

Preliminary Site Investigation Proposed Dwelling Site

Location:

Lot 2 DP 880732
51 Rock Road
Bungalora NSW 2486

Prepared for:

Claire & Dainen Keogh

Report No:

HMC2020.155.01

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RE: Lot 2 DP 880732, 51 Rock Road, Bungalora, NSW, 2486.

HMC Environmental Consulting Pty Ltd is pleased to present our report for a Preliminary Site Investigation for the abovementioned site.

We trust this report meets with your requirements. If you require further information please contact HMC Environmental Consulting directly on the numbers provided.

Yours sincerely



Helen Tunks
(B.App.Sc.Env.Hlth)

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EXECUTIVE SUMMARY

Background

A proposed dwelling and shed with studio is to be located on an existing rural property at 51 Rock Road, Bungalora, NSW. To support a development application and, meet the requirements of State Environmental Planning Policy No 55 *Remediation of Land*, a site contamination assessment is required.

HMC Environmental Consulting (HMC) was commissioned by Planit Consulting, on behalf of the client, to undertake the required investigation and assess the proposed dwelling site for potential site contamination. A Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection, indicated a banana plantation had occurred within the vicinity of the proposed dwelling site. Agrichemical use associated with this former land use is a potentially contaminating activity. A Soil and Analysis Quality Plan was developed. The collected samples were assessed for concentrations of contaminants of potential concern (COPC) including organochlorine and organophosphorus pesticides and metals.

Objectives

The objectives of the Preliminary Site Investigation are to:

1. Assess the current and former land use on and around the proposed dwelling site for potentially contaminating activities.
2. If potentially contaminating activities are identified, undertake a preliminary soil investigation across the area of concern (AOC) to assess the suitability of the proposed dwelling site for the proposed residential land use.

Scope of Works

The scope of work undertaken during the investigation included the following:

- A desktop assessment of current and former land use including search of available records and interviews with persons associated with the site.
- A detailed site inspection.
- Preparation of a sampling and analysis quality plan (SAQP) based on the results of the review of available information, and the site inspection.
- Laboratory analysis of 8 soil samples for COPC using a National Association of Testing Authorities (NATA) certified laboratory.
- Laboratory analysis of 2 QA/QC soil samples (duplicate & triplicate) for COPC using a National Association of Testing Authorities (NATA) certified laboratory
- Preparation of a Preliminary Site Investigation report including:
 - summary of available land use history information, interviews, and results of the site inspection.
 - site plan showing sampling locations
 - interpretation of laboratory results against relevant guidelines
 - suitability of site for current and proposed land use
 - conclusions and recommendations

Results Summary

The Soil and Analysis Quality Plan was implemented and all COPC results were below the investigation criteria.

All organochlorine, organophosphorus and cadmium results were below laboratory level of reporting (LOR) and, therefore, below the investigation criteria.

Metal results are typical of background concentrations and are all below the investigation criteria.

Conclusion/Recommendations Summary

The Preliminary Site Investigation conclusions are based on the information described in this report and appendices, and should be read in conjunction with the complete report, including Section 12 Limitations.

A review of available information and a detailed site inspection indicated historic land use including a possible banana plantation and cropping, potentially contaminating activities, have occurred on or around the proposed dwelling site.

The results from the laboratory analysis of samples collected during the implementation of the Soil and Analysis Quality Plan were all below the Health Investigation Levels for residential "A" land use (HIL A) as stated in Table 1A (1) and the Ecological Investigation Levels (EIL) as stated in Tables 1B(1)-1B(5) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater within the National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013.

In relation to potential site contamination associated with the current and former land use, the proposed dwelling site to be located at Lot 2 DP 880732, 51 Rock Road, Bungalora, NSW as shown in Appendix 2 of this report, would be considered suitable for the proposed residential land use.

In relation to potential site contamination associated with the current and former land use, no further investigation or remediation is required for the proposed dwelling site to be located at Lot 2 DP 880732, 51 Rock Road, Bungalora, NSW as shown in Appendix 2 of this report.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	2
Background.....	3
Objectives	3
Scope of Works.....	3
Results Summary	4
Conclusion/Recommendations Summary	4
1 INTRODUCTION.....	8
1.1 Background.....	8
1.2 Project Description	8
1.3 Objectives	8
1.4 Scope of Works.....	8
2 SITE INFORMATION	9
2.1 Site Identification.....	9
3 SITE HISTORICAL REVIEW.....	10
3.1 Aerial Photograph Interpretation.....	10
3.2 Historic Parish Maps & Topographic Maps	11
4 SITE INSPECTION.....	11
4.1 Summary of Site Conditions	11
4.2 Site photographs.....	11
4.3 Possible Contaminant Sources and Potential Off-site Effects.....	12
4.4 Site layout.....	12
5 IDENTIFIED AREAS OF ENVIRONMENTAL CONCERN	12
5.1 Identified Contaminants of Potential Concern.....	12
6 APPLICABLE INVESTIGATION LEVELS	12
6.1 Soil	12
6.2 Relevant Environmental Media	14
7 CONCEPTUAL SITE MODEL.....	14
7.1 Investigation Criteria	15
7.2 Data Quality Objectives	15
8 SAMPLING AND ANALYSIS PLAN AND SAMPLING METHODOLOGY	18
8.1 Sampling, analysis and data quality objectives	18
8.2 Soil Sampling And Analysis Program	18
9 SOIL INVESTIGATIONS.....	19
9.1 Fieldwork	19
9.2 Analytical Testing.....	19
9.3 Sampling Methodology and Quality Control	19
9.4 Primary and Replicate Results	22
9.5 QA/QA Laboratory Data Review.....	23
9.5.1 Relative percent difference (RPD)	23
9.5.2 Statistical Analysis.....	23
9.6 Soil Investigation Conclusions	23
10 RESULTS OF ENVIRONMENTAL INVESTIGATIONS.....	23
10.1 Site specific Geology and Hydrogeology	23
10.2 Analytical Results.....	23
10.3 Completed Conceptual Site Model.....	23
11 CONCLUSIONS AND RECOMMENDATIONS	24
12 LIMITATIONS.....	25
13 REFERENCES.....	26
14 GLOSSARY	27
15 APPENDICES.....	29
Appendix 1 Location Map.....	29
Appendix 2 Sampling Locations – Proposed Dwelling Site.....	30
Appendix 3 Geology and Soil Landscape	31

Appendix 4	Cattle Dip Sites (TSC GIS)	32
Appendix 5	Historic Aerial Photography	33
Appendix 6	Historic Topographical Maps	38
Appendix 7	Historic Parish Maps	40
Appendix 8	Zone Map	42
Appendix 9	Site Photos	43
Appendix 10	Human Health Investigation Levels	44
Appendix 11	Laboratory Results Summary	46
Appendix 12	Chain of Custody	47
Appendix 13	Laboratory Result Certificates	48

LIST OF TABLES

Table 1 - Site Identification Summary	9
Table 2 – Site Characteristics	9
Table 3 – Aerial Photography Summary	10
Table 4 - Statutory Searches	11
Table 5 - Historic Parish and Topographic Map Summary	11
Table 6 - Site Features Indicating Potential Contamination	12
Table 7 - List of Potential Contaminants of Concern and Areas of Potential Concern	12
Table 8 - Investigation Criteria (Soil & Sediment)	14
Table 9 – Data Quality Indicators	17
Table 10 – Sampling Design	18
Table 11 – Sample locations and compositing details	19
Table 12 – Data Quality Indicators	20
Table 13 – Sampling Design Summary	21
Table 14 – Laboratory Results Summary	22
Table 15 - Environmental Investigation Levels	22

LIST OF FIGURES

Figure 1 - Surrounding Area (Source: Google 2020)	29
Figure 2 - Geology Map (Source dipnsw.gov.au)	31
Figure 3 – Soil Landscape Map (Source: http://www.environment.nsw.gov.au/eSpadeWebApp/)	31
Figure 4 - Cattle Dip Sites, marked by red squares (TSC GIS)	32
Figure 5 – 1954 (Geoscience Australia)	33
Figure 6 – 1962 (TSC GIS)	33
Figure 7 – 1970 (TSC GIS)	34
Figure 8 – 1991 (NSW Gov)	35
Figure 9 – 1996 (TSC GIS)	35
Figure 10 – 1997 (NSW Gov)	36
Figure 11 – 2003 (Google Earth)	36
Figure 12 – 2011 (Google Earth)	37
Figure 13 – 2017 (Google Earth)	37
Figure 14 - Topographical Map Extract (Murwillumbah) 1976	38
Figure 15 - Topographical Map Extract (Murwillumbah) 2002	38
Figure 16 – Topographical Map Extract (Bilambil) 2016	39
Figure 17 – Topographical Map Extract (Murwillumbah) 2016	39
Figure 18 – Parish Map Extract 1894	40
Figure 19- Parish Map 1959	40
Figure 20- Charting Map 1971	41
Figure 21 – NSW Legislation Zone Plan	42

Abbreviations/acronyms

ACM	Asbestos containing material
ANZECC	Australian and New Zealand Environment and Conservation Council
AOC	Area of concern
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
AS	Australian Standard
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 (amended 2013)
PCOC	Potential Contaminant of Concern
CLM Act	<i>Contaminated Land Management Act 1997</i>
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the environment
CSM	Conceptual site model
DQO	Data quality objective
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ERA	Environmental Risk Assessment
HIL	Health investigation Level
HMC	HMC Environmental Consulting
LOR	Laboratory level of reporting
mBGL	Metres below ground level
MNA	Monitored natural attenuation
OEHS	[NSW] Office of Environment and Heritage
PAH	Polycyclic aromatic hydrocarbon
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/quality control
SAQP	Sampling and analysis quality plan
Site	Lot 2 DP 880732, 51 Rock Road, Bungalora, NSW
TCLP	Toxicity Characteristic Leaching Procedure

1 INTRODUCTION

1.1 Background

A proposed dwelling and shed with studio is to be located on an existing rural property at 51 Rock Road, Bungalora, NSW. To support a development application and, meet the requirements of State Environmental Planning Policy No 55 *Remediation of Land*, a site contamination assessment is required.

HMC Environmental Consulting (HMC) was commissioned by Planit Consulting, on behalf of the client, to undertake the required investigation and assess the proposed dwelling site for potential site contamination. A Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection, indicated a banana plantation had occurred within the vicinity of the proposed dwelling site. Agrichemical use associated with this former land use is a potentially contaminating activity. A Soil and Analysis Quality Plan was developed. The collected samples were assessed for concentrations of contaminants of potential concern (COPC) including organochlorine and organophosphorus pesticides and metals.

1.2 Project Description

A proposed four bedroom dwelling would be located on an elevated knoll on an existing rural property. The land slopes away from the dwelling with drainage ultimately directed via overland flow towards the Tweed River approximately 3.4 km distant. Intensive agriculture, that appears to be a banana plantation was situated on and around the proposed dwelling site after 1954 but prior to 1970. There are currently no structures located on the site.

1.3 Objectives

The objectives of the Preliminary Site Investigation are to:

1. Assess the current and former land use on and around the proposed dwelling site for potentially contaminating activities.
2. If potentially contaminating activities are identified, undertake a preliminary soil investigation across the area of concern (AOC) to assess the suitability of the proposed dwelling site for the proposed residential land use.

1.4 Scope of Works

The scope of work undertaken during the investigation included the following:

- A desktop assessment of current and former land use including search of available records and interviews with persons associated with the site.
- A detailed site inspection.
- Preparation of a sampling and analysis quality plan (SAQP) based on the results of the review of available information, and the site inspection.
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- Preparation of a Preliminary Site Investigation report including:
 - summary of available land use history information, interviews, and results of the site inspection.
 - site plan showing sampling locations
 - interpretation of laboratory results against relevant guidelines
 - suitability of site for current and proposed land use
 - conclusions and recommendations

2 SITE INFORMATION

2.1 Site Identification

Table 1 - Site Identification Summary

Street Address	51 Rock Road Bungalora NSW
Allotment size	4.14 Ha
Allotment Description	Lot 2 DP 880732
Property No.	41342
Local Government	Tweed Shire
Parish	Terranora
County	Rous
Zoning	RU2 Rural Landscape
Land use - Existing	Rural
Land use - Proposed	Rural residential
Site Services	Power
Surrounding land uses	Rural residential
Closest Sensitive Environment	Drainage lines generally discharge into the Tweed River via overland, located approximately 3.4km downstream.

Table 2 – Site Characteristics

Topography <i>NSW Land & Property Information (2016)</i> <i>1:25000 9541-1S Bilambil GeoPDF</i> <i>Topographic Map</i>	The current topographic map indicates the southern portion of the property is mapped as <i>Open forest 50-80% crown cover</i> land use. No structures are shown on the site.
Regional Geology (Hashimoto et al 2008)	Bedrock geology tertiary volcanic (Tv): rhyolite, trachyte, gabbro & syenite.
Soil Landscape (Morand, 1996) https://www.environment.nsw.gov.au/eSpade2Webapp	Carool (ca) soil landscape (Expected) Well drained Krasnozems on upper slopes and crests, Well drained chocolate soils on slopes and imperfectly drained brown earths elsewhere
Australian Soil Classification https://www.environment.nsw.gov.au/eSpade2Webapp	Ferrosols Soils with B2 horizons which are high in free iron oxide, and which lack strong texture contrast between A and B horizons These soils are almost entirely formed on either basic or ultrabasic igneous rocks, their metamorphic equivalents, or alluvium derived therefrom. Although these soils do not occupy large areas in Australia, they are widely recognised and often intensively used because of their favourable physical properties.
Site Drainage	The proposed dwelling site is located on well-drained, elevated land sloping generally north east.
Regional Hydrogeology http://tweedsc.maps.arcgis.com/apps/webappviewer	Groundwater vulnerability – Site is mapped as generally moderately high throughout with the south-eastern corner mapped as moderately low.
Groundwater Database Search http://allwaterdata.water.nsw.gov.au/water.stm	The online NSW Office of Water groundwater mapping shows a registered groundwater (GW073598) bore lying within the property boundary, approximately 50m from the proposed dwelling site.

3 SITE HISTORICAL REVIEW

A review of the title information via the online Land and Property Information portal on 9th September 2020 provides the following information:

Folio Description	Date of Folio	Date of Search	Ownership Details
2/880732	20/4/2020	09/09/2020	Dainen Keogh Claire Louise Keogh As joint tenants

3.1 Aerial Photograph Interpretation

A summary of the available historic aerial photography is shown in table 3.

Table 3 – Aerial Photography Summary

Year	Source	Comments	Areas of Potential Concern Yes/No
1954	Geoscience Australia	No structures visible. Site generally cleared. Some native vegetation in the south-east. Land use appears to be grazing or dairying.	NO
1962	Tweed Shire Council GIS	No structures visible within property boundary. Native vegetation visible on the southern part of site. Possible banana plantation can be seen covering northern part of site including the proposed dwelling site.	YES
1970		No structures visible. Possible cropping (fallow) can still be seen within the north eastern corner of site. Native vegetation similar to 1962.	YES
1987		Dwelling site clear of banana plantation now visible in south-western and western part of site. Only remnant native vegetation/re-growth visible on southern part of site	NO
1996		No structures. Site appears to be fallow with no fencing visible. Small patch of native vegetation in southern area. Clearing on property to east for future dwelling	NO
2003-2010	Google Earth	Similar to 1996. No structures on site. Dwellings now located east and north of site.	NO
2011		Similar to 2010 except an access track now visible on the western part of the site extending north.	NO
2012-2017		Similar to 2011, with access track less visible	NO

<http://tweedsc.maps.arcgis.com/apps/webappviewer>

Table 4 - Statutory Searches

Search	Comment
NSW EPA Contaminated Land Public Record http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx	No records (orders, notices) for the site were discovered
Australian Department of Defence Unexploded Ordnance Contaminated Sites http://www.defence.gov.au/uxo/where_is_uxo/UXOSearch.asp?State=NSW	No UXO sites are located in Tweed Shire
Cattle dip site locator http://www.dpi.nsw.gov.au/agriculture/livestock/health/specific/cattle/ticks/cattle-dip-site-locator TSC GIS https://tweedsc.maps.arcgis.com/apps/webappviewer	The nearest mapped cattle dip site, (Bungalora, decommissioned) is approximately 800m east of the proposed dwelling site south-west of the property.

3.2 Historic Parish Maps & Topographic Maps

A summary of the available historic parish and topographic mapping information is shown in table 5.

Table 5 - Historic Parish and Topographic Map Summary

Search	Comment
Historic parish maps 1894, 1903, 1913, 1918, 1929, 1924, 1935, 1959 and 1971 http://images.maps.nsw.gov.au/pixel.htm	Maps do not record land use. Maps 1984 to 1971 show the site is part of the larger Portions 194 (107 acres) that extends north and south of the property.
Topographic maps <i>Department of Lands (1976) 1:25000 9541-II-N Murwillumbah 1st Ed. Topographic Map</i> <i>NSW Land & Property Information (2002) 1:25000 9641-2N Murwillumbah 3rd Ed. Topographic Map</i> <i>NSW Land & Property Information (2016) 1:25000 9641-2N Murwillumbah GeoPDF Topographic Map</i> <i>Bilambil 9541-1S 1:25000 Geopdf Topographic map</i> Department of Finance Services and Innovation (2016)	No structures shown. No cropping or orchards shown. Generally mapped as <i>scattered timber</i>. No structures shown. No cropping or orchards shown. Generally mapped as <i>Open forest 50-80% crown cover</i> land use No structures shown. No cropping or orchards shown. Generally mapped as <i>Open forest 50-80% crown cover</i> land use No structures shown. No cropping or orchards shown. Generally mapped as <i>Open forest 50-80% crown cover</i> land use

4 SITE INSPECTION

4.1 Summary of Site Conditions

A site inspection was completed by H Tunks & T Richards of HMC on 3rd August 2020. The proposed dwelling site would be located near a knoll with land falling away in all directions. Groundcover is native and exotic grasses. There are no structures on the site, and overland flow drainage would eventually discharge into the Tweed River, approximately 3.4km distant

4.2 Site photographs

See Appendix 9.

4.3 Possible Contaminant Sources and Potential Off-site Effects

COPC associated with historical agrichemical use due to banana plantations and cropping located within the vicinity of the proposed dwelling site. No off-site impacts.

4.4 Site layout

The details of the site inspections are shown in table 6.

5 IDENTIFIED AREAS OF ENVIRONMENTAL CONCERN

Table 6 - Site Features Indicating Potential Contamination

Features of Contamination	Comments
Disturbed, discoloured or stained soil	No discoloured or stained soil noted.
Disturbed or distressed vegetation	No disturbed or distressed vegetation.
Surface water quality	No surface water present near the proposed dwelling site. Elevated, well-drained site.
Agrichemical Storage/Use	None recorded during site inspection.
Other chemical/fuel storage	None recorded
Waste storage	None recorded.
Asbestos Waste or Use in Structures	No structures
Fill from unapproved source	None recorded.
Other	Nil

5.1 Identified Contaminants of Potential Concern

The proposed dwelling is to be located on or near an area which was historically subject to banana plantation or perhaps intensive cropping. The COPC would be constituents of agricultural chemicals (pesticides and herbicides) that do not degrade (arsenic, lead, cadmium) or have extended degradation times (organochlorine chemicals).

Table 7 - List of Potential Contaminants of Concern and Areas of Potential Concern

PCOC	Description and common relationship	Hotspot/AOPC
Organochlorine and organophosphorus pesticides/herbicides (OCP/OPP)	Pest control, weed control	Banana plantation and perhaps cropping located near proposed dwelling site prior to 1970.
Heavy metals (arsenic (As), cadmium(Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg)) Laboratory heavy metal 8 suite completed.	Pest control, fungal control, weed control & fertiliser contaminants	

6 APPLICABLE INVESTIGATION LEVELS

6.1 Soil

The proposed land use would increase the number of persons residing on the property. Currently the land is used as a rural property. It is proposed to construct a new dwelling on the property.

The applicable exposure settings for the proposed dwelling are as follows:

HIL A – residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children's day care centres, preschools and primary schools.

Ecological investigation levels (EILs) for the protection of terrestrial ecosystems have been derived for common contaminants in soil based on a species sensitivity distribution (SSD) model developed for Australian conditions. EILs have been derived for a number of contaminants including arsenic, chromium, copper, nickel, zinc, and lead.

Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios. For the purposes of this report the urban residential/public open space EIL has been adopted.

The relevant soil investigation criteria under *Schedule B1 Guideline on Investigation Levels for Soil and Groundwater National Environment Protection (Assessment of Site Contamination) Measure 1999* (April 2013) adopted are:

- **Health Investigation Level A for Residential - HIL A.**
- **Ecological Investigation Level - urban residential areas and public open space.**

The following guidance notes were considered in the preparation of this report

- *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (April 2013), EPHC 2013, Canberra.

(Schedule B)

- *(1) Guidelines on the Investigation Levels for Soil and Groundwater, and*
- *(2) Guidelines on Site Characterisation*

In NSW the Measure is now being implemented by way of endorsement under section 105 of the Contaminated Land Management Act 1997. This will provide expanded technical guidance to site auditors, contaminated land consultants, planning authorities and the public when assessing a contaminated site.

- **NSW EPA (1995) *Sampling Design Guidelines*** – were followed during design of the sampling and analysis plan and predetermination of data quality objectives (DQOs).
- **NSW EPA (1997a) *Guidelines for Consultants Reporting on Contaminated Sites*** – were followed throughout the investigations and during preparation of this report.
- **NSW EPA (1997b) *Contaminated Sites - Guidelines for Assessing Former Banana Plantations*** were used to assist in sampling and analysis plan and preliminary screening criteria
- **NSW EPA (2005) *Contaminated Sites - Guidelines for Assessing Former Orchards and Market Gardens*** – were used to assist in sampling and analysis plan and preliminary screening criteria
- **SEPP 55 (1998) *State Environmental Planning Policy No. 55 – ‘Remediation of Land*** – provided guidance on project objectives’

Table 8 - Investigation Criteria (Soil & Sediment)

Metals/Metalloids (mg/kg)	HIL A ⁽¹⁾	EIL ⁽²⁾
Arsenic	100	100
Chromium	100 (IV)	400 (III)
Copper	6000	210
Nickel	400	270
Zinc	7400	270
Cadmium	20	
Lead	300	1100
Mercury (inorganic)	40	
Organochlorine/Organophosphorus Chemicals (mg/kg)		
Chlordane	50	
Dieldrin + Aldrin	6	
DDT+DDD+DDE	240	
Heptachlor	6	
Chlorpyrifos	160	
Endosulfan	270	
Endrin	10	

- (1) Health Investigation Levels for residential "A" land use (HIL A) as stated in Table 1A (1) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013
- (2) Ecological Investigation Levels (EILs) for Commercial/Industrial as stated in Tables 1B(1)-1B(5) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013

6.2 Relevant Environmental Media

Based on the site history, topography and soils, the relevant environmental media would be the surface soil generally across the proposed dwelling site. The land surface is covered by lawn grass species and slopes moderately south.

7 CONCEPTUAL SITE MODEL

POTENTIAL SOURCE	PATHWAY	EXPOSURE ROUTE	RECEPTOR
Former plantation/cropping	Surface water runoff	Chemical/sediment entering local water ways	Ecological receptors
	Exposed surface soil	Dermal contact to exposed soil during earthworks, dwelling occupation and recreational use	Site worker, Occupier, Visitor
	Atmospheric dispersion	Inhalation of soil exposed during earthworks and in exposed bare soil areas	
	Home grown produce	Consumption of home grown produce	Occupier/Visitor
	Leaching to groundwater	Groundwater movement off-site to beneficial users or ecological receptors	Beneficial users/Ecological receptor

7.1 Investigation Criteria

The investigation criteria are based on the investigation and screening levels provided in *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013 (ASC NEPM).

The Health Investigation Level deemed relevant for the proposed sensitive residential land use also includes consumption of home grown produce in clayey soil. The Ecological Investigation Level is relevant within 2m of the ground surface.

Groundwater was expected to be at >5m depth on this elevated site with clayey soil. No groundwater investigation was completed during this preliminary investigation. If surface soil investigation recorded elevated COPC, then the groundwater regime would be further assessed and, if warranted, groundwater investigation including collection of representative samples would be implemented.

ASC NEPM (2013) recommends that “at the very least, the maximum and the 95% UCL of the arithmetic mean contaminant concentration should be compared to the relevant Tier 1 screening criteria” and also that the results should also meet the following criteria:

- the standard deviation of the results should be less than 50% of the relevant investigation or screening level, and
- no single value should exceed 250% of the relevant investigation or screening level”.

The 95% UCL of the arithmetic mean provides a 95% confidence level that the true population mean will be less than, or equal to, this value. The 95% UCL is a useful mechanism to account for uncertainty in whether the data set is large enough for the mean to provide a reliable measure of central tendency.

Where the number of primary samples collected is <10, statistical means are not reliable. For this investigation the maximum concentration was used.

7.2 Data Quality Objectives

The purpose of the DQO process is to ensure data collection activities are focussed on:

- Collecting appropriate information needed to make decisions; and
- Answering relevant questions leading up to such decisions.

The DQO process comprises seven steps, summarised as follows:

1. State the problem;
2. Identify the decision;
3. Identify the inputs into the decision;
4. Define the boundaries on the investigation;
5. Develop a decision rule;
6. Specify limits on decision errors; and
7. Optimise the design for obtaining data.

Step 1 State the Problem

The identified and potential environmental and human health risks on the site are not fully understood, as potential remains for ‘hotspot’ contamination to be present onsite in area of chemical storage, and broadacre contamination across cultivated areas.

Step 2 Identify the Decisions/Goals

- Have all potential Areas of Environmental Concern identified during the site inspection and historical investigations been adequately investigated?
- Have all potential exposure pathways been appropriately assessed?

- Do complete exposure pathways exist which are currently posing a risk to human health and the environment?
- Has a reasonable amount of soil sampling been undertaken to collect sufficient data in order to characterise the site?
- Is the data sufficient to compile a Remediation Action Plan?
- Are the conclusions and recommendations derived as a result of assessment work completed defensible?

Step 3 Identify Information Inputs

- Soil sampling program across the cultivated areas of the site
- Soil sampling data including: soil screening results, bore logs, tabulated concentrations of the COPC compared against the adopted assessment criteria and a figure showing spatial distribution of the sample locations and exceedances, as required;
- Updated CSM.

Step 4 Define the Study Boundaries

- Investigation area (~2000m² as recommended by Tweed Shire Council) is confined to the proposed dwelling site and immediate surrounds as shown in Appendix 2 in this report.
- Temporal boundary is the development application submission date

Step 5 Develop the Decision Rule

The decision rules adopted for the decisions listed in Step 2 are as follows:

- If concentrations of the COPC are reported above the adopted assessment criteria, then further assessment, management or remediation will be required;
- If the bounds (north, south, east and west) of the soil contamination can be mapped without unknowns and all potentially impacted areas can be identified, then the contamination will be considered adequately delineated;
- If no data gaps are identified in the CSM then it will be considered that the potential exposure pathways have been adequately assessed and potential complete exposure pathways identified;

Step 6 Specify limits on decision errors

With respect to the decision rules presented in Step 5, decision errors would occur as a result of presenting concentrations of the COPC or other data which are not representative of site conditions. This may lead to non-contaminated land being remediated/managed as contaminated, contaminated land being considered suitable for use without remediation/management or incorrect management/remediation methods applied. Decision errors may be a result of the following:

- Execution of an incorrect sampling plan;
- Field sampling errors;
- Failure to identify preferential pathways;
- Not following QA/QC procedures;
- Use of non NATA accredited analytical techniques;
- Errors made by the analytical laboratories;
- Transcriptions errors in laboratory result summary tables;
- Applying incorrect methods for statistical analysis of results; and
- Adoption of assessment criteria which does not best represent the site's land use.

The limits on decision errors are best defined by establishing a framework for the assessment of data quality, including data quality indicators. The data quality assessment process will be used to assess the representativeness of analytical results and the effects of the sampling program on data quality.

Data quality is typically discussed in terms of precision, accuracy, representativeness, comparability and completeness. These are referred to as the PARCC parameters. The PARCC parameters and corresponding data quality indicators are provided in Table 11.

Table 9 – Data Quality Indicators

Data quality indicator	Criteria
Precision	
Laboratory matrix duplicate relative percentage differences (RPDs) within criteria	Limits set by the laboratory: • Soil results <10 times the LOR: No limit • Soil results between 10-20 times the LOR: RPD must lie between 0-50% • Soil results >20 times the LOR: RPD must lie between 0-30%
Field duplicate RPDs within criteria	In accordance with AS4482.1 (2005), PRD results ≥50% will be considered to exceed the data quality objectives (DQO) of the assessment. However, based on industry best practice, RPD results will be discounted if both sample results used to calculate the RPD are below the laboratory's limit of reporting (LOR) or less than 10 times the LOR.
Accuracy	
Matrix spike sample results reported with prescribed limits	Limits set by the laboratory: • Results to be between 70-130%.
Surrogate spike sample results reported with prescribed limits	Limits set by the laboratory: • Recoveries must lie between 50-150%.
Laboratory method blanks reported with prescribed limits	Concentrations of targeted parameters should be below the laboratory's limit of reporting (LOR).
All analysis NATA accredited	Analysis to be completed by a NATA accredited laboratory.
Representativeness	
Samples delivered to laboratory within sample holding times, chilled and with correct preservative	Target temp <4°C. Samples to be submitted to the laboratory within the designated holding times. Different holding times exist for different parameters. Samples to meet the preservation requirements set by the laboratory.
Required number of field duplicates and sample blanks taken	Intra and inter laboratory duplicates are to be collected at a ratio of one duplicate pair per 20 samples. One rinse blank and field blank to be collected per day as required. One trip blank to be collected per cooler where analysis of volatile compounds is proposed.
Sample blanks reported results below detection limits	Concentrations of targeted parameters to be below the laboratory's limit of reporting (LOR).
Samples collected in accordance with regulatory and HMC procedures	Samples to be collected in general accordance with standard operating procedures (SOPs) which are based on applicable regulatory guidance and industry best practice.
Comparability	
Same standard operation procedures (SOPs) applied during each sampling event	The same SOPs to be adopted for each sampling event.
LORs below the adopted assessment criteria	The laboratory's LOR is to be below the adopted assessment criteria.
Qualified sampler	The sampler is to be a Suitably Qualified Person (SQP)
Same type of sample preservation and analysis techniques	The same type of sample preservation and analysis techniques are to be applied to all samples. This information is to be provided within laboratory reports.
Completeness	
All laboratory data	All information provided by the laboratory is to be provided in the final report.

reviewed and presented in the report (i.e. COCs, SRNs, COAs and QCRs)	
All sample results reported	All sample results are to be reported and discussed.
Sample blanks data reported	All sample blank data is to be reported.
Relative percent differences (RPDs) calculated	RPDs to be calculated for all sets of field duplicates.
Laboratory duplicates reported	All laboratory duplicate results are to be reported.
NATA stamp on reports	NATA stamps to be shown on all laboratory reports.

Step 7 Optimise the Design for Obtaining Data

The following will be undertaken to optimise the data collection process:

- Sampling to be undertaken by an appropriately experienced and qualified environmental scientist in accordance with SOP which are based on relevant Australian Standards, guidance documents and industry best practice;
- Laboratory analysis is to be undertaken by a NATA accredited laboratory.

8 SAMPLING AND ANALYSIS PLAN AND SAMPLING METHODOLOGY

8.1 Sampling, analysis and data quality objectives

The following sampling, analysis and data quality objectives have been adopted for this site investigation:

- To collect a minimum number of soil samples typical of the proposed dwelling site to assess that concentrations of COPC meet the soil investigation criteria for the proposed land use.
- To employ quality assurance when sampling, assessing and during evaluation of the subject soils.
- To ensure that decontamination techniques are applied during the sampling procedure and that no cross contamination of samples occurs.

Table 10 – Sampling Design

Proposed Sampling Locations	Depth (mm)	Proposed Samples for Analysis	Proposed Analysis
Systematic surface soil across proposed dwelling site and surrounding area (2000m ²)	0-75	Estimated 8 plus 2 x QA/QC Final sample numbers would depend on site conditions	Total Concentration OCP/OPP arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc

8.2 Soil Sampling And Analysis Program

A sampling and analysis quality plan (SAQP) and a sampling and analysis program were developed to assess the site for COPC associated with historical agrichemical.

As intensive agriculture, that appears to be a banana plantation was situated on and around the proposed dwelling site, a systematic sampling pattern was adopted. Eight sub-samples were collected from an approximate 2000m² area (recommended min area by Tweed Shire Council for residential dwellings) that included the proposed dwelling, using the EPA (2005) guidelines. It is expected that the agrichemical applications associated with the historic plantation/cropping would be representative within the sampling area.

Surface soil sampling was adopted as past agrichemical application would be to the soil surface and the clay soil would generally bind the COPCs. Soil samples were collected at a sampling depth interval of 0-75mm to

maximise dieldrin concentrations in accordance with EPA (1997b) and to assess COPC concentrations throughout the sampling area (Appendix 2).

The following basic measures were undertaken by HMC Environmental Consulting to conform to the minimum standards for field quality assurance and quality control procedures for the samples collected:

- Soil sampling was undertaken by Helen Tunks of HMC Environmental Consulting, with experience in site contamination investigations.
- Clean stainless-steel trowels (8) were used to collect samples from immediately below the surface (0-75mm) using disposable nitrile gloves.
- No decontamination procedures were necessary as dedicated, clean stainless-steel trowels were used for each sampling location.
- Field quality assurance and quality control (QA/QC) protocols implemented included details of collection and analysis of duplicate and triplicate samples.
- Chain of custody documentation was completed.
- The laboratory results and quality assurance and quality control reports including a description of the analytical methods used and reporting for surrogates was also completed.

9 SOIL INVESTIGATIONS

9.1 Fieldwork

Systematic field sampling was conducted by an experienced environmental scientist on 3 August 2020:

Table 11 – Sample locations and compositing details

Table 11 Sample locations and composting details		
Primary Sample	Location	Depth (mm)
RR1A	Eastern portion of 2000m ² sampling area surrounding proposed dwelling site	0-75
RR2A		
RR3A		
RR4A		
RR5A	Western portion of 2000m ² sampling area surrounding proposed dwelling site	
RR6A		
RR7A		
RR8A		

A total of 8 primary soil samples were recovered and placed in laboratory supplied glass jars. The primary samples together with the QA/QC samples (1 duplicate, and 1 triplicate sample) were transported to HMC Environmental Consulting offices and refrigerated. The chilled samples were packaged and sent to ALS Environmental Laboratory for analysis for COPC. As clean dedicated stainless steel trowels were used for each sampling location, no rinsate sample was collected.

9.2 Analytical Testing

Laboratory analytical services were provided by ALS Environmental in Brisbane and Sydney.

9.3 Sampling Methodology and Quality Control

Sampling was undertaken generally in accordance with the SAQP (see section 8).

The laboratory results and quality control reports include a description of the analytical methods used and reporting for surrogates used by ALS Environmental. The results certificates are attached as Appendix 13.

Table 12 – Data Quality Indicators

Data quality indicator	Criteria	Comment
Precision		
Laboratory matrix duplicate relative percentage differences (RPDs) within criteria	Limits set by the laboratory: - Soil results <10 times the LOR: No limit - Soil results between 10-20 times the LOR: RPD must lie between 0-50% - Soil results >20 times the LOR: RPD must lie between 0-30%	Soil results were <10 times the LOR meaning no limit was set or were within the set recovery limits.
Field duplicate RPDs within criteria	In accordance with AS4482.1 (2005), RPD results ≥50% will be considered to exceed the data quality objectives (DQO) of the assessment. However, based on industry best practice, RPD results will be discounted if both sample results used to calculate the RPD are below the laboratory's limit of reporting (LOR) or less than 10 times the LOR.	Field duplicate generally <50% RPD Field triplicate generally <50% RPD
Accuracy		
Matrix spike sample results reported with prescribed limits	Limits set by the laboratory: Results to be between 70-130%.	Matrix spike sample results reported with prescribed limits excluding one nickel result was below (34.6%) the prescribed limits set by the laboratory.
Surrogate spike sample results reported with prescribed limits	Limits set by the laboratory: Recoveries must lie between 50-150%.	Surrogate spike sample results reported with prescribed limits
Laboratory method blanks reported with prescribed limits	Concentrations of targeted parameters should be below the laboratory's limit of reporting (LOR).	Laboratory method blanks reported with prescribed limits
All analysis NATA accredited	Analysis to be completed by a NATA accredited laboratory.	All analysis NATA accredited
Representativeness		
Samples delivered to laboratory within sample holding times, chilled and with correct preservative	Target temp <4°C. Samples to be submitted to the laboratory within the designated holding times. Different holding times exist for different parameters. Samples to meet the preservation requirements set by the laboratory.	Samples delivered to laboratory within sample holding times, chilled and with correct preservative
Required number of field duplicates and sample blanks taken	Intra and inter laboratory duplicates are to be collected at a ratio of one duplicate pair per 20 samples. One rinse blank and field blank to be collected per day as required. One trip blank to be collected per cooler where analysis of volatile compounds is proposed.	Required number of field duplicates and sample blanks taken Dedicated stainless steel trowels (8) so no rinsate required No volatile samples so trip blank required
Sample blanks reported results below detection limits	Concentrations of targeted parameters to be below the laboratory's limit of reporting (LOR).	Sample blank not required
Samples collected in accordance with regulatory and HMC procedures	Samples to be collected in general accordance with standard operating procedures (SOPs) which are based on applicable regulatory guidance and industry best practice.	Samples collected in accordance with regulatory and HMC procedures
Comparability		
Same standard operation procedures (SOPs)	The same SOPs to be adopted for each sampling event.	Same standard operation procedures (SOPs) applied during each sampling event

applied during each sampling event		
LORs below the adopted assessment criteria	The laboratory's LOR is to be below the adopted assessment criteria.	LORs below the adopted assessment criteria
LORs below the adopted assessment criteria	The sampler is to be a Suitably Qualified Person (SQP)	LORs below the adopted assessment criteria
Same type of sample preservation and analysis techniques	The same type of sample preservation and analysis techniques are to be applied to all samples. This information is to be provided within laboratory reports.	Same type of sample preservation and analysis techniques applied to all samples
Completeness		
All laboratory data reviewed and presented in the report (i.e. COCs, SRNs, COAs and QCRs)	All information provided by the laboratory is to be provided in the final report.	All laboratory data reviewed and presented in the report
All sample results reported	All sample results are to be reported and discussed.	All sample results reported
Sample blanks data reported	All sample blank data is to be reported.	Sample blanks not required
Relative percent differences (RPDs) calculated	RPDs to be calculated for all sets of field duplicates.	Relative percent differences (RPDs) calculated
Laboratory duplicates reported	All laboratory duplicate results are to be reported.	Laboratory duplicates reported
NATA stamp on reports	NATA stamps to be shown on all laboratory reports.	NATA stamp on reports

Table 13 – Sampling Design Summary

Proposed Sample Locations	Proposed Samples for Analysis	Proposed Analysis	Sampling Completed	Final Sample Analysis	Rationale
Former Plantation/Cropping					
Systematic surface soil across proposed dwelling site and surrounding area (2000m ²).	Estimated 8 plus 2 x QA/QC Final numbers would depend on site conditions/ indicators	Total Concentration OCP/OPP arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc	3 August 2020	8 x primary + 2 x QA/QC samples	Systematic sampling as broadacre – no hotspot identified Sampling intensity - Table A EPA (1995) for 2000m ² as preliminary Tier 1 screening only. COPC – OCP/OPP suite includes common pesticides used in agricultural applications. Metals 8 includes common arsenic, lead pesticides + cadmium (fertilizer contaminant). Copper common in fungicides.

9.4 Primary and Replicate Results

The laboratory analysis of the primary samples is summarised in table 14.

All organochlorine, organophosphorus and cadmium results were below laboratory level of reporting (LOR) and, therefore, below the investigation criteria.

Metal results are typical of background concentrations and are all below the investigation criteria.

Table 14 – Laboratory Results Summary

Parameter	Number of primary samples	PQL (mg/kg)	Criteria ⁽¹⁾ (HIL-A) (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
METALS/METALLOIDS						
Arsenic	8	5	100	0	<5-18	5-53
Chromium ⁽²⁾	8	5	100 (VI)	0	17-61	5-56
Copper	8	5	6000	0	13-58	3-412
Nickel	8	5	400	0	15-24	5-38
Zinc	8	5	7400	0	66-131	5-92
Cadmium	8	1	20	0	<1	nd
Lead	8	1	300	0	5-14	5-56
Mercury (inorganic)	8	1	40	0	<0.1-0.1	nd
ORGANOCHLORINE/ORGANOPHOSPHORUS						
Chlordane	8	0.05	50	0	<0.05	
Dieldrin + Aldrin	8	0.05	6	0	<0.05	
DDT+DDD+DDE	8	0.05	240	0	<0.05	
Heptachlor	8	0.05	6	0	<0.05	
Chlorpyrifos	8	0.05	160	0	<0.05	
Endosulfan	8	0.05	270	0	<0.05	
Endrin	8	0.05	10	0	<0.05	

- (1) Health Investigation Levels for residential "A" land use (HIL A) as stated in Table 1A (1) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013
- (2) Total chromium results.

Table 15 - Environmental Investigation Levels

Contaminant	ABC	ACL mg/kg	EIL mg/kg	Range mg/kg	Exceedance
Zinc	Not measured	270	270	66-131	1
Copper		210	210	13-58	0
Chromium		400 (III)	400 (III)	17-61	0
Lead		1100	1100	5-14	0
Arsenic		100	100	<5-18	0
Nickel		270	270	15-24	0

- (1) Ecological Investigation Levels (EILs) for Urban residential/public open space (coarse soil) as stated in Tables 1B(1)-1B(5) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013

9.5 QA/QA Laboratory Data Review

9.5.1 Relative percent difference (RPD)

The results show very good correlation between the primary sample (RR1A) and the field replicate (RR9A). Correlation was within the recommended 30-50% range. The results show good correlation between the RR1A and the triplicate (RR10A) samples.

9.5.2 Statistical Analysis

All total concentration results were below the investigation criteria.

9.6 Soil Investigation Conclusions

The Soil and Analysis Quality Plan was implemented, and all organochlorine, organophosphorus and cadmium results are below laboratory level of reporting (LOR) and, therefore, below the investigation criteria.

Metal results are typical of background concentrations and are all below the investigation criteria.

10 RESULTS OF ENVIRONMENTAL INVESTIGATIONS

10.1 Site specific Geology and Hydrogeology

The investigation recorded clay soil in the upper part of the undisturbed soil profile. No groundwater was intercepted or expected in the upper soil profile. The drainage within the area indicates that the groundwater gradient would likely be in an easterly direction towards the Tweed River.

10.2 Analytical Results

The Soil and Analysis Quality Plan was implemented and all COPC results were below the investigation criteria.

10.3 Completed Conceptual Site Model

POTENTIAL SOURCE	PATHWAY	EXPOSURE ROUTE	RECEPTOR	PATHWAY COMPLETE
Former orchard/cropping & ancillary uses	Surface water runoff	Chemical/sediment entering local water ways	Ecological receptors	COPC results < Investigation criteria
	Exposed surface soil	Dermal contact to exposed soil during earthworks, dwelling occupation and recreational use	Site worker, Occupier, Visitor	
	Atmospheric dispersion	Inhalation of soil exposed during earthworks and in exposed bare soil areas		
	Home grown produce	Consumption of home grown produce	Occupier/Visitor	
	Leaching to groundwater	Groundwater movement off-site to beneficial users or ecological receptors	Beneficial users/Ecological receptor	

11 CONCLUSIONS AND RECOMMENDATIONS

The Preliminary Site Investigation conclusions are based on the information described in this report and appendices, and should be read in conjunction with the complete report, including Section 12 Limitations.

A review of available information and a detailed site inspection indicated with historic land use, including a possible banana plantation and cropping, potentially contaminating activities, have occurred on or around the proposed dwelling site.

The results from the laboratory analysis of samples collected during the implementation of the Soil and Analysis Quality Plan were all below the Health Investigation Levels for residential “A” land use (HIL A) as stated in Table 1A (1) and the Ecological Investigation Levels (EIL) as stated in Tables 1B(1)-1B(5) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013.

In relation to potential site contamination associated with the current and former land use, the proposed dwelling site to be located at Lot 2 DP 880732, 51 Rock Road, Bungalora, NSW as shown in Appendix 2 of this report, would be considered suitable for the proposed residential land use.

In relation to potential site contamination associated with the current and former land use, no further investigation or remediation is required for the proposed dwelling site to be located at Lot 2 DP 880732, 51 Rock Road, Bungalora, NSW as shown in Appendix 2 of this report.

12 LIMITATIONS

Any conclusions presented in this report are relevant to the site condition at the time of inspection and legislation enacted as at date of this report. Actions or changes to the site after time of inspection or in the future will void this report as will changes in relevant legislation.

The findings of this report are based on the objectives and scope of work outlined in Section 1. HMC Environmental has performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees expressed or implied, are given. This report does not comment on any regulatory issues arising from the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the client. The report and conclusions are based on the information obtained at the time of the assessment.

The site history and associated uses, areas of use, and potential contaminants were determined based on the activities described in the scope of work. Additional site information held by the client, regulatory authorities or in the public domain, which was not provided to HMC Environmental or was not sourced by HMC Environmental under the scope of work, may identify additional uses, areas of use and/or potential contaminants. The information sources referenced have been used to determine the site history.

Whilst HMC Environmental has used reasonable care to avoid reliance on data and information that is inaccurate and unsuitable, HMC Environmental is not able to verify the accuracy or completeness of all information and data made available. Further chemicals or categories of chemicals may exist at the sites, which were not identified in the site history, and which may not be expected at the site. The absence of any identified hazardous or toxic materials on the subject land should not be interpreted as a warranty or guarantee that such materials do not exist on the site. If additional certainty is required, additional site history or desktop studies, or environmental sampling and analysis should be commissioned.

The results of this assessment are based upon site inspections and fieldwork conducted by HMC Environmental personnel and information provided by the client. All conclusions regarding the property area are the professional opinions of the HMC Environmental personnel involved with the project, subject to the qualifications made above. HMC Environmental assume no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of HMC Environmental, or developments resulting from situations outside the scope of this project.

SIGNATURE

This report has been prepared by Helen Tunks of HMC Environmental Consulting Pty Ltd.



Helen Tunks
Director

8 September 2020

13 REFERENCES

Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC guidelines) published by the Australian and New Zealand Environment and Conservation Council/National Health and Medical Research Council, January 1992;

Australian Standard AS4482.1-2005 Guide to the sampling and investigation of potentially contaminated soil Part 1 - Non volatile and semi volatile compounds;

ANZECC & ARMCANZ, 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)

EPA 1995, *Contaminated Sites: Sampling Design Guidelines*, Environment Protection Authority, Sydney

EPA 1995, *Contaminated Sites: Guidelines for Assessing Former Orchards and Market Gardens*, Environment Protection Authority, Sydney

NEPC, 2013. National Environment Protection (Assessment of Site Contamination) Measure 1999 *Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater*, National Environment Protection Council Service Corporation, as amended 16 May 2013

OEH 2011, *Guidelines for Consultants Reporting on Contaminated Sites*, Office of Environment and Heritage, Sydney; available at www.epa.nsw.gov.au/clm/guidelines.htm

Olszowy, H., Torr, P., and Imray, P.,(1983) *Trace element concentrations in soils from rural and urban areas of Australia. Contaminated Site Monograph Series 4*. South Australian Health Commission, Adelaide.

14 GLOSSARY

Added contaminant limit (ACL) is the added concentration of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values will be required. ACL values are generated in the process of deriving ecological investigation levels (EILs).

Ambient background concentration (ABC) of a contaminant is the soil concentration in a specified locality that is the sum of the naturally occurring background and the contaminant levels that have been introduced from diffuse or non-point sources by general anthropogenic activity not attributable to industrial, commercial or agricultural activities.

An **area of ecological significance** is one where the planning provisions or land use designation is for the primary intention of conserving and protecting the natural environment. This would include national parks, state parks, and wilderness areas and designated conservation areas.

Bioavailability is a generic term defined as the fraction of a contaminant that is absorbed into the body following dermal contact, ingestion or inhalation.

Bonded asbestos-cement-material (bonded ACM) comprises bonded asbestos containing material which is in sound condition (although possibly broken or fragmented), and is restricted to material that cannot pass a 7 mm x 7 mm sieve. This sieve size is selected as it approximates the thickness of common asbestos cement sheeting and for fragments to be smaller than this would imply a high degree of damage and potential for fibre release.

Conceptual site model (CSM) is a description of a site including the environmental setting, geological, hydrogeological and soil characteristics together with the nature and distribution of contaminants. Potentially exposed populations and exposure pathways are identified. Presentation is usually graphical or tabular with accompanying explanatory text.

Contamination means the condition of land or water where any chemical substance or waste has been added as a direct or indirect result of human activity at above background level and represents, or potentially represents, an adverse health or environmental impact.

Ecological investigation levels (EILs) are the concentrations of contaminants above which further appropriate investigation and evaluation will be required. EILs depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2 m of soil. EILs may also be referred to as soil quality guidelines in Schedules B5b and B5c.

Health investigation levels (HILs) are the concentrations of a contaminant above which further appropriate investigation and evaluation will be required. HILs are generic to all soil types and generally apply to the top 3 m of soil.

Health risk assessment (HRA) is the process of estimating the potential impact of a chemical, biological or physical agent on a specified human population system under a specific set of conditions.

Investigation levels and **screening levels** are the concentrations of a contaminant above which further appropriate investigation and evaluation will be required. Investigation and screening levels provide the basis of Tier 1 risk assessment.

Multiple-lines-of-evidence approach is the process for evaluating and integrating information from different sources of data and uses best professional judgement to assess the consistency and plausibility of the conclusions which can be drawn.

Risk assessment is the process of estimating the potential impact of a chemical, physical, microbiological or psychosocial hazard on a specified human population or ecological system under a specific set of conditions and for a certain timeframe.

Risk management is a decision-making process involving consideration of political, social, economic and technical factors with relevant risk assessment information relating to a hazard to determine an appropriate course of action.

Screening is the process of comparison of site data to screening criteria to obtain a rapid assessment of contaminants of potential concern.

Tier 1 assessment is a risk-based analysis comparing site data with investigation and screening levels for various land uses to determine the need for further assessment or development of an appropriate management strategy.

DRAFT

15 APPENDICES

Appendix 1 Location Map

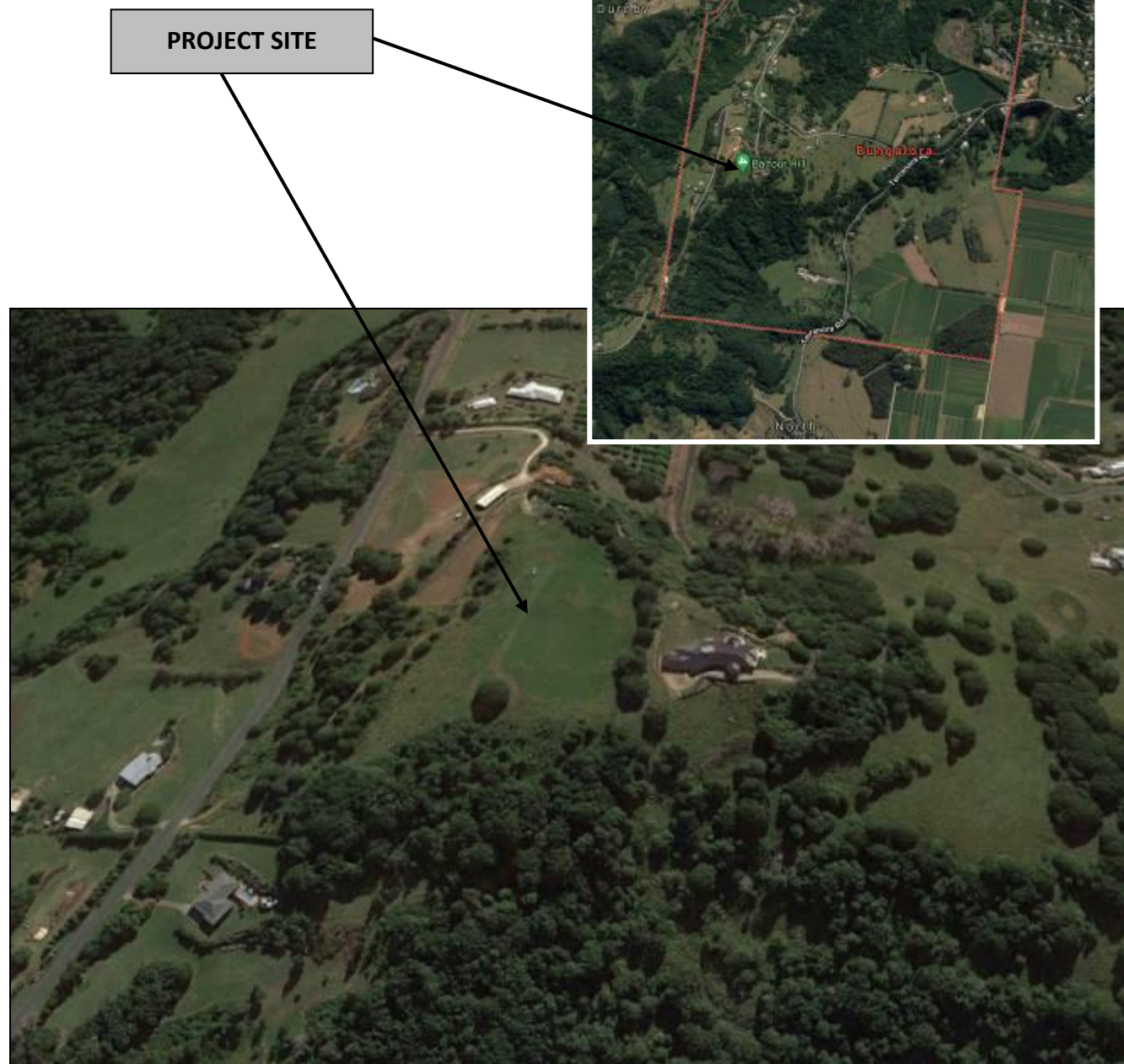
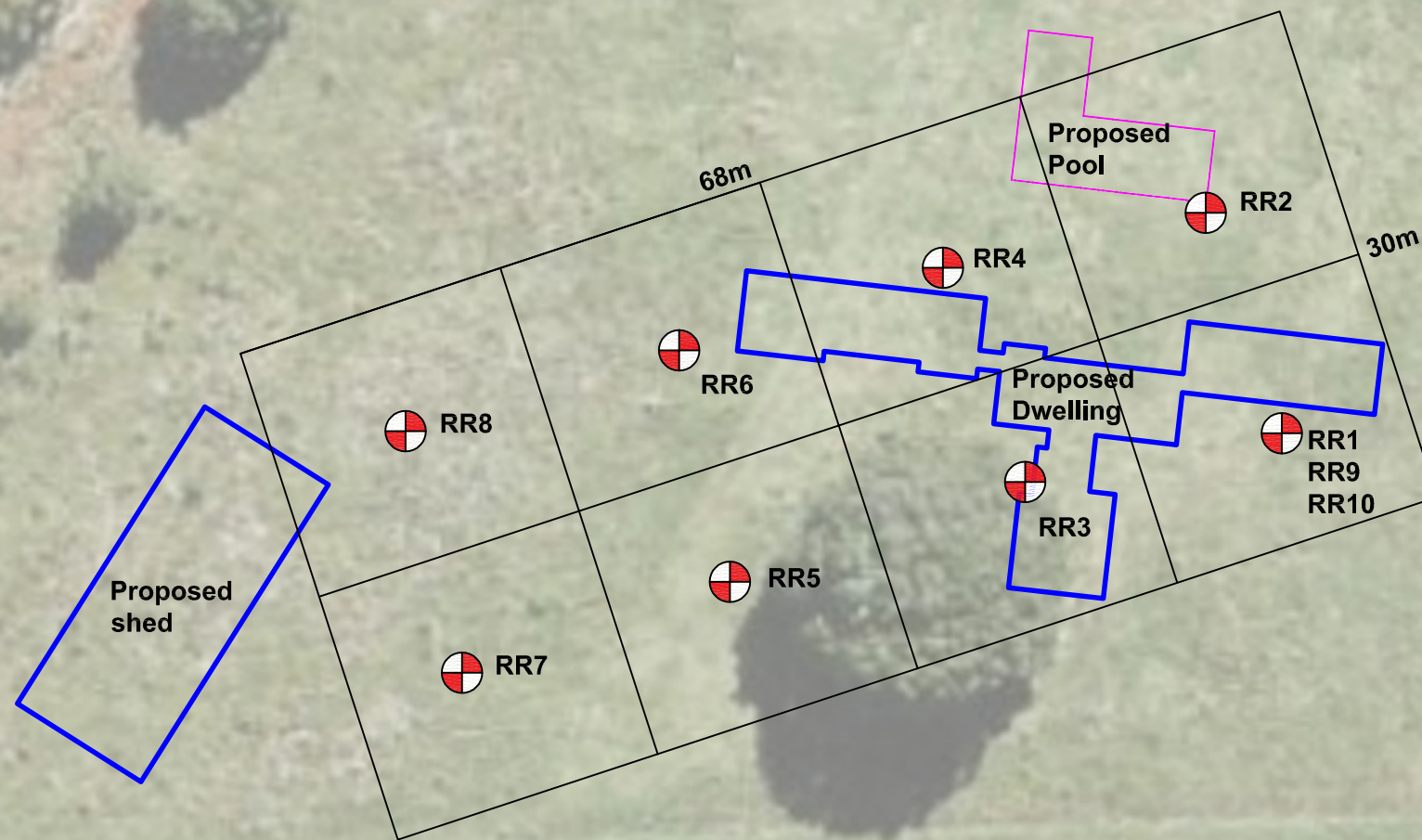


Figure 1 - Surrounding Area (Source: Google 2020)

Appendix 2 Sampling Locations – Proposed Dwelling Site

See next page

DRAFT



HMC Sampling Locations

Scale: 1:400 @ A3

0 10 20 30m



PRELIMINARY SITE INVESTIGATION - SAMPLING LOCATIONS

Lot 2 DP 880732
51 Rock Road Bungalora

Base Drawing Source: Shane Denman Architects Locality Plan HMC Ref: HMC DWG2020.155.01

Job No: 2020.155
Date: September 2020
Revision Date:

Appendix 3 Geology and Soil Landscape

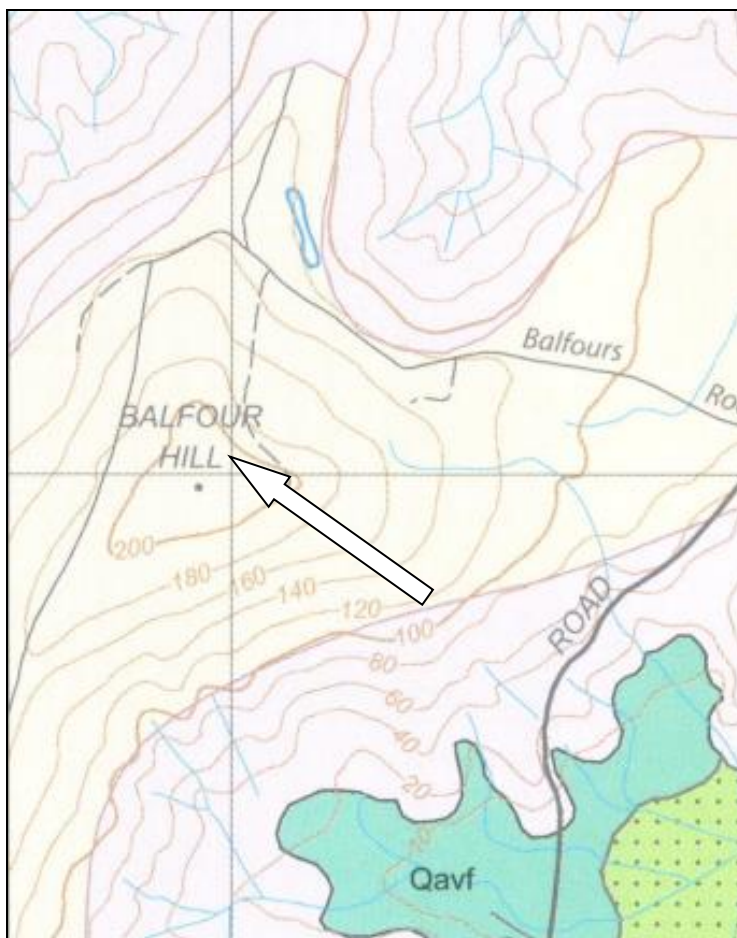


Figure 2 - Geology Map (Source dipsw.gov.au)



Figure 3 – Soil Landscape Map (Source: <http://www.environment.nsw.gov.au/eSpadeWebApp/>)

Appendix 4 Cattle Dip Sites (TSC GIS)

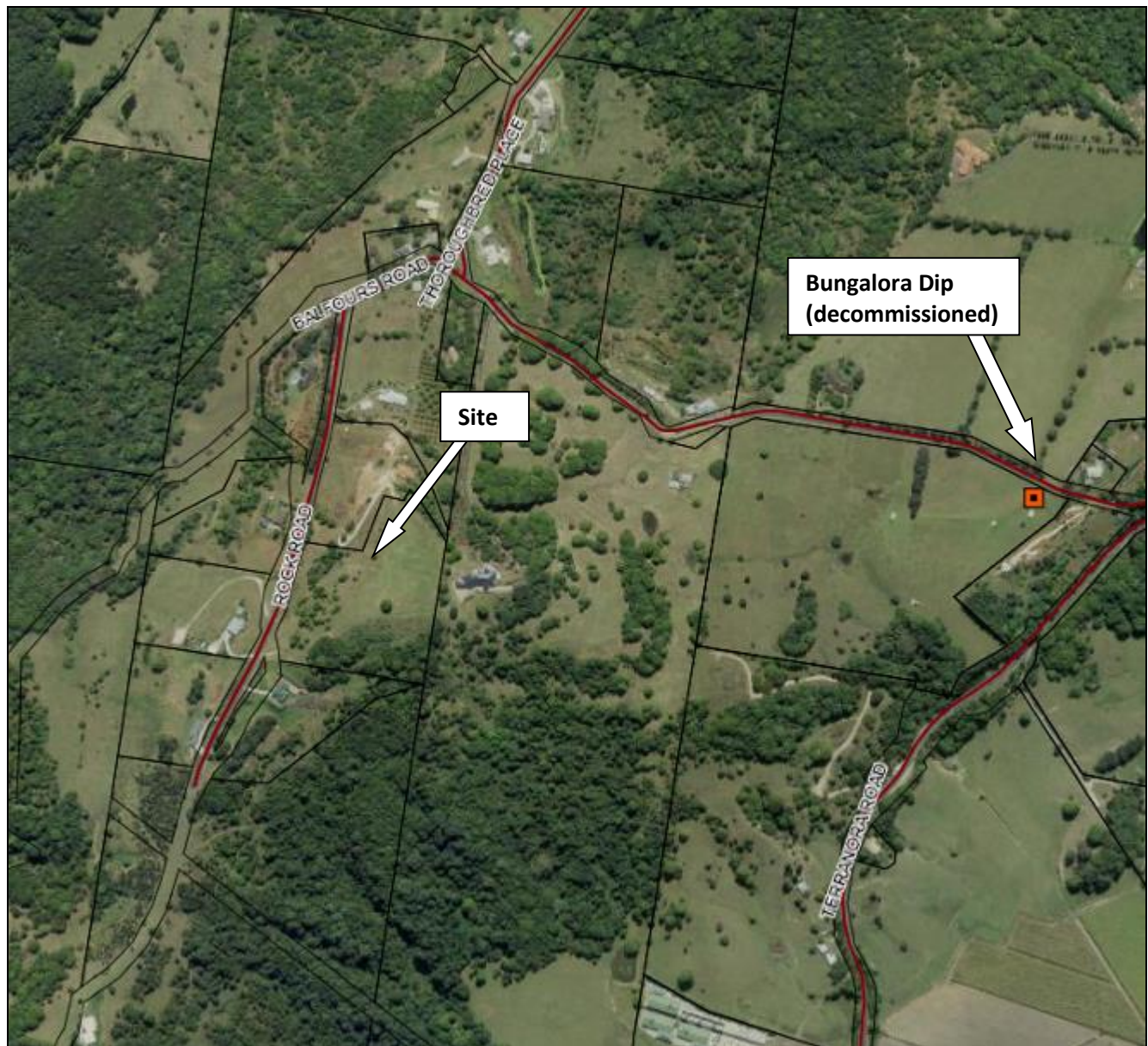


Figure 4 - Cattle Dip Sites, marked by red squares (TSC GIS)

Appendix 5 *Historic Aerial Photography*



Figure 5 – 1954 (Geoscience Australia)

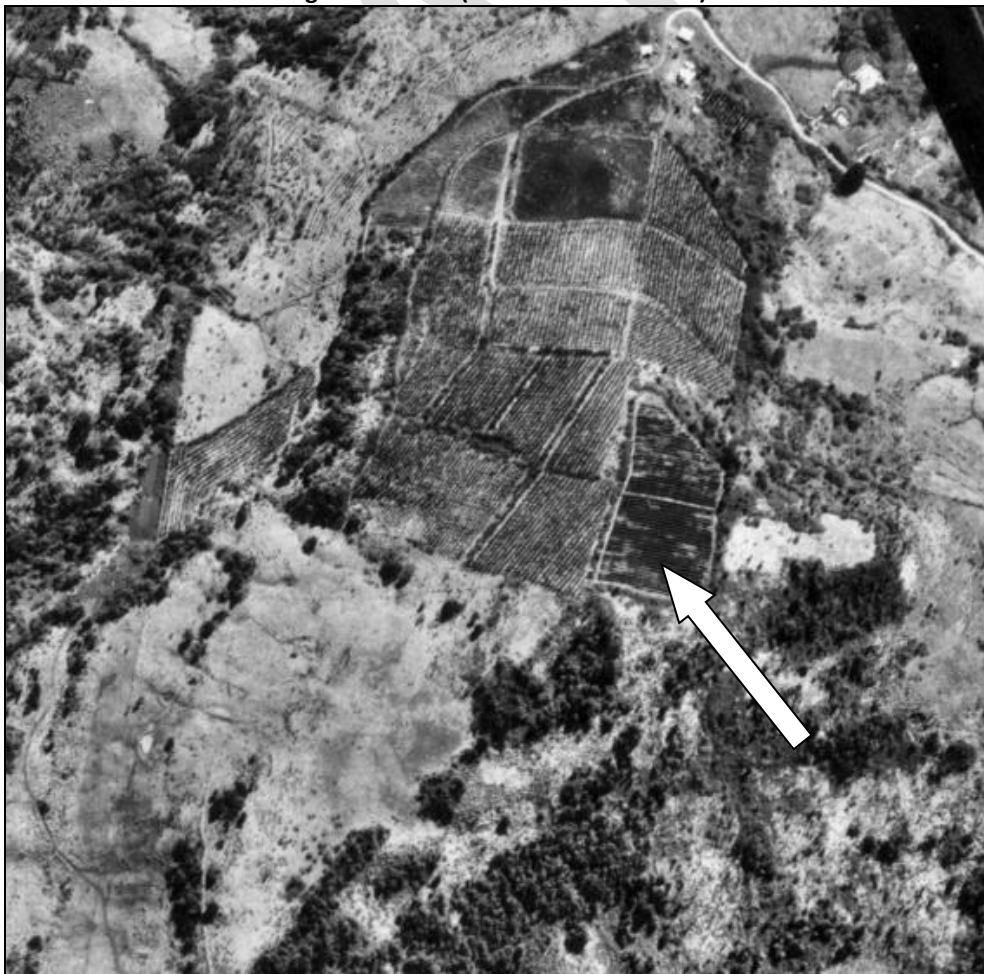


Figure 6 – 1962 (TSC GIS)



Figure 7 – 1970 (TSC GIS)



Figure – 1987 (TSC GIS)



Figure 8 – 1991 (NSW Gov)



Figure 9 – 1996 (TSC GIS)



Figure 10 – 1997 (NSW Gov)



Figure 11 – 2003 (Google Earth)



Figure 12 – 2011 (Google Earth)



Figure 13 – 2017 (Google Earth)

Appendix 6 *Historic Topographical Maps*



Figure 14 - Topographical Map Extract (Murwillumbah) 1976

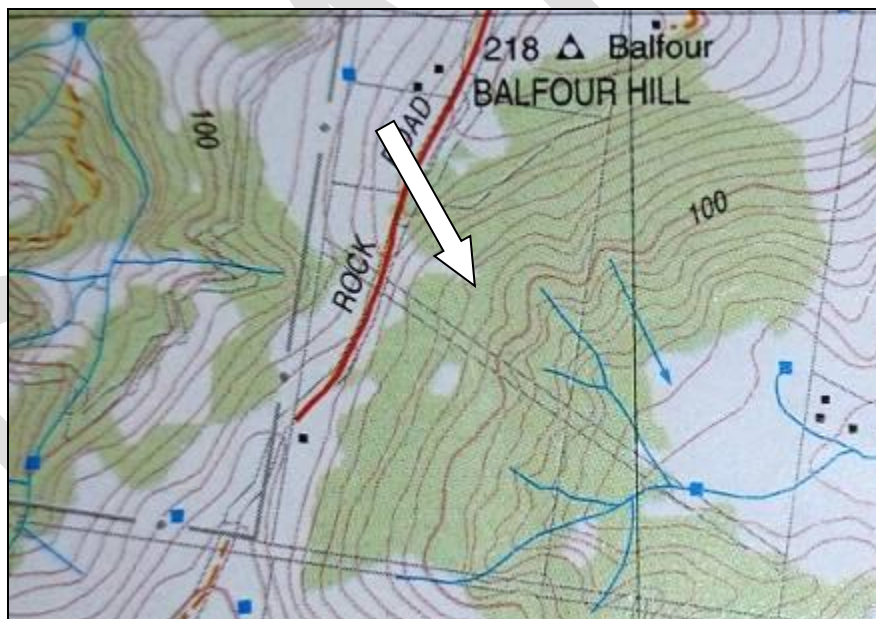


Figure 15 - Topographical Map Extract (Murwillumbah) 2002

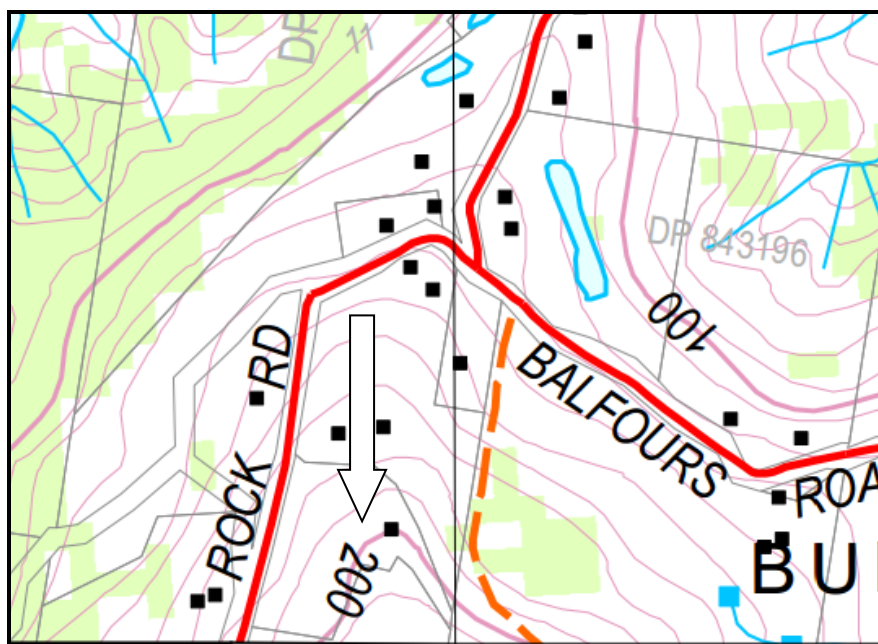


Figure 16 – Topographical Map Extract (Bilambil) 2016

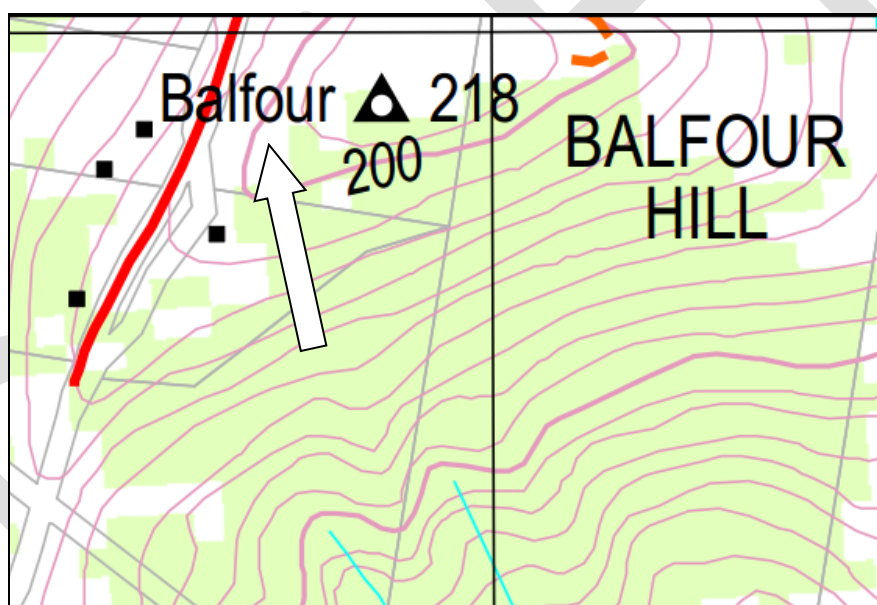


Figure 17 – Topographical Map Extract (Murwillumbah) 2016

Appendix 7 Historic Parish Maps

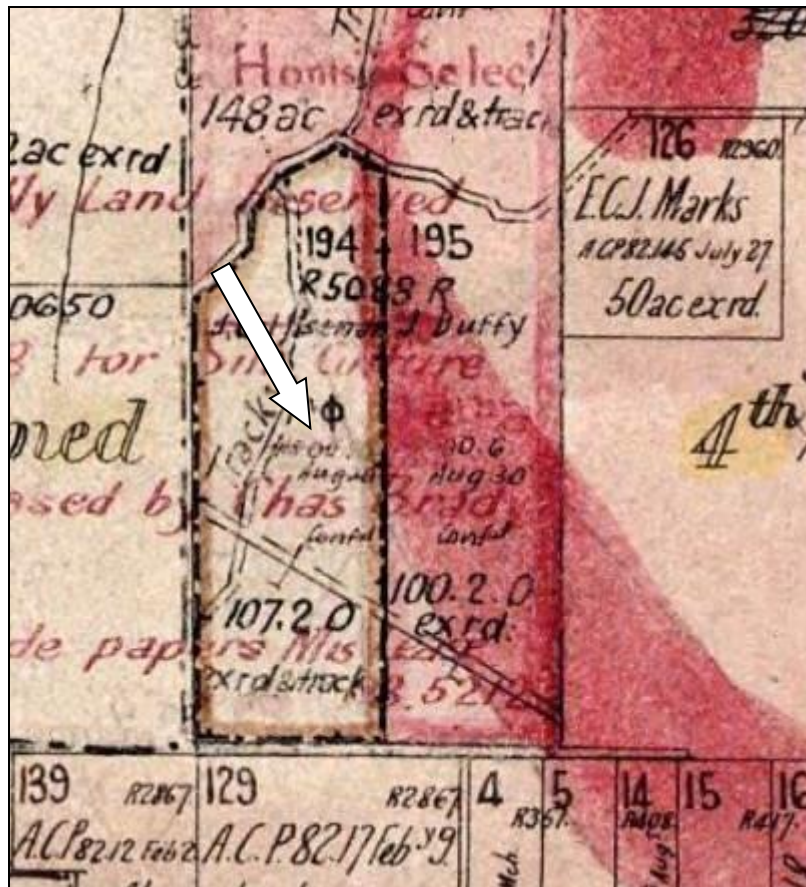


Figure 18 – Parish Map Extract 1894

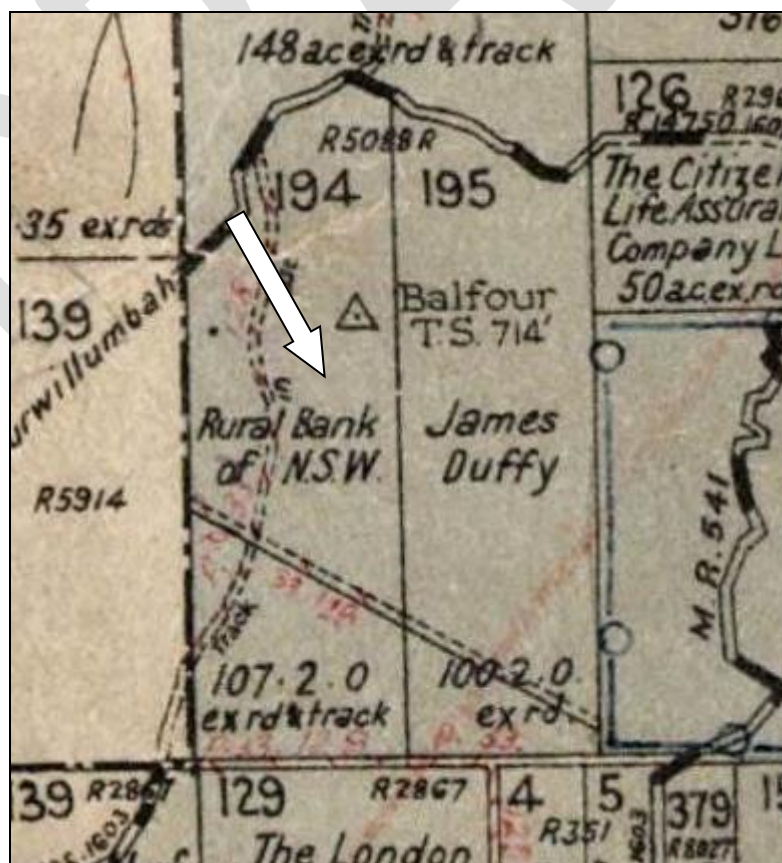


Figure 19- Parish Map 1959

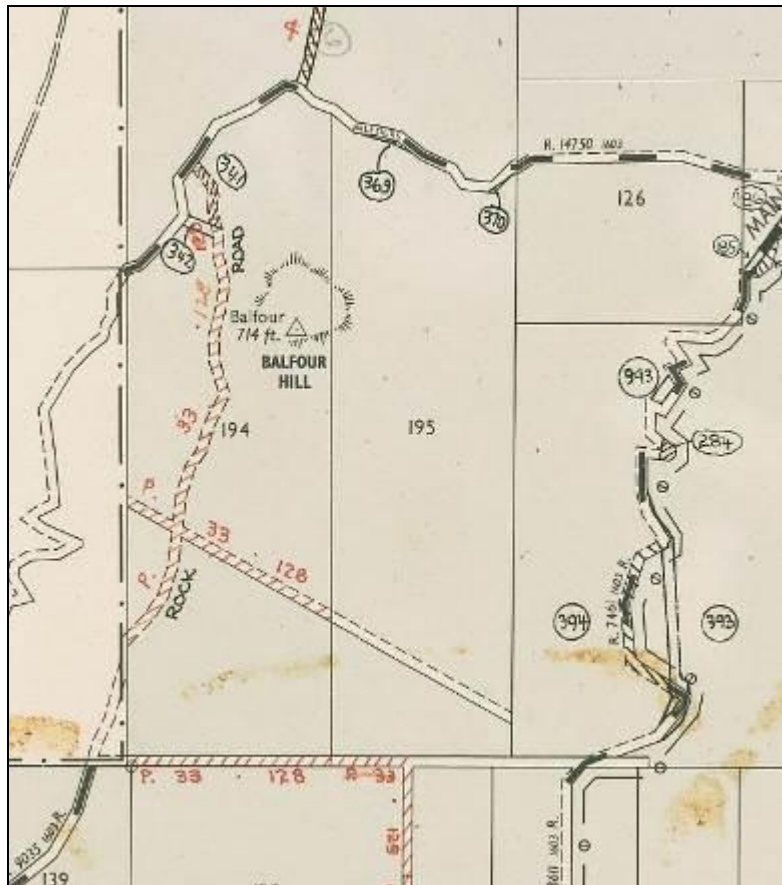


Figure 20- Charting Map 1971

Appendix 8 Zone Map

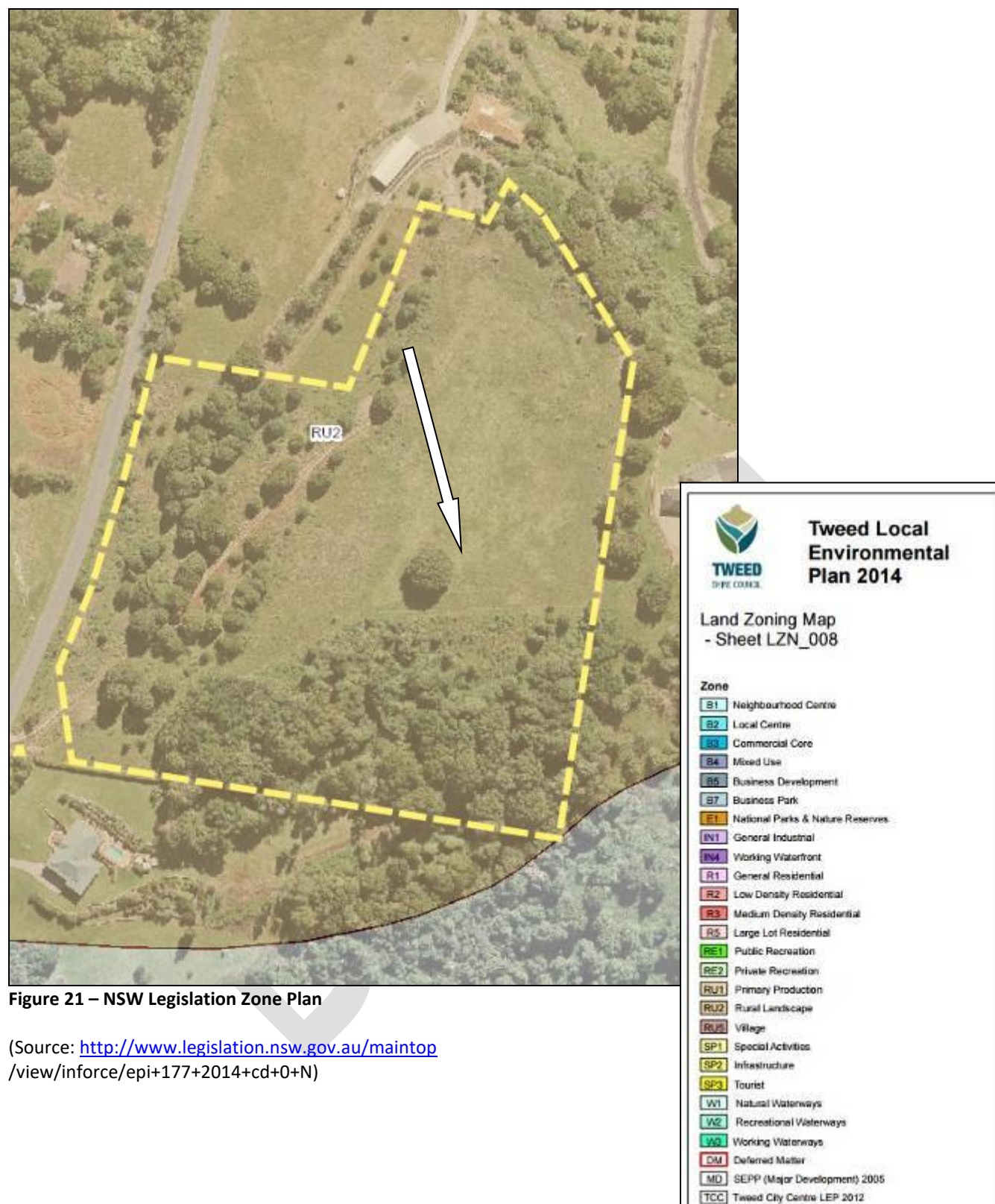


Figure 21 – NSW Legislation Zone Plan

(Source: <http://www.legislation.nsw.gov.au/maintop/view/inforce/epi+177+2014+cd+0+N>)

Appendix 9 Site Photos



Photo 1 – View north-east looking across sampling area, north of the large tree shown on plans.



Photo 2 – View north-east across sampling area from proposed shed site.

Appendix 10 Human Health Investigation Levels

Chemical	Health-based investigation levels (mg/kg)			
	Residential ¹ A	Residential ¹ B	Recreational ¹ C	Commercial/ industrial ¹ D
Metals and Inorganics				
Arsenic ²	100	500	300	3 000
Beryllium	60	90	90	500
Boron	4500	40 000	20 000	300 000
Cadmium	20	150	90	900
Chromium (VI)	100	500	300	3600
Cobalt	100	600	300	4000
Copper	6000	30 000	17 000	240 000
Lead ³	300	1200	600	1 500
Manganese	3800	14 000	19 000	60 000
Mercury (inorganic) ⁵	40	120	80	730
Methyl mercury ⁴	10	30	13	180
Nickel	400	1200	1200	6 000
Selenium	200	1400	700	10 000
Zinc	7400	60 000	30 000	400 000
Cyanide (free)	250	300	240	1 500
Polycyclic Aromatic Hydrocarbons (PAHs)				
Carcinogenic PAHs (as BaP TEQ) ⁶	3	4	3	40
Total PAHs ⁷	300	400	300	4000
Phenols				
Phenol	3000	45 000	40 000	240 000
Pentachlorophenol	100	130	120	660
Cresols	400	4 700	4 000	25 000
Organochlorine Pesticides				
DDT+DDE+DDD	240	600	400	3600
Aldrin and dieldrin	6	10	10	45
Chlordane	50	90	70	530
Endosulfan	270	400	340	2000
Endrin	10	20	20	100
Heptachlor	6	10	10	50
HCB	10	15	10	80
Methoxychlor	300	500	400	2500
Mirex	10	20	20	100
Toxaphene	20	30	30	160
Herbicides				
2,4,5-T	600	900	800	5000
2,4-D	900	1600	1300	9000
MCPA	600	900	800	5000
MCPB	600	900	800	5000
Mecoprop	600	900	800	5000
Picloram	4500	6600	5700	35000
Other Pesticides				
Atrazine	320	470	400	2500

Chemical	Health-based investigation levels (mg/kg)			
	Residential ¹ A	Residential ¹ B	Recreational ¹ C	Commercial/ industrial ¹ D
Chlorpyrifos	160	340	250	2000
Bifenthrin	600	840	730	4500
Other Organics				
PCBs ⁸	1	1	1	7
PBDE Flame Retardants (Br1–Br9)	1	2	2	10

Health Investigation Levels for residential “A” land use (HIL A) as stated in Table 1A (1) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater within the National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013

Notes:

- (1) Generic land uses are described in detail in Schedule B7 Section 3

HIL A – Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools.

HIL B – Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.

HIL C – Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. This does not include undeveloped public open space where the potential for exposure is lower and where a site-specific assessment may be more appropriate.

HIL D – Commercial/industrial, includes premises such as shops, offices, factories and industrial sites.

- (2) Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability may be important and should be considered where appropriate (refer Schedule B7).
- (3) Lead: HIL is based on blood lead models (IEUBK for HILs A, B and C and adult lead model for HIL D where 50% oral bioavailability has been considered. Site-specific bioavailability may be important and should be considered where appropriate.
- (4) Methyl mercury: assessment of methyl mercury should only occur where there is evidence of its potential source. It may be associated with inorganic mercury and anaerobic microorganism activity in aquatic environments. In addition the reliability and quality of sampling/analysis should be considered.
- (5) Elemental mercury: HIL does not address elemental mercury. A site-specific assessment should be considered if elemental mercury is present, or suspected to be present,

Carcinogenic PAHs: HIL is based on the 8 carcinogenic PAHs and their TEFs (potency relative to B(a)P) adopted by CCME 2008 (refer Schedule B7). The B(a)P TEQ is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its B(a)P TEF, given below, and summing these products.

Appendix 11 Laboratory Results Summary

Laboratory Results

	Sample ID							
	RR1A	RR2A	RR3A	RR4A	RR5A	RR6A	RR7A	RR8A
Metals/Metalloids (mg/kg)								
Arsenic	<5	8	<5	10	11	9	18	13
Chromium (total)	49	55	61	52	28	51	46	49
Copper	15	58	18	45	16	43	17	29
Nickel	19	24	19	18	15	15	22	20
Zinc	66	85	81	89	131	76	103	109
Cadmium	<1	<1	<1	<1	<1	<1	<1	<1
Lead	6	7	7	7	14	7	7	7
Mercury (inorganic)	0.1	0.1	<0.1	0.1	<0.1	<0.1	0.1	0.1
Organochlorine/Organophosphorus (mg/kg)								
Chlordane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin + Aldrin	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DDT+DDD+DDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Relative Percentage Difference (RPD%)

	RR1A	RR9A	Mean	RPD%	RR1A	RR10A	Mean	RPD%
Metals/Metalloids (mg/kg)								
Arsenic	<5	<5	-	-	<5	6	5.5	18
Chromium (total)	49	47	48	2	49	57	53	15
Copper	15	13	14	7	15	16	15.5	6
Nickel	19	19	-	-	19	30	24.5	44
Zinc	66	72	69	8	66	74	70	11
Cadmium	<1	<1	-	-	<1	<1	-	-
Lead	6	5	5.5	18	6	9	7.5	40
Mercury (inorganic)	0.1	0.1	-	-	0.1	<0.1	-	-

Appendix 12 Chain of Custody

(Next page)



CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 3/1 Burma Road Pooraka SA 5085
Ph: 08 8162 5130 E: adelaide@alsglobal.comBRISBANE 2 Byth Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.comGLADSTONE 48 Callamondah Drive Gladstone QLD 4680
Ph: 07 4978 7944 E: ALSEnviro.Gladstone@alsglobal.comMACKAY Unit 2/20 Caterpillar Drive Paget QLD 4740
Ph: 07 4952 5795 E: ALSEnviro.Mackay@alsglobal.comMELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.comMUDGEE 1/29 Sydney Road Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee.mail@alsglobal.comNEWCASTLE 5/885 Maitland Road Mayfield West NSW 2304
Ph: 02 4014 2500 E: samples.newcastle@alsglobal.comNOWRA 4/13 Geary Place North Nowra NSW 2541
Ph: 02 4423 2063 E: nowra@alsglobal.comPERTH 10 Hod Way Malaga WA 6060
Ph: 08 9209 7655 E: samples.perth@alsglobal.comSYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 6555 E: samples.sydney@alsglobal.comEnvironmental Division
Brisbane

WV 2500

Work Order Reference
EB2020884

N/A

N/A



Telephone +61-7-3243 7222

CLIENT: HMC Environmental Consulting Pty Ltd		TURNAROUND REQUIREMENTS: ☒ Standard TAT (List due date):		FOR Custo Free i receipt Rank Other
OFFICE: Tweed Heads		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):		
PROJECT: ROCK ROAD BUNGALORA	PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	
ORDER NUMBER: 2020.155	PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	COC: ① 2 3 4 5 6 7	
PROJECT MANAGER:	CONTACT PH: 0755 368863		OF: ① 2 3 4 5 6 7	
SAMPLER: Mark Tunks HMC	SAMPLER MOBILE: 0408 279212	RELINQUISHED BY:	RECEIVED BY: <i>Renata</i>	RELINQUISH
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: <i>7.8.2020</i>	DATE/TIME: <i>12.10</i>	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): admin@hmcenvironment.com.au				
Email Invoice to (will default to PM if no other addresses are listed): admin@hmcenvironment.com.au				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	S-12 OC/OP	S2-METALS							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	RR1A	3/08/2020 0:00	S	ST	X	X	X							
2	RR2A	3/08/2020 0:00	S	ST	X	X	X							
3	RR3A	3/08/2020 0:00	S	ST	X	X	X							
4	RR4A	3/08/2020 0:00	S	ST	X	X	X							
5	RR5A	3/08/2020 0:00	S	ST	X	X	X							
6	RR6A	3/08/2020 0:00	S	ST	X	X	X							
7	RR7A	3/08/2020 0:00	S	ST	X	X	X							
8	RR8A	3/08/2020 0:00	S	ST	X	X	X							
9	RR9A	3/08/2020 0:00	S	ST	X	X	X							
10	RR10A	3/08/2020 0:00	S	ST	X	X	X							INTERLAB
TOTAL					10	10	10							

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LJ = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

Appendix 13 Laboratory Result Certificates

(See next pages)

CERTIFICATE OF ANALYSIS

Work Order : **EB2020884**
Client : **HMC ENVIRONMENTAL**
Contact : **MARK TUNKS**
Address : **SUITE 29, LEVEL 2 75-77 WHARF STREET**
TWEED HEADS 2485
Telephone : **+61 07 5536 8863**
Project : **2020.155 ROCK ROAD BUNGALORA**
Order number : **2020.155**
C-O-C number : **----**
Sampler : **MARK TUNKS**
Site : **----**
Quote number : **EN/222**
No. of samples received : **9**
No. of samples analysed : **9**

Page : 1 of 7
Laboratory : Environmental Division Brisbane
Contact : Customer Services EB
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61-7-3243 7222
Date Samples Received : 07-Aug-2020 12:10
Date Analysis Commenced : 10-Aug-2020
Issue Date : 17-Aug-2020 14:02



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Morgan Lennox		Brisbane Organics, Stafford, QLD



General Comments

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

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

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

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

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

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

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

- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	RR1A	RR2A	RR3A	RR4A	RR5A
Client sampling date / time					03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00
Compound	CAS Number	LOR	Unit		EB2020884-001	EB2020884-002	EB2020884-003	EB2020884-004	EB2020884-005
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		33.3	27.0	28.1	29.0	31.4
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	8	<5	10	11
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		49	55	61	52	28
Copper	7440-50-8	5	mg/kg		15	58	18	45	16
Lead	7439-92-1	5	mg/kg		6	7	7	7	14
Nickel	7440-02-0	2	mg/kg		19	24	19	18	15
Zinc	7440-66-6	5	mg/kg		66	85	81	89	131
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		0.1	0.1	<0.1	0.1	<0.1
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05



Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				RR1A	RR2A	RR3A	RR4A	RR5A
Client sampling date / time				03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00
Compound	CAS Number	LOR	Unit	EB2020884-001	EB2020884-002	EB2020884-003	EB2020884-004	EB2020884-005
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
	0-2							
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	90.5	96.0	98.9	107	94.5
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	87.6	90.8	100	109	100



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	RR6A	RR7A	RR8A	RR9A	----
Client sampling date / time					03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	----
Compound	CAS Number	LOR	Unit		EB2020884-006	EB2020884-007	EB2020884-008	EB2020884-009	-----
					Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		28.6	36.3	32.4	33.2	----
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		9	18	13	<5	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg		51	46	49	47	----
Copper	7440-50-8	5	mg/kg		43	17	29	13	----
Lead	7439-92-1	5	mg/kg		7	7	7	5	----
Nickel	7440-02-0	2	mg/kg		15	22	20	19	----
Zinc	7440-66-6	5	mg/kg		76	103	109	72	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	0.1	0.1	0.1	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
^ Total Chlordane (sum)	----	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
4,4'-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
4,4'-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
4,4'-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	RR6A	RR7A	RR8A	RR9A	----
Client sampling date / time					03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	03-Aug-2020 00:00	----
Compound	CAS Number	LOR	Unit		EB2020884-006	EB2020884-007	EB2020884-008	EB2020884-009	-----
					Result	Result	Result	Result	----
EP068A: Organochlorine Pesticides (OC) - Continued									
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
	0-2								
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		95.3	100	97.7	112	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		92.9	96.0	103	109	----



Surrogate Control Limits

Sub-Matrix: **SOIL**

		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	10	138
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	23	134

CERTIFICATE OF ANALYSIS

Work Order : **ES2027816**
Client : **HMC ENVIRONMENTAL**
Contact : ADMIN ADDRESS
Address : SUITE 29, LEVEL 2 75-77 WHARF STREET
 TWEED HEADS 2485
Telephone : +61 07 5536 8863
Project : ROCK ROAD BUNGALORA
Order number : 2020.155
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : EN/222
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 11-Aug-2020 10:20
Date Analysis Commenced : 13-Aug-2020
Issue Date : 18-Aug-2020 14:42



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	Position	Accreditation Category
Edwandy Fadjjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



General Comments

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

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

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

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

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

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

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

- EP068: Where reported, Total Chlordane (sum) is the sum of the reported concentrations of cis-Chlordane and trans-Chlordane at or above the LOR.
- EP068: Where reported, Total OCP is the sum of the reported concentrations of all Organochlorine Pesticides at or above LOR.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	RR10A	----	----	----	----
Client sampling date / time				03-Aug-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2027816-001	-----	-----	-----	-----
Result				----	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	33.7	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	6	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	57	----	----	----	----
Copper	7440-50-8	5	mg/kg	16	----	----	----	----
Lead	7439-92-1	5	mg/kg	9	----	----	----	----
Nickel	7440-02-0	2	mg/kg	30	----	----	----	----
Zinc	7440-66-6	5	mg/kg	74	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	----	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	----	----
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	----	----
4,4'-DDT	50-29-3	0.2	mg/kg	<0.2	----	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	RR10A	----	----	----	----
Client sampling date / time				03-Aug-2020 00:00	----	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2027816-001	-----	-----	-----	-----	-----
Result				----	----	----	----	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	----	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/5 0-2	0.05	mg/kg	<0.05	----	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	----	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	----	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	----	----	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	----	----	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	----	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	----	----	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	----	----	----	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	----	----	----	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	----	----	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	----	----	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	----	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	----	----	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	----	----	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	----	----	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	----	----	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	----	----	----	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	----	----	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	----	----	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	----	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%	80.3	----	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%	90.6	----	----	----	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143