 Mar 2021	22 Aug 2021	29 Mar 2021	22 Aug 2021	29 Mar 2021
D108	SE216927B.012	LB221577	23 Feb 2021	25 Mar 2021	22 Aug 2021	29 Mar 2021	22 Aug 2021	29 Mar 2021

TCLP (Toxicity Characteristic Leaching Procedure) for Metals

Method: ME-(AU)-[ENV]AN006

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
D103	SE216927B.007	LB221507	23 Feb 2021	25 Mar 2021	22 Aug 2021	26 Mar 2021	22 Aug 2021	29 Mar 2021
D108	SE216927B.012	LB221507	23 Feb 2021	25 Mar 2021	22 Aug 2021	26 Mar 2021	22 Aug 2021	29 Mar 2021

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

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

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.

Metals in TCLP Extract by ICPOES**Method: ME-(AU)-[ENV]AN320**

Sample Number	Parameter	Units	LOR	Result
LB221577.001	Arsenic, As	mg/L	0.02	<0.02
	Chromium, Cr	mg/L	0.005	<0.005

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

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

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

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

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

No duplicates were required for this job.



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.

Metals in TCLP Extract by ICPOES**Method: ME-(AU)-[ENV]AN320**

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB221577.002	Arsenic, As	mg/L	0.02	0.51	0.5	80 - 120	102
	Chromium, Cr	mg/L	0.005	0.52	0.5	80 - 120	104

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

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

No matrix spikes were required for this job.

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

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

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

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

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

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.

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1 LEMKO PLACE PENRITH NSW 2750

CHAIN OF CUSTODY

Results Required By: Normal Turnaround 4 days
Except pH Results Required By -

Date: Wednesday, 31 March 2021

Date:

Your Reference No.: SE216927A

TO: SGS UNIT 16, 33 MADDOX STREET ALEXANDRIA NSW 2015							Sampled By: JH										Ref No: 14328/2					Project Manager: JOHN XU									
							Location: Googong																								
Location	Depth (m)	Date	Soil	Water	Material	Metals As Cd Cr Cu Pb Hg Ni Zn	pH	CEC	CL8 TRH BTEX PAH	CL10 Metals* TRH BTEX PAH	CL16 Metals* TRH BTEX PAH OC PCB	As Cr Cu Zn	TCLP for As Cr	Asbestos 0.001% w/w	TCLP As, Cr	BTEX	TRH & BTEX	PAH	OCP	OCP & PCB	Phenol	Cyanide	VOC	OCP OPP & PCB							
D103	0.45-0.55	23/02/2021	G		Clay										✓																
D108	0.0-0.1	23/02/2021	G		Clay										✓																
Relinquished by							Received by																								
Name		Signature		Date			Name		Signature		Date																				
JOHN XU		JX		25/03/2021			<i>[Signature]</i>		<i>[Signature]</i>		25/3/2021																				
WG: Water sample (glass bottle)							FCP Fibro Cement Piece (plastic bag)							*: As,Cd,Cr,Cu,Pb,Hg,Ni & Zn (8 metals)																	
WP: Water sample (plastic bottle)							✓ Test required																								

SGS EHS Alexandria Laboratory



SE216927B COC

Received: 25 - Mar - 2021



SAMPLE RECEIPT ADVICE

SE216927B

CLIENT DETAILS

Contact John Xu
Client Geotechnique
Address P.O. Box 880
NSW 2751

Telephone 02 4722 2700
Facsimile 02 4722 6161
Email john.xu@geotech.com.au

Project **14328/2 Googong - Additional**
Order Number (Not specified)
Samples 17

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

Samples Received Thu 25/3/2021
Report Due Wed 31/3/2021
SGS Reference **SE216927B**

SUBMISSION DETAILS

This is to confirm that 17 samples were received on Thursday 25/3/2021. Results are expected to be ready by COB Wednesday 31/3/2021. Please quote SGS reference SE216927B when making enquiries. Refer below for details relating to sample integrity upon receipt.

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	2 Clay
Date documentation received	25/3/2021@2:02pm	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	13.3°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

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SAMPLE RECEIPT ADVICE

SE216927B

CLIENT DETAILS

Client **Geotechnique**

Project **14328/2 Googong - Additional**

SUMMARY OF ANALYSIS

No.	Sample ID	Metals in TCLP Extract by ICPOES	TCLP (Toxicity Characteristic Leaching
007	D103 0.45-0.55	2	6
012	D108 0.0-0.1	2	6

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

CERTIFICATE OF ANALYSIS 262841

Client Details

Client	Geotechnique Pty Ltd
Attention	John Xu
Address	PO Box 880, Penrith, NSW, 2751

Sample Details

Your Reference	<u>14328/2, Googong</u>
Number of Samples	1 Soil
Date samples received	25/02/2021
Date completed instructions received	25/02/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	03/03/2021
Date of Issue	02/03/2021
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Giovanni Agosti, Group Technical Manager
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

Acid Extractable metals in soil		
Our Reference		262841-1
Your Reference	UNITS	DSS101
Date Sampled		23/02/2021
Type of sample		Soil
Date prepared	-	26/02/2021
Date analysed	-	26/02/2021
Arsenic	mg/kg	150
Chromium	mg/kg	85
Copper	mg/kg	170
Zinc	mg/kg	260

Moisture		
Our Reference	UNITS	262841-1
Your Reference		DSS101
Date Sampled		23/02/2021
Type of sample		Soil
Date prepared	-	26/02/2021
Date analysed	-	01/03/2021
Moisture	%	36

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.

Client Reference: 14328/2, Googong

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	[NT]
Date prepared	-			26/02/2021	[NT]	[NT]	[NT]	[NT]	26/02/2021	[NT]
Date analysed	-			26/02/2021	[NT]	[NT]	[NT]	[NT]	26/02/2021	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	80	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	84	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	73	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Laboratory Test Request / Chain of Custody Record

Lemko Place

PENRITH NSW 2750

Tel: (02) 4722 2700

Page

of

TO: ENVIROLAB SERVICES PTY LD
12 ASHLEY STREET
CHATSWOOD NSW 2067

Sampling By: JH

Ref No: 14328/2

Project:

PH: 02 9910 6200

Project Manager: JOHN XU

Location: Googong

ATTN: MS AILEEN HIE

[illegible]

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No:

20259

Date Received: 25-02-2021

Time Received: 7-15

Received By: 7 FAW

Temp: Cool/Ambient

Cooling: Ice/Icepack

Security: ~~Intact~~/Broken/None

SAMPLE RECEIPT ADVICE

Client Details

Client	Geotechnique Pty Ltd
Attention	John Xu

Sample Login Details

Your reference	14328/2, Googong
Envirolab Reference	262841
Date Sample Received	25/02/2021
Date Instructions Received	25/02/2021
Date Results Expected to be Reported	03/03/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	1 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	16.8
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	Phone: 02 9910 6200
Fax: 02 9910 6201	Fax: 02 9910 6201
Email: ahie@envirolab.com.au	Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:

Sample ID	Acid Extractable metals in soil
DSS101	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

APPENDIX C

WASTE CLASSIFICATION SUMMARY TABLES W1 to W6

<i>Table W1</i>	<i>Metals (Area 2)</i>
<i>Table W2</i>	<i>Total Petroleum Hydrocarbons (TPH), BTEX, Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine Pesticides (OCP) & Organophosphorus Pesticides (OPP) Test Results (Area 2)</i>
<i>Table W3</i>	<i>Scheduled Chemicals (Area 2)</i>
<i>Table W4</i>	<i>Moderately Harmful Pesticides & Polychlorinated Biphenyls (PCB) Test Results (Area 2)</i>
<i>Table W5</i>	<i>TCLP Test Results (Area 2)</i>
<i>Table W6</i>	<i>Waste Classification (Area 2)</i>

TABLE W1
METALS (AREA 2)
Old Cooma Road, Googong
(Ref No: 14328/2)

		METAL (mg/kg)					
		ARSENIC	CADMIUM	CHROMIUM (Total)	LEAD	MERCURY	NICKEL
Sample Location	Depth (m)						
D101	0.0-0.1	520	-	170	-	-	-
D102	0.0-0.1	1800	-	620	-	-	-
D103	0.45-0.55	750	-	200	-	-	-
D104	0.0-0.1	1000	-	280	-	-	-
D108	0.0-0.1	630	-	150	-	-	-
SGS Lab Duplicate LB175907.023 = DDS6=J2 (0.0-0.1)		1000	5.5	490	290	<0.05	8.9
DSS101=D103 (0.0-0.1)		150	-	85	-	-	-
Limit of Reporting (LOR) (SGS)		1	0.3	0.5	1	0.05	0.5
Practical Quantitation Limit (PQL) (EnviroLab)		4.0	-	1.0	-	-	-
Maximum		1800	5.5	620	290	<0.05	8.9
ProUCL 5.1 ^a							
Number of Sample		7	-	7	-	-	-
Mean		836	-	285	-	-	-
Standard Deviation		517	-	197	-	-	-
Coefficient of Variance		0.619	-	0.691	-	-	-
95% Upper Confidence Limit (UCL)		1176	-	428	-	-	-

Notes:

a: Refer to attached ProUCL (Version 5.1) calculations for details.

TABLE W2
TOTAL PETROLEUM HYDROCARBONS (TPH), BTEX, POLYCYCLIC AROMATIC HYDROCARBONS (PAH), ORGANOCHLORINE
PESTICIDES (OCP) & ORGANOPHOSPHATE PESTICIDES (OPP) TEST RESULTS (AREA 2)
Old Cooma Road, Googong
(Ref No: 14328/2)

		TRH (mg/kg)		BTEX (mg/kg)				PAH(mg/kg)		OCP (mg/kg)	OPP (mg/kg)
Sample Location	Depth (m)	C6-C9	C10-C36	BENZENE	TOLUENE	ETHYLBENZENE	XYLENES (TOTAL)	BENZO(a)PYRENE (BaP)	TOTAL PAHs	ENDOSULFAN (TOTAL) ¹	Chlorpyrifos (Chlorpyrifos Ethyl)
J2	0.0-0.1	<20	250	<0.1	<0.1	<0.1	<0.3	<0.1	<0.8	<0.5	<0.2
Limit of Reporting (LOR) (SGS)		20	110	0.1	0.1	0.1	0.3	0.1	0.8	0.5	0.2
Maximum		<20	250	<0.1	<0.1	<0.1	<0.3	<0.1	<0.8	<0.5	<0.2

Note:

1: Alpha, beta Endosulfan and Endosulfan Sulphate

TABLE W3
SCHEDULED CHEMICALS (AREA 2)
Old Cooma Road, Googong
(Ref No: 14328/2)

		Scheduled Chemicals (mg/kg)							Scheduled Chemicals ¹
		HEXACHLOROBENZENE (HCB)	HEPTACHLOR	ALDRIN	DIELDRIN	ENDRIN	DDD+DDE+DDT	CHLORDANE (alpha & gamma)	
Sample Location	Depth (m)								
J2	0.0-0.1	<0.1	<0.1	<0.1	<0.05	<0.2	<0.6	<0.2	<1.35
Limit of Reporting (LOR) (SGS)		0.1	0.1	0.1	0.2	0.2	0.6	0.2	-
Maximum		<0.1	<0.1	<0.1	<0.2	<0.2	<0.6	<0.2	<1.35

Note:

1:

Includes only Aldrin, Alpha BHC, Beta BHC, gamma BHC (Lindane), delta BHC, Chlordane, DDD, DDE, DDT, Dieldrin, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, HCB & Isodrin

TABLE W4
MODERATELY HARMFUL PESTICIDES & POLYCHLORINATED BIPHENYLS (PCB) TEST RESULTS (AREA 2)
Old Cooma Road, Googong
(Ref No: 14328/2)

		Moderately Harmful Pesticides (mg/kg)			(mg/kg) Polychlorinated Biphenyls (PCB)
		Fenitrothion	Ethion	Moderately Harmful Pesticides ¹	
Sample Location	Depth (m)				
J2	0.0-0.1	<0.2	<0.2	<0.4	<1
Limit of Reporting (LOR) (SGS)		0.2	0.2	-	1
Maximum		<0.2	<0.2	<0.4	<1

Note:
1: Includes only Fenitrothion & Ethion

Table W5
TCLP TEST RESULTS (AREA 2)
Old Cooma Road, Googong
(Ref No: 14328/2)

Analyte		ARSENIC (mg/L)	CHROMIUM (mg/L)	LEAD (mg/L)
Sample Location	Depth (m)			
D101	0.0-0.1	0.51	0.023	-
D102	0.0-0.1	1.1	0.069	-
D103	0.45-0.55	0.29	0.008	-
D108	0.0-0.1	0.67	0.012	-
DDS6	=J2 (0.0-0.1)	5.2	0.049	<0.02
Limit of Reporting (LOR)		0.02	0.005	0.02
Maximum		5.2	0.069	<0.02
ProUCL 5.1^a				
Number of Sample		5	5	-
Mean		1.6	0.03	-
Standard Deviation		2.1	0.03	-
Coefficient of Variance		1.325	0.809	-
95% Upper Confidence Limit (UCL)		13	0.1	-

Note:

a: Refer to Attached ProUCL (Version 5.1) calculations for details.

TABLE W6
WASTE CLASSIFICATION (AREA 2)
Old Cooma Road, Googong
(Ref No: 14328/2)

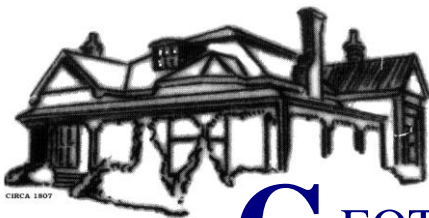
Analyte	Total Concentration (mg/kg)					Leachable Concentration (mg/L)			Classification
	95%UCL/ Maximum	CT1	CT2	SCC1	SCC2	95%UCL/ Maximum	TCLP1	TCLP2	
Metals									Restricted Solid Waste
Arsenic	1176	100	400	500	2,000	13	5	20	General Solid Waste **
Cadmium	5.5	20	80	100	400	ND	1	4	General Solid Waste **
Chromium (IV)	428*	100	400	1,900	7,600	0.1	5	20	General Solid Waste **
Lead	290	100	400	1,500	6,000	< 0.02	5	20	General Solid Waste **
Mercury	<0.05	4	16	50	200	ND	0.2	0.8	General Solid Waste **
Nickel	8.9	40	160	1,050	4,200	ND	2	8	General Solid Waste **
Total Petroleum Hydrocarbons									
C6-C9	<20	650	2,600	650	2,600	NA	NA	NA	General Solid Waste **
C10-C36	250	10,000	40,000	10,000	40,000	NA	NA	NA	General Solid Waste **
Benzene	<0.1	10	40	18	72	ND	0.5	2	General Solid Waste **
Toluene	<0.1	288	1,152	518	2,073	ND	14.4	57.6	General Solid Waste **
EthylBenzene	<0.1	600	2,400	1,080	4,320	ND	30	120	General Solid Waste **
Xylenes (Total)	<0.3	1,000	4,000	1,800	7,200	ND	50	200	General Solid Waste **
Polycyclic Aromatic Hydrocarbons									
Benzo(a)pyrene (BaP)	<0.1	0.8	3.2	10	23	ND	0.04	0.16	General Solid Waste **
Total PAHs	<0.8	200	800	200	800	NA	NA	NA	General Solid Waste **
Organochlorine and Organophosphate Pesticides									
Endosulfan (total) ¹	<0.5	60	240	108	432	ND	3	12	General Solid Waste **
Chlorpyrifos (Chlorpyrifos Ethyl)	<0.2	4	16	7.5	30	ND	0.2	0.8	General Solid Waste **
Scheduled Chemicals ²	<1.35	<50	<50	<50	<50	NA	NA	NA	General Solid Waste **
Moderately Harmful Pesticides ³	<0.4	250	1,000	250	1,000	NA	NA	NA	General Solid Waste **
Polychlorinated Biphenyls (PCB)	<1	<50	<50	<50	<50	NA	NA	NA	General Solid Waste **

NOTES:

ND:	Not Determined
NA:	Not Applicable
TCLP:	Toxicity Characteristic Leaching Procedure
UCL:	Upper confidence limit
1:	Alpha, beta Endosulfan and Endosulfan Sulphate
2:	Includes only Aldrin, Alpha BHC, Beta BHC, gamma BHC (Lindane), delta BHC, Chlordane, DDD, DDE, DDT, Dieldrin, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, HCB & Isodrin
3:	Includes only Fenitrothion & Ethion
CT1:	Contaminant concentration for defining General Solid Waste (without TCLP)
CT2:	Contaminant concentration for defining Restricted Solid Waste (without TCLP)
SCC1:	Contaminant concentration for defining General Solid Waste when combined with TCLP
SCC2:	Contaminant concentration for defining Restricted Solid Waste when combined with TCLP
TCLP1:	Leachable concentration for defining General Solid Waste when combined with SCC1
TCLP2:	Leachable concentration for defining Restricted Solid Waste when combined with SCC2
*:	Total Chromium
**:	Non-putrescible

APPENDIX D

UNEXPECTED FINDS MANAGEMENT PROTOCOL



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**Unexpected Finds Management Protocol
Neighbourhood (NH) 3, NH4 & NH5
Old Cooma Road, Googong**

In the event that unexpected finds and / or suspect materials (identified by unusual staining, odour, discolouration or inclusions such as building rubble, asbestos sheets / pieces / pipes, livestock carcasses, ash material, imported fill materials [which are different to those encountered during the previous assessments and this assessment], etc.) are encountered during future demolition / remediation / site preparation / earthworks, the following actions are to be undertaken.

Management of unexpected finds and / or suspect materials

If unexpected finds and / or suspect materials are encountered:

- Works are to be ceased.
- An Environmental Consultant is to be engaged to take appropriate action.
- If contamination is identified, the contaminated materials must be disposed of at an EPA licensed landfill facility with an appropriate waste classification.

Management of bonded asbestos containing material (ACM)

If bonded ACM is encountered, the following measures are implemented:

- Engage a NSW WorkCover accredited Class B asbestos contractor.
- Removal of the asbestos waste must be carried out in accordance with the requirements of the regulators, such as NSW WorkCover and NSW EPA.
- A WorkCover Licensed Asbestos Assessor should be engaged to provide a clearance certificate.

Management of friable asbestos within the soil

It is recommended that the following measures are implemented if friable asbestos is encountered:

- Engage a NSW WorkCover accredited Class A Asbestos contractor.
- Removal of the asbestos waste must be carried out in accordance with the requirements of the regulators, such as NSW WorkCover and NSW EPA
- A WorkCover Licensed Asbestos Assessor must be engaged to provide a clearance certificate.

APPENDIX E

ENVIRONMENTAL NOTES

IMPORTANT INFORMATION REGARDING YOUR ENVIRONMENTAL SITE ASSESSMENT

These notes have been prepared by Geotechnique Pty Ltd, using guidelines prepared by the ASFE (Associated Soil and Foundation Engineers). The notes are offered to assist in the interpretation of your environmental site assessment report.

REASONS FOR AN ENVIRONMENTAL ASSESSMENT

Environmental site assessments are typically, though not exclusively, performed in the following circumstances:

- As a pre-acquisition assessment on behalf of either a purchaser or a vendor, when a property is to be sold
- As a pre-development assessment, when a property or area of land is to be redeveloped, or the land use has changed e.g. from a factory to a residential subdivision
- As a pre-development assessment of greenfield sites, to establish baseline conditions and assess environmental, geological and hydrological constraints to the development of e.g. a landfill
- As an audit of the environmental effects of previous and present site usage

Each circumstance requires a specific approach to the assessment of soil and groundwater contamination. In all cases the objective is to identify and if possible quantify the risks that unrecognised contamination poses to the ongoing proposed activity. Such risks may be both financial (clean-up costs or limitations in site use) and physical (health risks to site users or the public).

ENVIRONMENTAL SITE ASSESSMENT LIMITATIONS

Although information provided by an environmental site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination within a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which did not show signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant that may occur; only the most likely contaminants are screened.

AN ENVIRONMENTAL SITE ASSESSMENT REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

In the following events and in order to avoid cost problems, you should ask your consultant to assess any changes in the conclusion and recommendations made in the assessment:

- When the nature of the proposed development is changed e.g. if a residential development is proposed, rather than a commercial development
- When the size or configuration of the proposed development is altered e.g. if a basement is added
- When the location or orientation of the proposed structure is modified
- When there is a change of land ownership, or
- For application to an adjacent site

ENVIRONMENTAL SITE ASSESSMENT FINDINGS ARE PROFESSIONAL ESTIMATES

Site assessment identifies actual sub-surface conditions only at those points where samples are taken, when they are taken. Data obtained from the sampling and subsequent laboratory analyses are interpreted by geologists, engineers or scientists and opinions are drawn about the overall sub-surface conditions, the nature and extent of contamination, the likely impact on any proposed development and appropriate remediation measures. Actual conditions may differ from those inferred, because no professional, no matter how qualified and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, however, steps can be taken to help minimise the impact. For this reason site owners should retain the services of their consultants throughout the development stages of the project in order to identify variances, conduct additional tests that may be necessary and to recommend solutions to problems encountered on site.

Soil and groundwater contamination is a field in which legislation and interpretation of legislation by government departments is changing rapidly. Whilst every attempt is made by Geotechnique Pty Ltd to be familiar with current policy, our interpretation of the investigation findings should not be taken to be that of the relevant authority. When approval from a statutory authority is required for a project, approval should be directly sought.

STABILITY OF SUB-SURFACE CONDITIONS

Sub-surface conditions can change by natural processes and site activities. As an environmental site assessment is based on conditions existing at the time of the investigation, project decisions should not be based on environmental site assessment data that may have been affected by time. The consultant should be requested to advise if additional tests are required.

ENVIRONMENTAL SITE ASSESSMENTS ARE PERFORMED FOR SPECIFIC PURPOSES AND CLIENTS

Environmental site assessments are prepared in response to a specific scope of work required to meet the specific needs of specific individuals e.g. an assessment prepared for a consulting civil engineer may not be adequate to a construction contractor or another consulting civil engineer.

An assessment should not be used by other persons for any purpose or by the client for a different purpose. No individual, other than the client, should apply an assessment, even for its intended purpose, without first conferring with the consultant. No person should apply an assessment for any purpose other than that originally contemplated, without first conferring with the consultant.

MISINTERPRETATION OF ENVIRONMENTAL SITE ASSESSMENTS

Costly problems can occur when design professionals develop plans based on misinterpretation of an environmental site assessment. In order to minimise problems, the environmental consultant should be retained to work with appropriate design professionals, to explain relevant findings and to review the adequacy of plans and specifications relative to contamination issues.

LOGS SHOULD NOT BE SEPARATED FROM THE REPORT

Borehole and test pit logs are prepared by environmental scientists, engineers or geologists, based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these would not be redrawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however, contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. Should this occur, delays and disputes, or unanticipated costs may result.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of sub-surface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations, such as contractors.

READ RESPONSIBILITY CLAUSES CLOSELY

An environmental site assessment is based extensively on judgement and opinion; therefore, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. In order to aid in prevention of this problem, model clauses have been developed for use in written transmittals. These are definitive clauses, designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment and you are encouraged to read them closely. Your consultant will be happy to give full and frank answers to any questions you may have.